

**TI 386 (1.6 EN)**

**NoizCalc**

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## Quick guide

This is a short step-by-step guide (1 page) how to prepare and calculate a noise prediction.

## Getting started

### Adjust NoizCalc reference point in ArrayCalc

Activate NoizCalc in Settings > Advanced features.

Adjust the position of the reference point in the 3D plot at a representative point in the audience area at listening height (e.g. 1.7 m standing, 1.5 m sitting).

Start NoizCalc. Create a new project: **FILE > NEW PROJECT**.

Select a calculation standard (Nord2000 provides greater accuracy; use ISO 9613-2 when requested).

Select default ground for your project: Urban for mostly paved grounds, Rural for countryside / fields.

Integrate an ArrayCalc file in the project settings (button).

## Modelling

### Import geo data (bitmap, elevation data and objects)

New project: switch to Editor tab → map window opens.  
Projects with geo data: click map button in Editor tab (top right).

Navigate to event location. Adjust viewport to obtain an overview of event site and possibly affected areas.

Select service for bitmap: Google Maps (aerial image, map; with or without labels and points of interest) or OpenStreetMap.

Adjust default building height. This value is used when no height data is available for Import.

The import includes:

- Bitmap of selected viewport.
- Elevation data from Google Maps.
- Objects from OpenStreetMap (OSM)  
(Buildings, Ground effects and Forests).

Click the "Import" button to execute the import. A Digital Ground Model (DGM) is calculated and shown underneath the bitmap in the Editor. Objects are only imported onto the DGM.

Check DGM and objects in the editor; use 3D map for heights.

**Ground effects** define the acoustical properties of grounds. Default ground: "urban" or "rural".

**Buildings, Ground effects** and **Forests** can be entered and edited (shape & height). If height data is not available, then:

- Buildings: user defined default height is used.
- Forests: default height of 10 m is used.

The default Right angle drawing mode can be changed also while entering an object.

## Stage

Activate the Stage object by clicking the ArrayCalc symbol (black abacus). Place a stage on the bitmap using a left mouse click. Define its orientation (angle).

## SPL at reference point and spectrum

Select a spectrum from the pull down menu or alternatively open the Emission library by clicking the library symbol  for more options.

Change **SPL AT REFERENCE POINT** as needed.

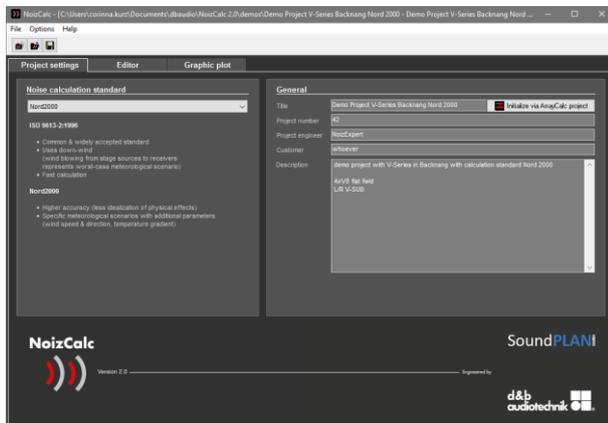
## Calculation

The size of the noise color map (=result) is either determined by the min/max coordinates of all objects or by defining a calculation area.

Click the abacus  symbol to set the parameters for the calculation and Run to start the calculation. After a successful calculation the result will automatically be shown in the Graphic plot tab in form of a grid noise map. Click Signs and symbols, the level color scale or the length scale to customize the appearance of the result.

## 1. Introduction

This Technical Information explains the use of NoizCalc for noise predictions with sound systems defined in the ArrayCalc simulation software.



### NoizCalc start-up screen

With NoizCalc you can calculate the noise impact on neighboring areas of sound systems at outdoor events. A sound system that has been defined in ArrayCalc is simply imported and positioned as one stage object. The quality of the simulation depends on the accuracy of the model: Topography, terrain and different types of acoustically relevant objects have to be modelled to perform a realistic sound propagation calculation.

### What NoizCalc does

NoizCalc calculates the sound propagation from the sources (sound system of one or more stages) to the grid points on a calculation area. The calculation is performed according to the chosen standard (Nord2000 or ISO 9613-2) and takes into account directivity and interaction of complex loudspeaker setups along with propagation effects. The noise map resulting from the calculation represents a momentary snapshot based on the given sound system setup, signal spectrum, terrain and meteorology.

### What NoizCalc doesn't do

NoizCalc does not provide any evaluation of the calculation results nor any indication whether the allowed noise levels in the neighborhood are exceeded. In order to obtain this kind of assessment, a noise consultant should be involved.

## 2. Installation

Administrator rights are required for installation. Double click the installation file and follow the instructions.

Main versions require a new download and installation, e.g. NoizCalc 2.4 and NