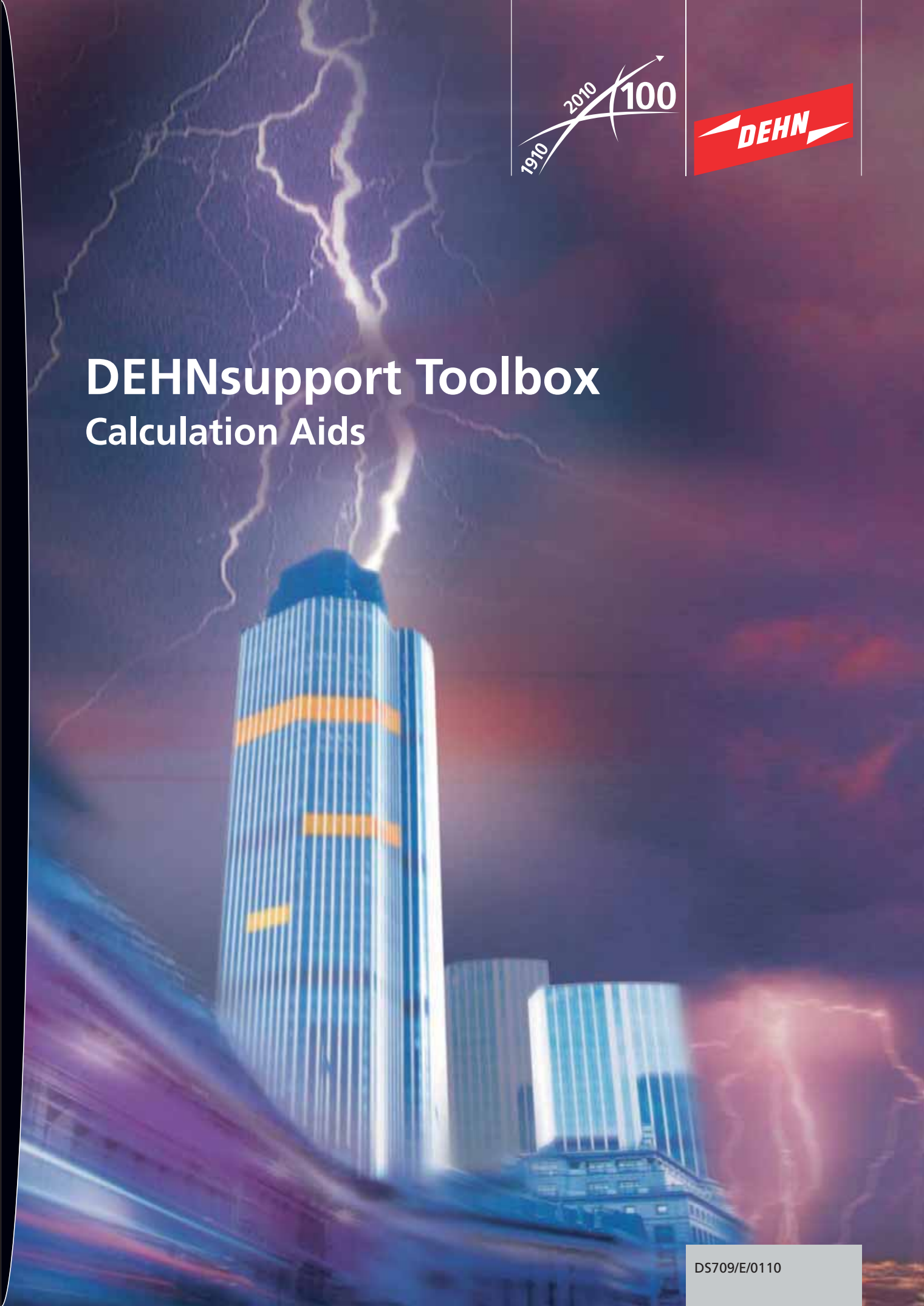


DEHNsupport Toolbox
Calculation Aids

DS709/E/0110

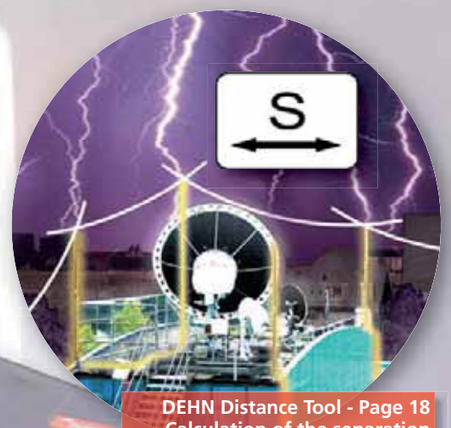
DEHNsupport Toolbox
Calculation aids

The DEHNsupport Toolbox offers a variety of calculation possibilities in the field of lightning protection and is based on the requirements of the EN, BS EN 62305-x* standard series.
Using the appropriate EN, BS EN 62305-2 risk assessment software contains all of the country specific variations required to carry out the calculations.

This software, which is available in different languages and which complies with the international standard, is a tool to help in the implementation of lightning and surge protection measures.

The following calculation aids are integrated into the software:

DEHN Risk Tool - Page 3
Risk analysis in accordance with EN 62305-2



DEHN Distance Tool - Page 18
Calculation of the separation distance in accordance with EN 62305-3

DEHN Earthing Tool - Page 20
Calculation of the length of the earth electrodes in accordance with EN 62305-3

DEH Air-Termination Tool - Page 19
Calculation of the length of the air-termination rods in accordance with EN 62305-3

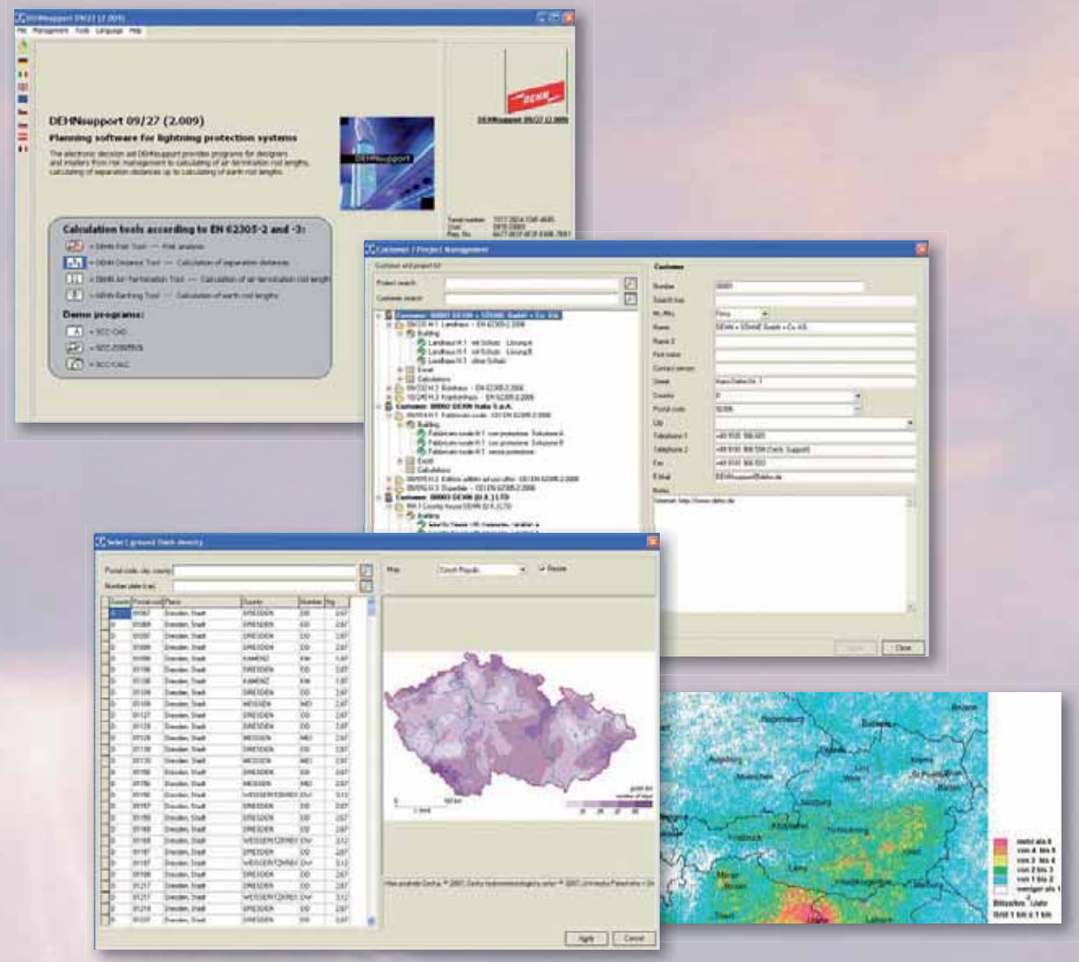
* DIN EN 62305-2/-3 (VDE 0185-305-2/-3); IEC 62305-2/-3; ČSN EN 62305-2/-3; CEI EN 62305-2 e-3 (CEI 81-10/2 e 3); STN EN 62305-2/-3; ÖVE/ÖNORM EN 62305-2/-3; NF EN 62305-2/-3; NBN EN 62305-2/-3; BS EN 62305-2/-3;

DEHNsupport Toolbox
Customer / project management

The DEHNsupport software is based on a customer / project management where all calculations can be structured and permanently stored. To manage calculations
a) a customer has to be created and
b) a project has to be created for the customer.

The calculations are saved in a project file and can be retrieved and changed at a later date.

Data can be recorded for the relevant customer / project, this is then displayed in the reports based on the calculated results.



The value of the ground flash density, which is important for performing a risk analysis in accordance with EN 62305-2*, can easily be selected in the customer / project management.

The software includes ground flash density data for Germany, Italy and Austria. For other countries ground flash density maps are integrated.
a) a country has to be selected
b) the ground flash density selection has to be activated.

* DIN EN 62305-2/-3 (VDE 0185-305-2/-3); IEC 62305-2/-3; ČSN EN 62305-2/-3; CEI EN 62305-2 e-3 (CEI 81-10/2 e 3); STN EN 62305-2/-3; ÖVE/ÖNORM EN 62305-2/-3; NF EN 62305-2/-3; NBN EN 62305-2/-3; BS EN 62305-2/-3;

DEHN Risk Tool

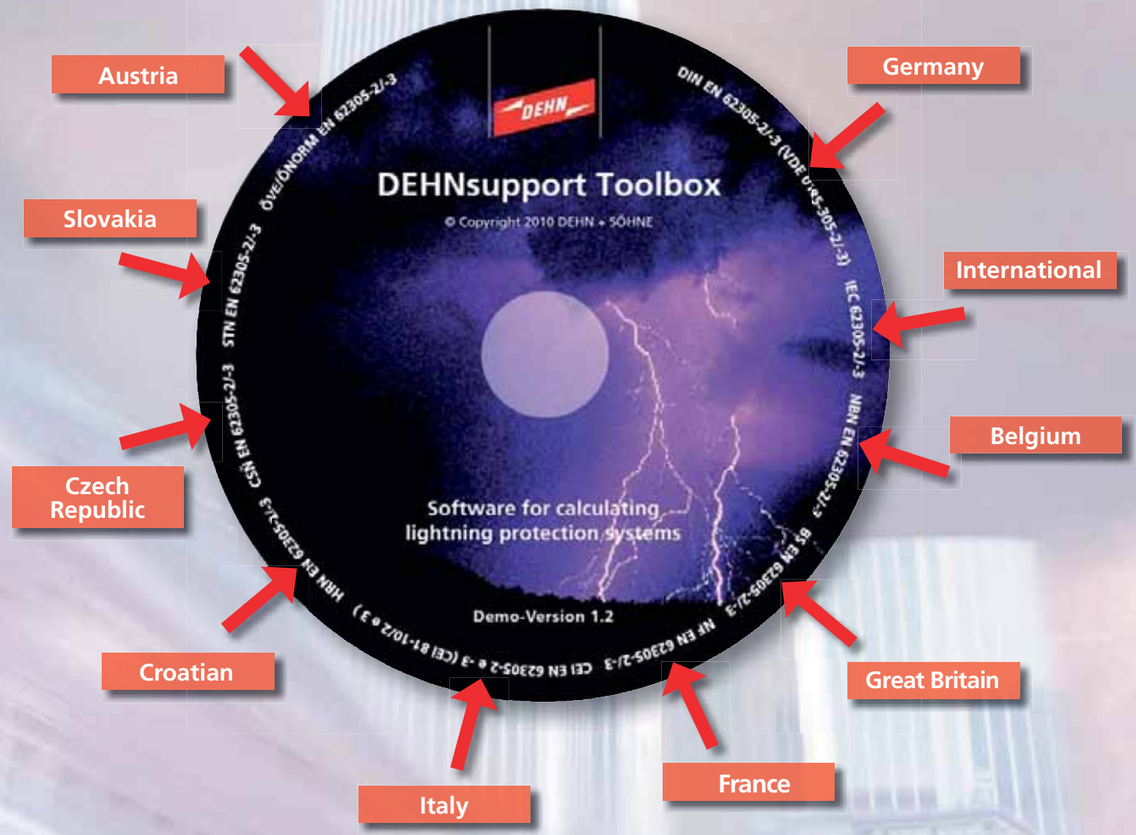
Risk analysis in accordance with EN 62305-2*

A risk analysis allows to assess the potential risk for structures and to take specific measures to reduce the risk. The result is the selection of protection measures which make good economic sense and which are ideally suited for the characteristics of the structure and the type of utilisation.

The risk assessment not only allows to determine the class of LPS (lighting protection system), but also to develop a complete protection concept including the shielding measures required to protect the structure against LEMP.

Since the lightning protection standard is an EN standard, it has to be included into the national standards of the member countries of CENELEC, the European Committee for Electrotechnical Standardization. National conditions and variations were also taken into consideration.

Country specific variations and the associated national calculation values can be activated in the DEHN Risk Tool software. The software was specified for the following countries:



The following pages describe how to use the DEHN Risk Tool software for performing a risk analysis.

* DIN EN 62305-2 (VDE 0185-305-2); IEC 62305-2; ČSN EN 62305-2; CEI EN 62305-2 (CEI 81-10/2); STN EN 62305-2; ÖVE/ÖNORM EN 62305-2; NF EN 62305-2; NBN EN 62305-2; BS EN 62305-2;

DEHN Risk Tool

Risk

General procedure for performing a risk analysis

At the beginning of a risk analysis, the type of utilisation of the structure has to be taken into account to determine the risks to be considered for the object requiring protection. When performing a risk analysis, four different risks can be distinguished:

Risk R1

Risk of loss of human life

Risk R2

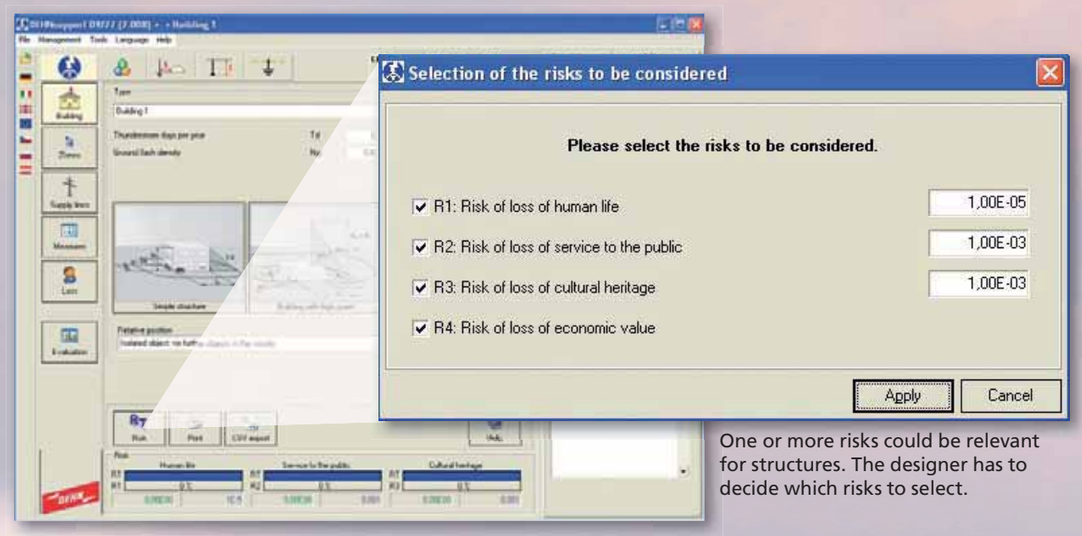
Risk of loss of service to the public

Risk R3

Risk of loss of cultural heritage

Risk R4

Risk of economic loss



One or more risks could be relevant for structures. The designer has to decide which risks to select.

When selecting the risks, the tolerable risk R_T is also defined. The following tolerable risks are specified in the standard, however, responsible authorities having jurisdiction may define them in another way:

Risk R1

$R_T = 10^{-5}$

Risk R2

$R_T = 10^{-3}$

Risk R3

$R_T = 10^{-3}$

Risk R4

Economic loss

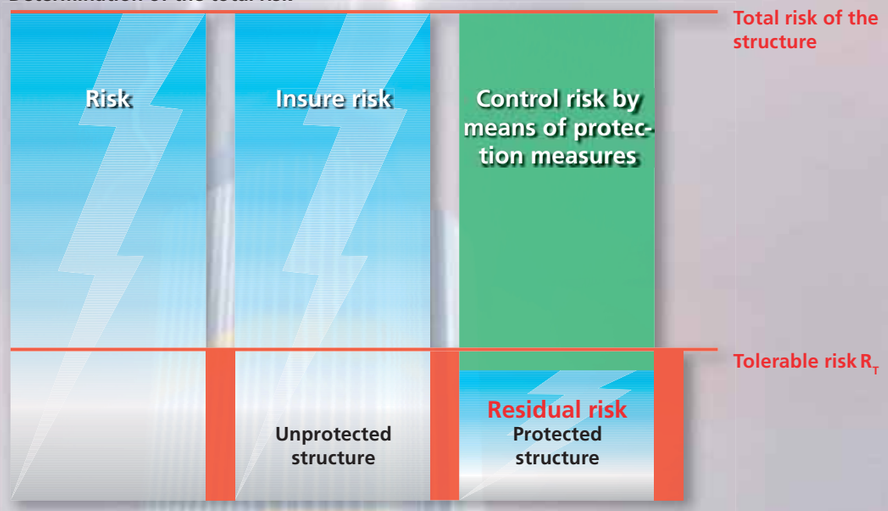
No tolerable risk is defined for economic loss. In this case, it is considered if the protection measures make economic sense with regard to the value of the structure.

DEHN Risk Tool

Tolerable risk

The aim of a risk analysis is to reduce the existing risk to a tolerable (acceptable) risk R_T.

Determination of the total risk



When performing a risk analysis, not only the total risks R1 to R4 are considered. More important that the total risks is their composition. Each risk consists of a sum of individual risk components.

These components have to be evaluated properly to be able to define potential risks for the structure and to take specific measures to reduce the risk.

The risks are made up of a sum of risk components.

Risk R1

Risk R2

Risk R3

Risk R4

R1, R2, R3, R4 = Sum of risk components

$$R1 = R_A + R_B + R_C + R_M + R_U + R_V + R_W + R_Z$$

$$R2 = R_B + R_C + R_M + R_V + R_W + R_Z$$

$$R3 = R_B + R_V$$

$$R4 = R_A + R_B + R_C + R_M + R_U + R_V + R_W + R_Z$$

DEHN Risk Tool

Sources of damage

Risk components

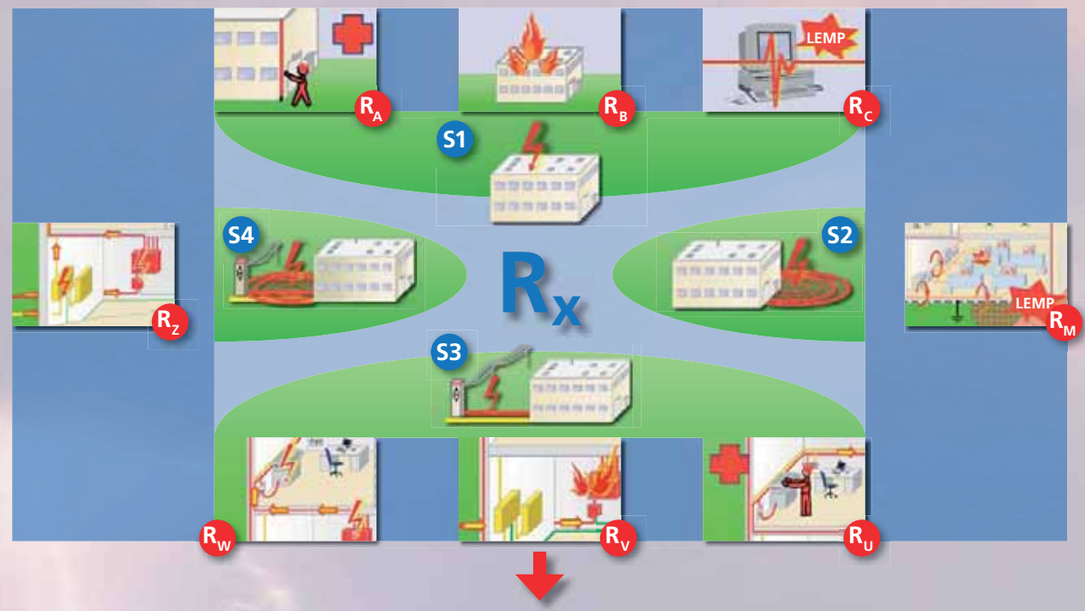
The classification of risk components is based on the sources of damage. The EN 62305-2 standard lists different types of lightning effects as potential sources of damage. When performing a risk analysis, the following components are considered according to the sources of damage:

Source of damage S1, direct flashes into a structure
R_A = Human life (touch and step voltage outside the structure)
R_B = Fire
R_C = Overvoltage (LEMP)

Source of damage S2, flashes near a structure
R_M = Overvoltage (LEMP)

Source of damage S3, flashes into a service
R_U = Human life (touch voltage inside a structure)
R_V = Fire
R_W = Overvoltage

Source of damage S4, flashes near a service
R_Z = Overvoltage



Each risk component consists of different factors:

$$R_x = N_x \cdot P_x \cdot L_x$$

- R_x: Risk component
- N_x: Frequency of dangerous events
- P_x: Probability (characteristics of the structure)
- L_x: Loss

DEHN Risk Tool

Frequency of dangerous events N_X

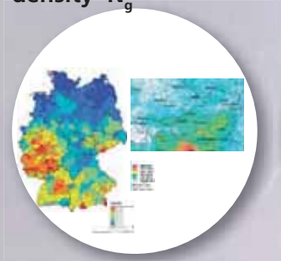
R1, R2, R3, R4

R_A, R_B, R_C, R_M, R_U, R_V, R_W, R_Z

$$R_X = N_X \bullet P_X \bullet L_X$$

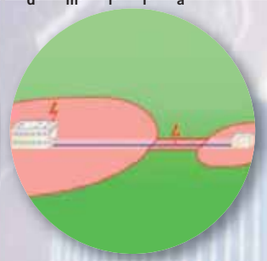
A variety of parameters are considered for the calculation of the "frequency of dangerous events N_x".

Ground flash density N_g



Flash density 1/km²/year

Collection areas A_d, A_m, A_l, A_i, A_a



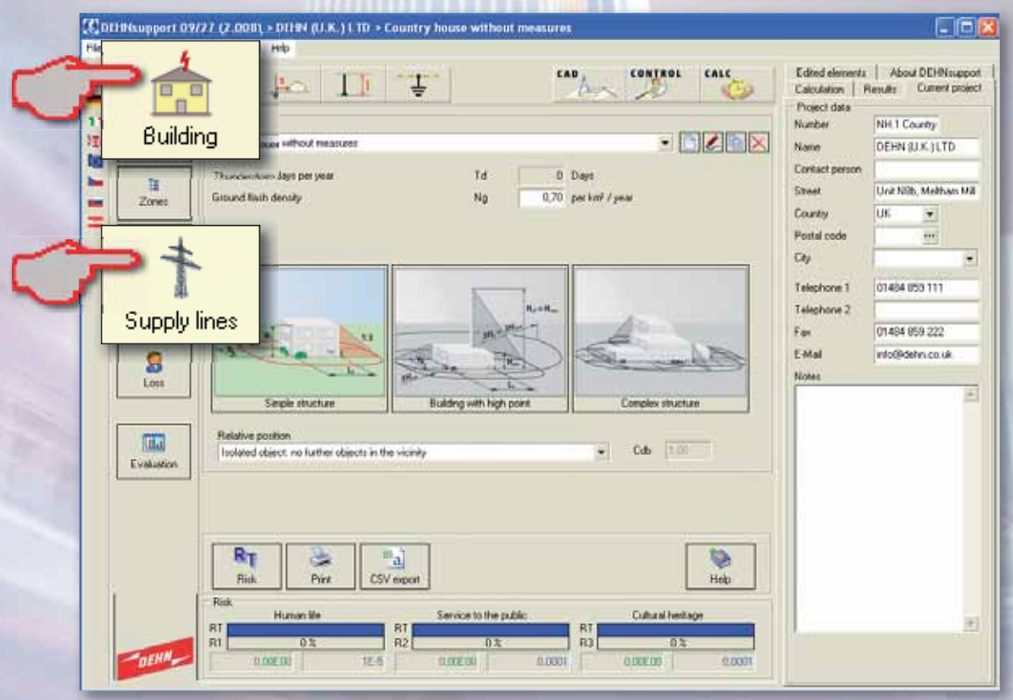
A_d = Collection area for direct flashes into a structure
A_m = Collection area for direct flashes near a structure
A_l = Collection area for direct flashes into a service
A_i = Collection area for direct flashes near a service
A_a = Collection area for flashes into an interconnected structure

Location factor C_d

e.g. The building is surrounded by higher objects (structures, trees, etc.) thus reducing the risk of a direct flash.

Environmental factor C_e

e.g. rural, suburban, urban



DEHN Risk Tool

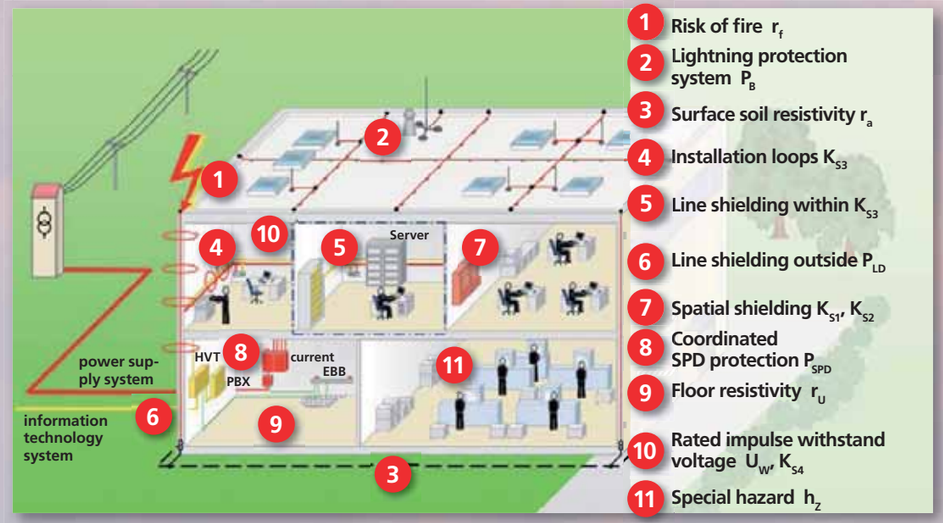
Probability P_X

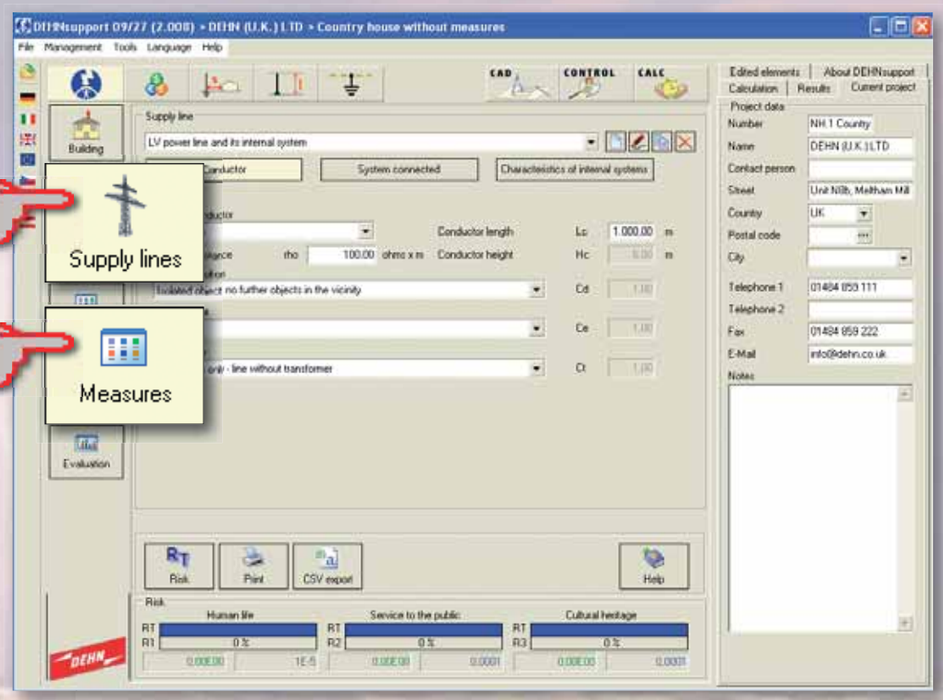
R1, R2, R3, R4

R_A, R_B, R_C, R_M, R_U, R_V, R_W, R_Z

$$R_X = N_X \bullet P_X \bullet L_X$$

The "probability P_X" describes the structure and installation characteristics of a structure. These characteristics can either increase or reduce the risk.





DEHN Risk Tool

Loss L_X

R1, R2, R3, R4

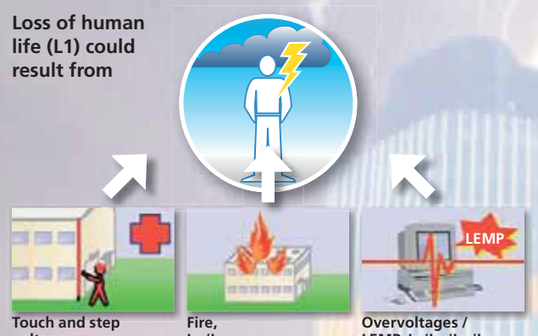
R_A, R_B, R_C, R_M, R_U, R_V, R_W, R_Z

$$R_X = N_X \cdot P_X \cdot L_X$$

In addition to the “frequency of dangerous events” and “probabilities”, the numerical values of possible “losses L_X” also has to be determined.
.

Losses are divided into risks which are considered for the analysis and consequently into risk components. The following losses can be determined:

Loss of human life (L1) could result from

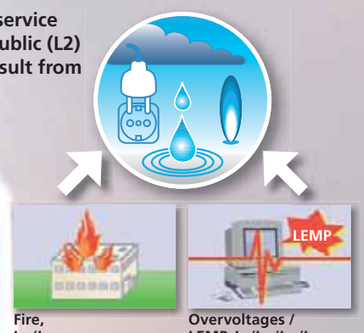


Touch and step voltage L_A/L_U

Fire, L_B/L_V

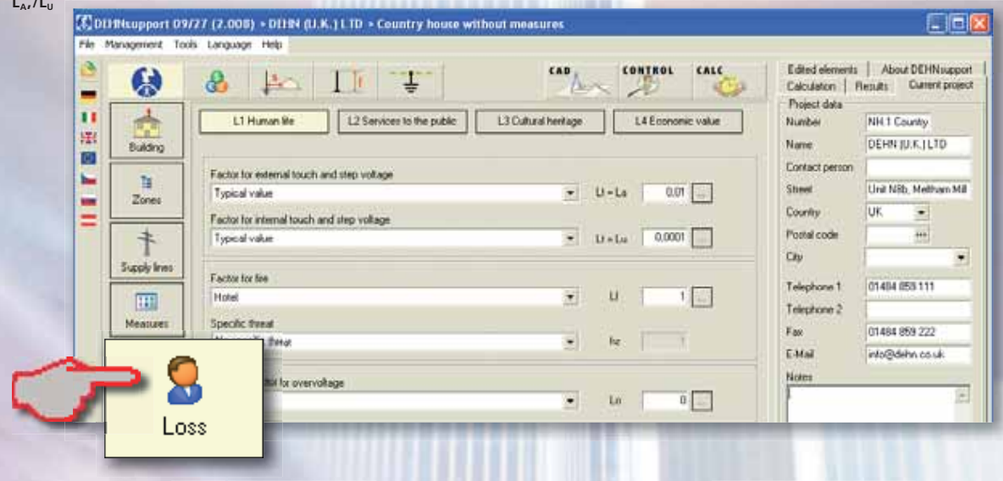
Overvoltages / LEMP, $L_C/L_M/L_W/L_Z$

Loss of service to the public (L2) could result from



Fire, L_B/L_V

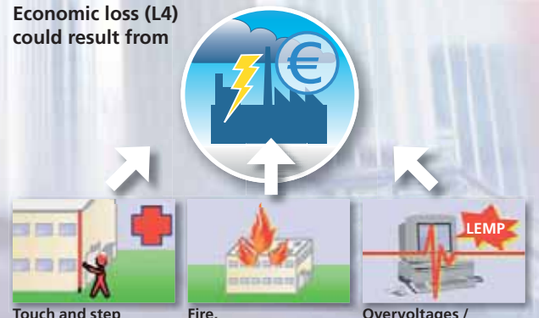
Overvoltages / LEMP, $L_C/L_M/L_W/L_Z$



Loss of cultural heritage (L3) could result from

Fire, L_B/L_V

Economic loss (L4) could result from



Touch and step voltage , L_A/L_U

Fire, L_B/L_V

Overvoltages / LEMP, $L_C/L_M/L_W/L_Z$

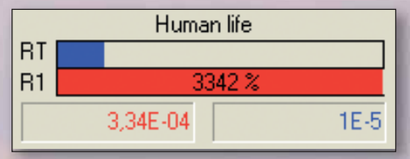
DEHN Risk Tool

Result

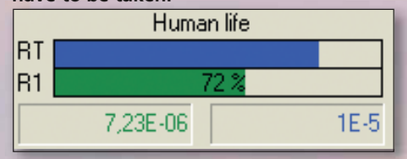
Appropriate evaluation of the result

Each risk to be considered is displayed as a graphic. Blue stands for the tolerable risk, red or green for the calculated risk of the structure to be protected.

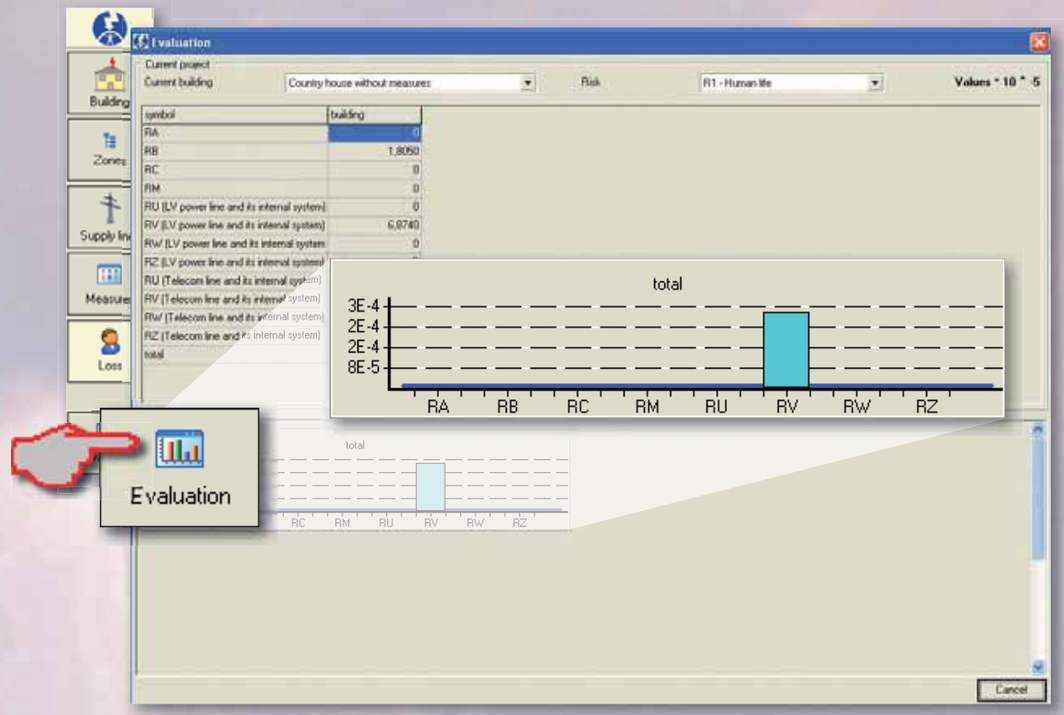
Example R1 red:
Protection measures have to be taken.



Example R1 green:
Very low risk. No protection measures have to be taken.



The risk components of each risk have to be considered in detail to be able to adequately evaluate the potential risk for a structure. Each component describes a potential risk. The aim of the risk analysis is to take reasonable measures to specifically reduce the main risks.



R_A = Human life
R_C = Overvoltage (LEMP)
R_U = Human life
R_W = Overvoltage

R_B = Fire
R_M = Overvoltage (LEMP)
R_V = Fire
R_Z = Overvoltage

DEHN Risk Tool

Selection of measures

Selection of measures

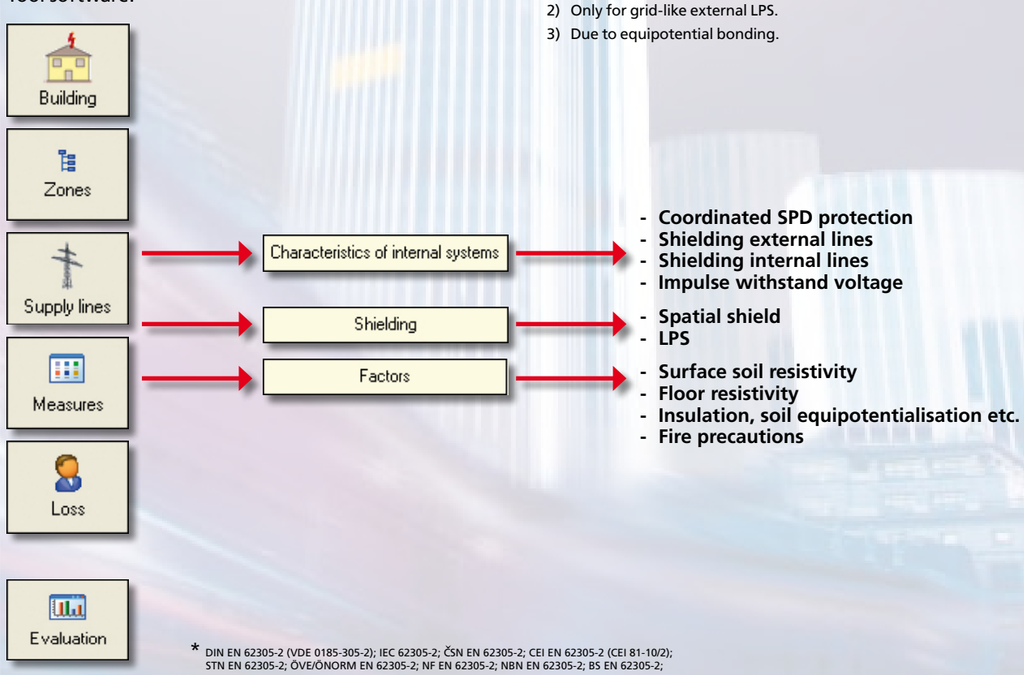
Each risk component can be influenced (reduced or increased) by different parameters. The table below serves as a selection aid.

Characteristics of the structure or the internal systems Protection measures	R_A	R_B	R_C	R_M	R_U	R_V	R_W	R_Z
Collection area	X	X	X	X	X	X	X	X
Surface soil resistivity	X							
Floor resistivity					X			
Physical restrictions, insulation, warning notice, soil equipotentialisation	X				X			
LPS	X[1)]	X	X[2)]	X[2)]	X[3)]	X[3)]		
Coordinated SPD protection			X	X			X	X
Spatial shield			X	X				
Shielding external lines					X	X	X	X
Shielding internal lines			X	X				
Routing precautions			X	X				
Bonding network			X					
Fire precautions		X				X		
Fire sensitivity		X				X		
Special hazard		X				X		
Impulse withstand voltage			X	X	X	X	X	X

Source: EN 62305-2*:2006; Table 5

1) In the case of a "natural" or standardized LPS with down-conductor spacing of less than 10 m, or where physical restriction are provided, the risk related to injury to living beings caused by touch and step voltages is negligible.
2) Only for grid-like external LPS.
3) Due to equipotential bonding.

The following measures are integrated in the DEHN Risk Tool software:



* DIN EN 62305-2 (VDE 0185-305-2); IEC 62305-2; ČSN EN 62305-2; CEI EN 62305-2 (CEI 81-10/2); STN EN 62305-2; ÖVE/ÖNORM EN 62305-2; NF EN 62305-2; NBN EN 62305-2; BS EN 62305-2;

DEHN Risk Tool

Economic aspects

Efficiency of protection measures

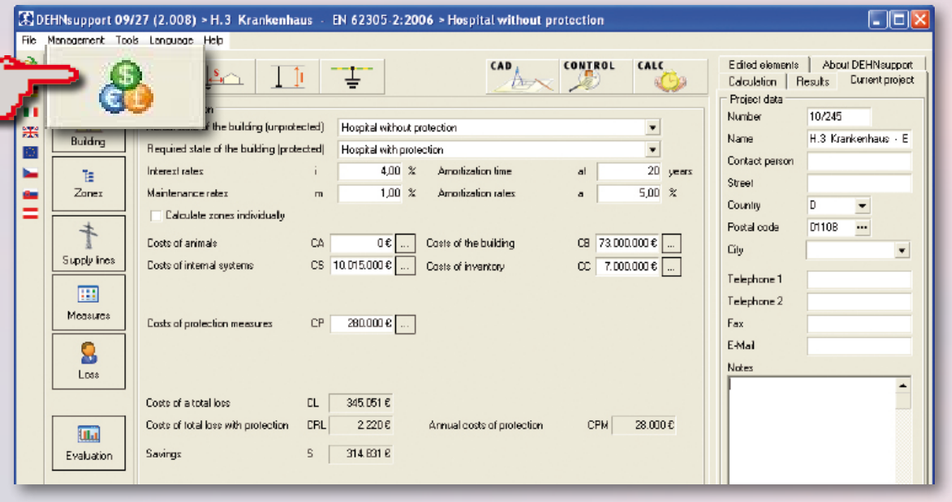
In addition to the technical aspect, the economic aspect is also a decisive factor for the selection and installation of protection measures.

With the publication of the EN 62305* standard series, economic aspects have found their way into the lightning protection standard.

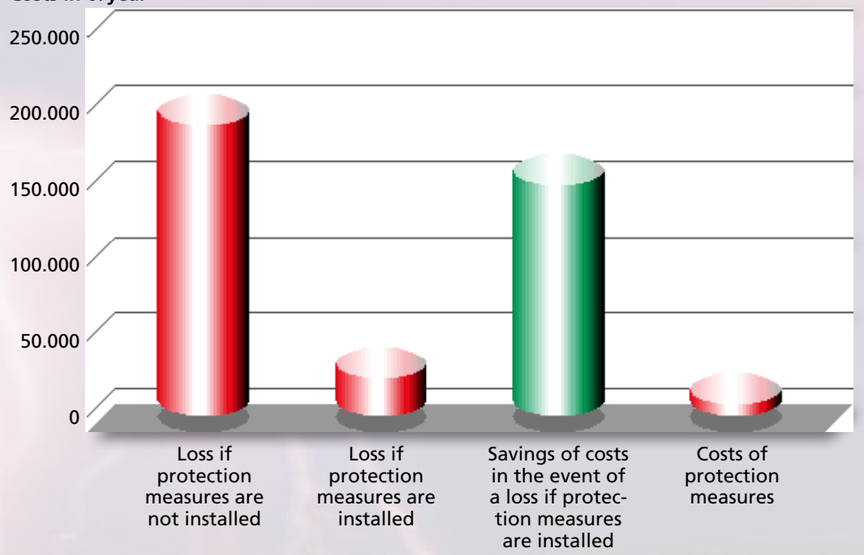
Structure owners are often faced with the question which costs could arise if lightning strikes the structure.

This also involves the question how high costs for protection measures should be with regard to the value of the structure.

The economic aspect in the risk analysis according to the EN 62305-2* standard provides a valuable selection aid.



Costs in € /year



* DIN EN 62305-2 (VDE 0185-305-2); IEC 62305-2; ČSN EN 62305-2; CEI EN 62305-2; STN EN 62305-2; ÖVE/ÖNORM EN 62305-2; NF EN 62305-2; NBN EN 62305-2; BS EN 62305-2;

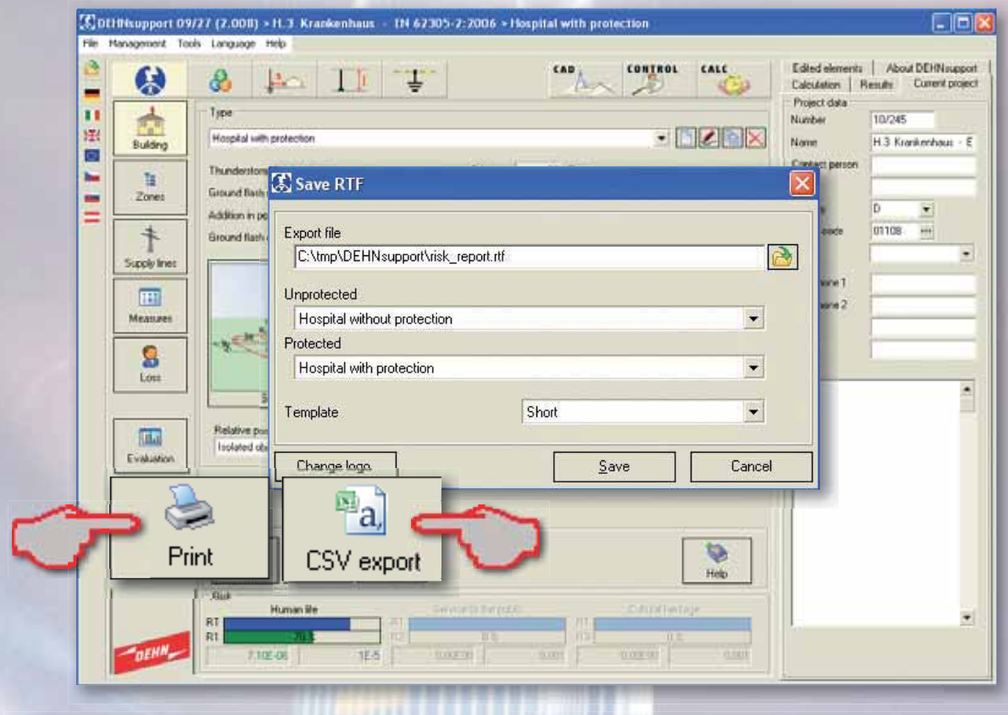
DEHN Risk Tool

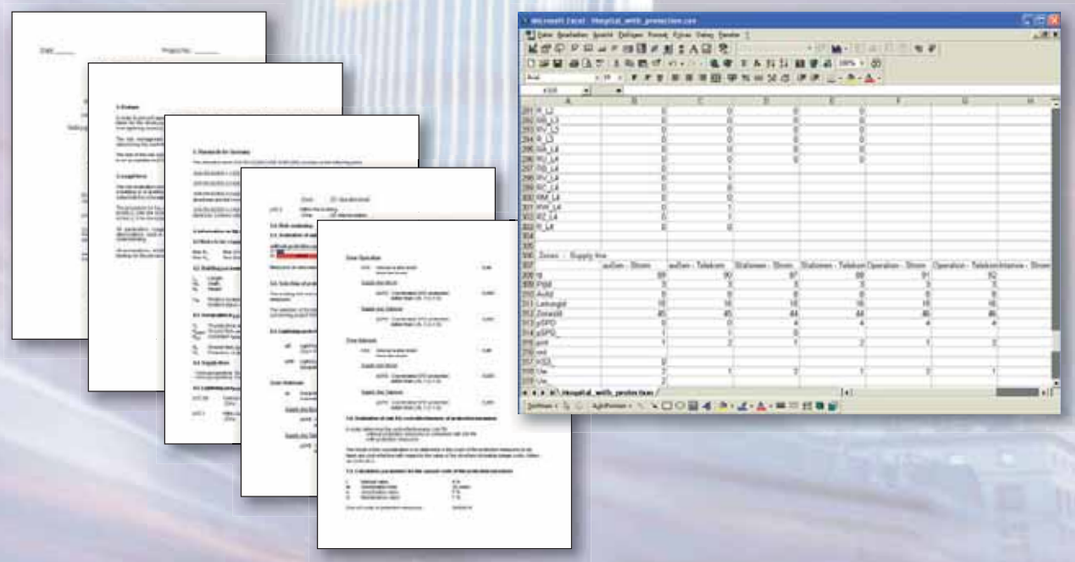
Documentation

Documentation of results

Once completed the risk analysis results can be printed in either a short or long version report format.

In addition to the relevant language, country-specific standard designations can also be selected and printed.





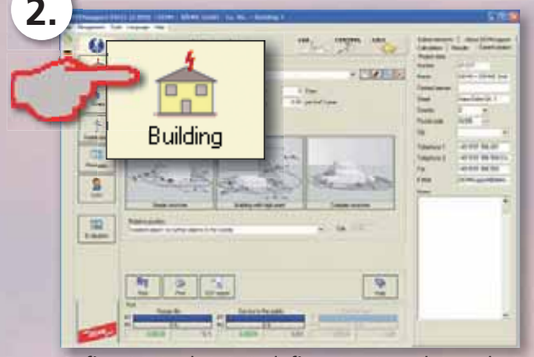
DEHN Risk Tool

Brief instruction of the Risk Tool

1.

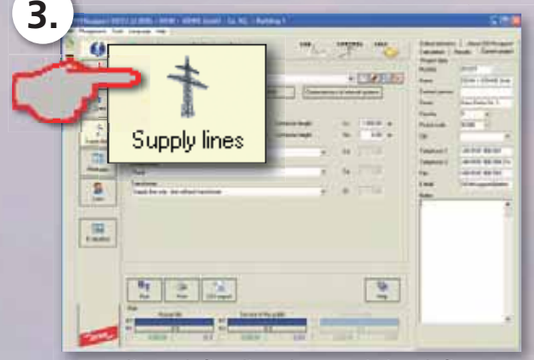
Create customer, create project, select ground flash density Ng, define basis of calculation (standard)

2.



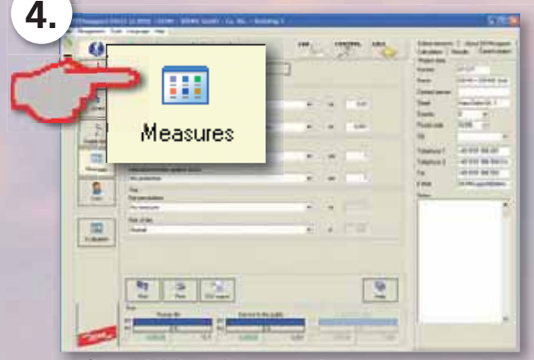
Define “Actual state”, define structure data, select relative position

3.



Create lines, define line characteristics, define interconnected system, define characteristics of internal systems

4.

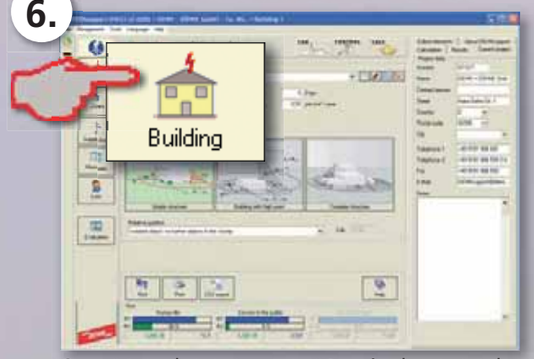


Define shielding characteristics

5.

Define losses for each type of risk L1/L2/L3/L4

6.



Copy “Actual state”, create “Required state”, take specific measures considering the risk components

DEHN Distance Tool

Calculation of the separation distance in accordance with EN 62305-3*

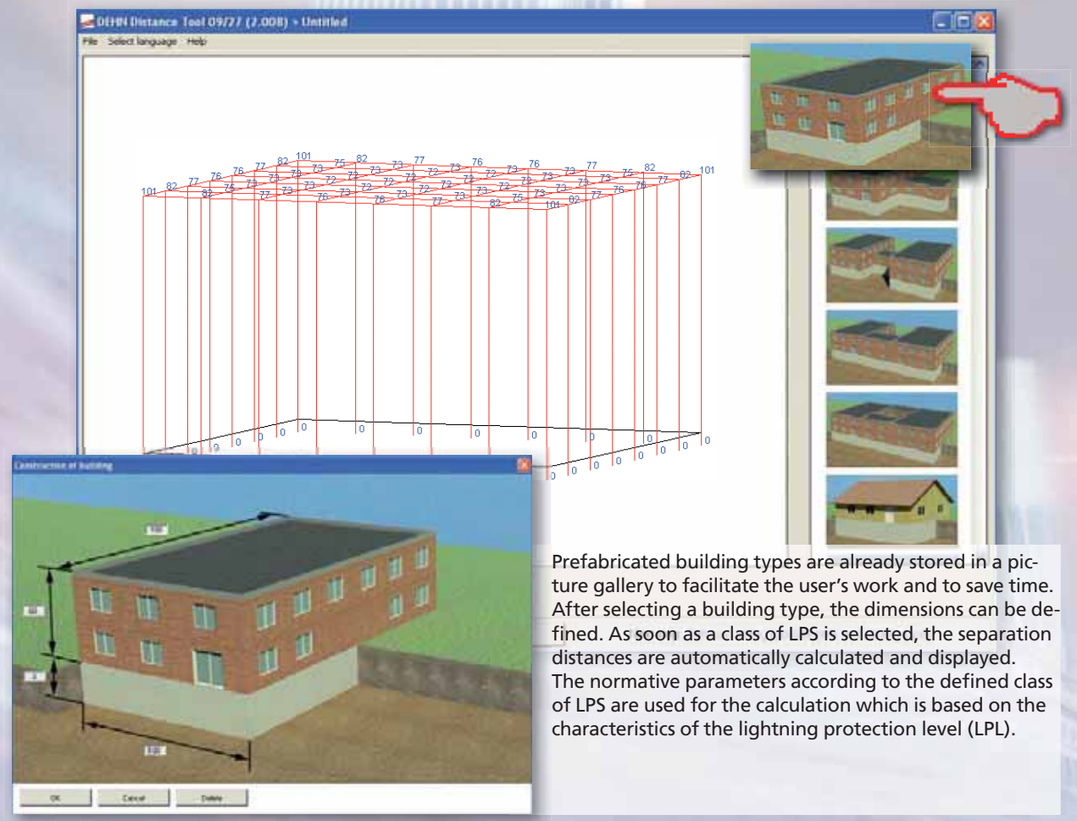
To prevent damage caused by lightning strikes, specific protection measures have to be taken for the objects to be protected. The calculation of the separation distance was continuously developed due to the ever increasing scientific knowledge in the field of lightning research.

In accordance with the current EN 62305-3* standard, roof superstructures installed on structures should be located in the strike protected area by using air-termination rods or elevated air-termination systems (ring conductor or catenary wires) while maintaining the calculated separation distances.

In addition to the conventional calculation formula for determining the partitioning coefficient k_c, more precise calculations can be made according to the standard.

The calculation of the separation distance by means of the Distance Tool software is based on nodal analysis, a method for network analysis used in electrical engineering. A constant earth resistance is assumed when calculating the separation distance (type B earth electrode).

3D building modelling with automatic calculation of the separation distance s according to prefabricated building types



Prefabricated building types are already stored in a picture gallery to facilitate the user's work and to save time. After selecting a building type, the dimensions can be defined. As soon as a class of LPS is selected, the separation distances are automatically calculated and displayed. The normative parameters according to the defined class of LPS are used for the calculation which is based on the characteristics of the lightning protection level (LPL).

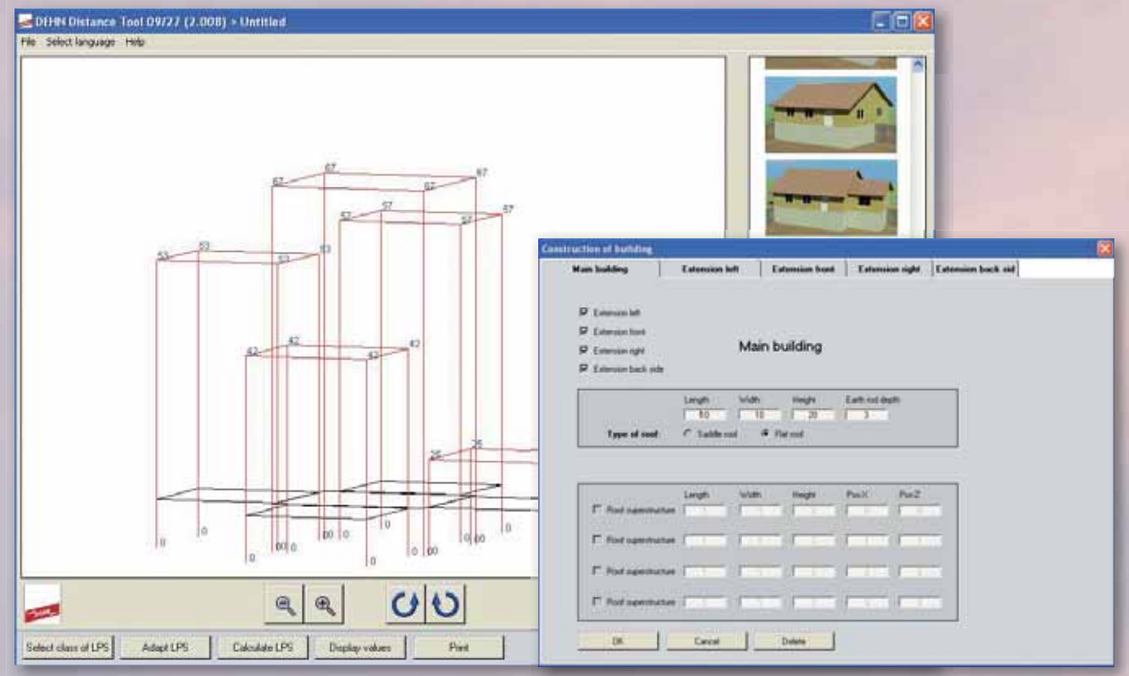
* DIN EN 62305-3 (VDE 0185-305-3); IEC 62305-3; ČSN EN 62305-3; CEI EN 62305 e-3 (CEI 81-10-10/2 e 3); STN EN 62305-3; ÖVE/ÖNORM EN 62305-3; NF EN 62305-3; NBN EN 62305-3; BS EN 62305-3;

DEHN Distance Tool

Calculation

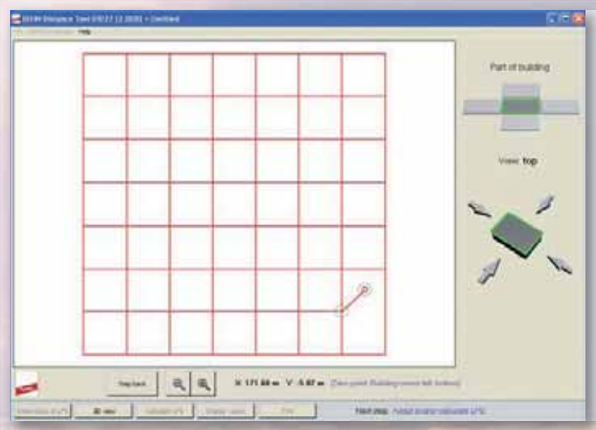
3D building modelling by means of free construction

To meet the ever growing requirements for complex buildings, the Distance Tool software offers the opportunity to model a building complex according to requirements. In addition to different annexes also roof superstructures can be integrated.



Editing the lightning protection system

The LPS can be modified since frequently mesh sizes cannot be observed and air-termination rods have to be adapted to local conditions.



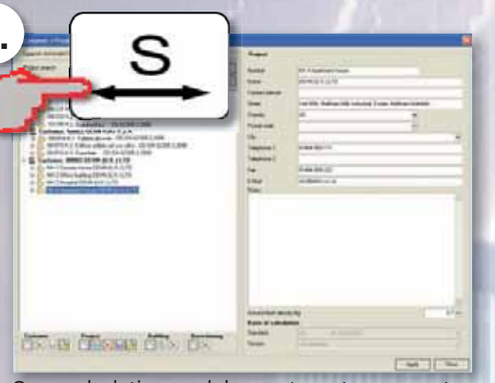
The following modifications are possible:

- **Insertion of ring conductor**
- **Addition of down conductors**
- **Insertion of internal down conductors**
- **Insertion of air-termination rods**
- **Deletion of air-termination / down conductors**
- **Shifting / lifting of the zero potential level**
- **Shifting of air-termination / down conductors**

DEHN Distance Tool

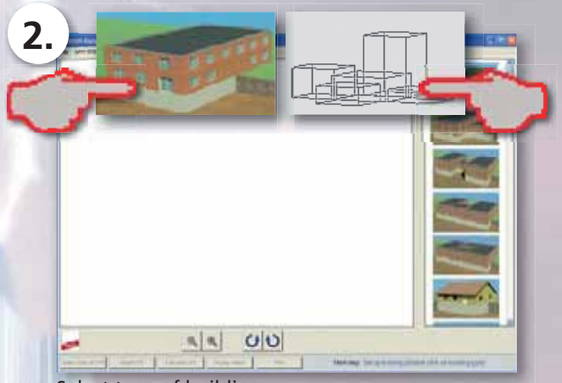
Brief instruction of the Distance Tool

1.



Open calculation module, create customer, create project

2.

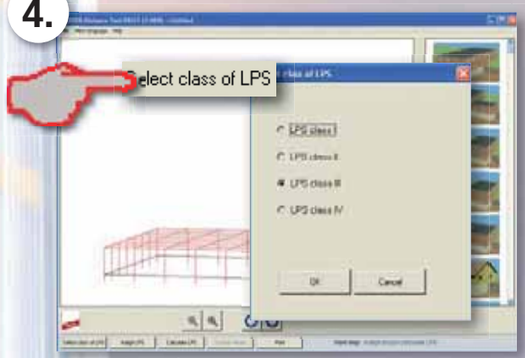


Select type of building

3.

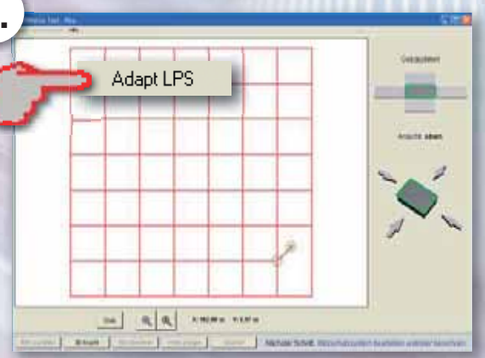
Enter building data, define annexes, define roof superstructures

4.



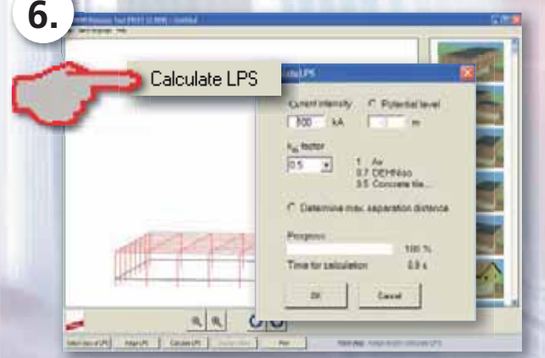
Select class of LPS

5.



Edit lightning protection system

6.



Define k_m factor, calculation of the lightning protection system, print results

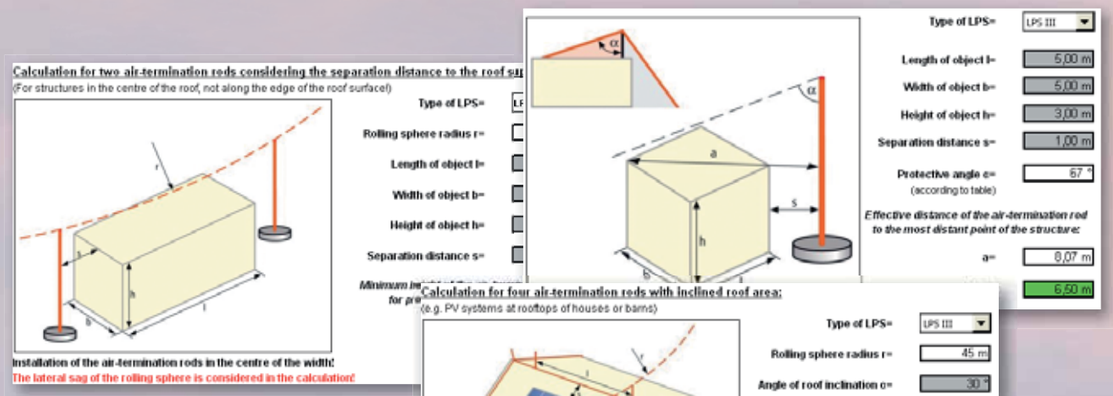
DEHN Air-Termination Tool

Calculation

Determination of the length of the air-termination rods

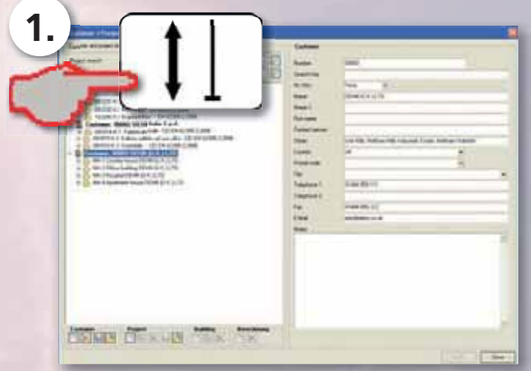
The DEHNsupport software also includes the determination of the length of the air-termination rods. Air-termination rods allow to integrate large areas into the protected zone of lightning protection zone 0B.
In some cases, graphics are required for determining the height of the air-termination rods which have to be created depending on the class of LPS.

To facilitate work for experts, different kinds of calculations are available in the DEHNsupport software.
The aim should be an adequately designed external lightning protection system. The dimensioning of the protected zones depending on the height of the air-termination rod are an important factor.



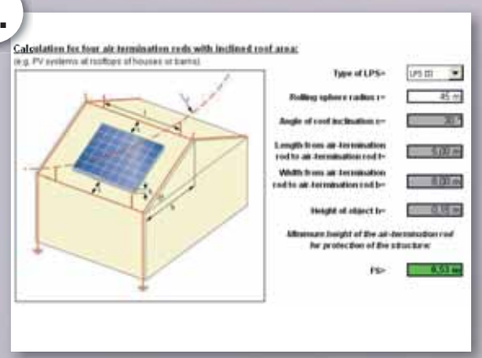
Brief instruction of the Air-Termination-Tool

1.



Select type of calculation, create customer, create project

2.



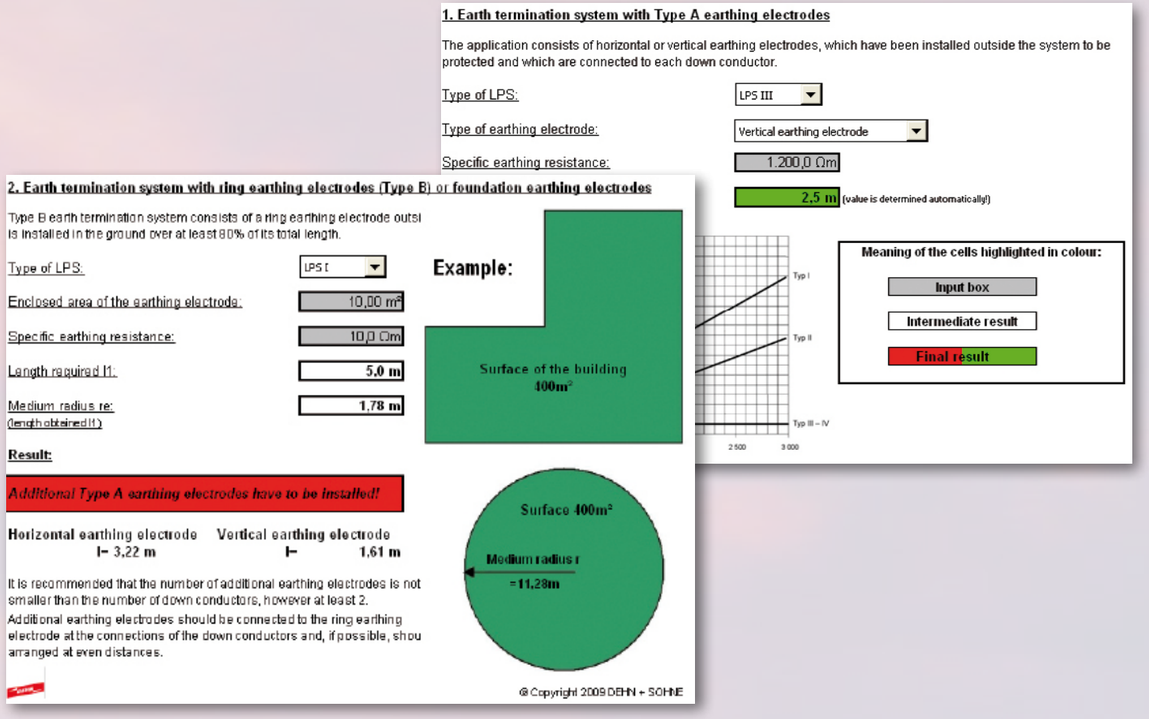
Start calculation, save and print

DEHN Earthing Tool

Calculation

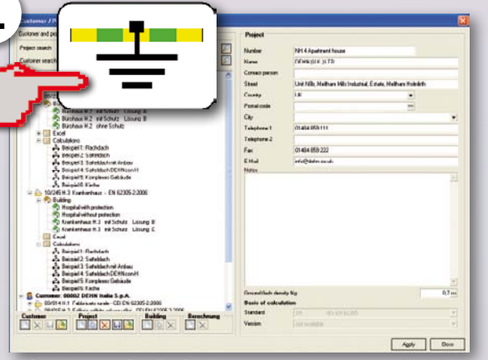
Determination of the length of the earth electrodes

Another tool of the DEHNsupport software allows to determine the length of the earth electrodes in accordance with EN 62305-3*.
For this purpose the different types of earth electrodes are distinguished (foundation earth electrode, ring earth electrode or earth rod).
The surface soil resistivity is an important factor for the determination of the required length of the earth electrodes.



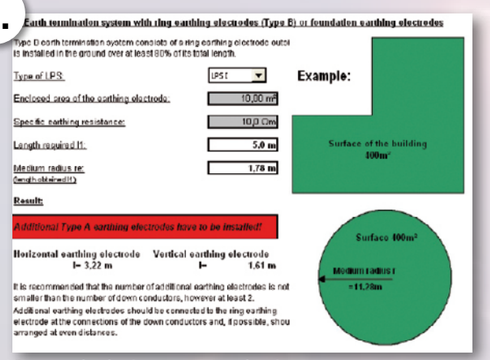
Brief instruction of the Earthing-Tool

1.



Select type of calculation, create customer, create project

2.



Start calculation, save and print

* DIN EN 62305-3 (VDE 0185-305-3); IEC 62305-3; ČSN EN 62305-3; CEI EN 62305 e-3 (CEI 81-10-10/2 e 3); STN EN 62305-3; ÖVE/ÖNORM EN 62305-3; NF EN 62305-3; NBN EN 62305-3; BS EN 62305-3;

DEHN Support

System description

System requirements:

- IBM compatible PC (Pentium 1 GHz or higher)
- Min. 256 MB RAM (512 MB or higher recommended)
- Min. 75 MB free hard disc space
- Monitor resolution min. 1024 x 768 pixels, colour depth at least High Color (16 bits)
- 32 MB VGA graphics card (64 MB or higher recommended)
- Operating systems: Windows 2000/XP/2003/Vista
- Internet Explorer 5.0 (or higher)
- Internet connection (optional)

System maintenance/support

Update
A piece of software is a living product and requires continuous development and improvement. Therefore updates will be provided. We will inform you as soon as an update is released.

Technical Support
Please contact us simply by e-mail at dehnsupport@dehn.de.

Ordering information

The DEHNsupport software can be ordered from DEHN + SÖHNE UK. The product includes single-user licences. Installation on the server is not possible. Please also refer to the instruction which can be found in the Help menu item of the software.
The DEHNsupport software is available in different combinations:

Software DEHNsupport Basic
DEHNsupport Basic with risk analysis, calculation of the length of the earth electrodes and calculation of the separation distance (conventional).
DEHNsupport Basic is available at a price of 180 €.

DEHNsupport Distance Edition
DEHNsupport Distance Edition with risk analysis, calculation of the length of the earth electrodes, determination of the length of the air-termination rods and calculation of the separation distance according to the nodal analysis.
DEHNsupport Distance Edition is available at a price of 275 €.

Update from Basic to Distance Edition
If the Basic version is already installed, the upgrade for the calculation of the separation distance according to the nodal analysis is available at a price of 95 €.

Multi-user installation
A multi-user installation for more than two work places is also available. The price depends on the number of users (e.g. 2 work places 275 €, 4 work places 550 € etc.).

(All prices are subject to VAT and shipping costs)

Lightning Protection
Surge Protection
Safety Equipment

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GmbH + Co.KG.
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Fax +49 9181 906-1100
www.dehn.de
info@dehn.de

☐ I hereby order the DEHNsupport Basic software at a price of 180.00 € plus VAT and shipping costs.

☐ I hereby order the DEHNsupport Distance Edition software including the calculation of the separation distance according to the nodal analysis at a price of 275.00 € plus VAT and shipping costs.

☐ I hereby order the upgrade calculation of the separation distance according to the nodal analysis for the already existing DEHNsupport Basic software at a price of 95.00 € plus VAT and shipping costs.

☐ I hereby order the DEHNsupport Distance Edition for multi-user installation for .... work places at a price of ..... x 275.00 € plus VAT and shipping costs.

Name _____

Company _____

Street _____

Postal code/City _____

Tel. _____

Fax _____

Date _____

Signature _____

Complete the above form and return it to us!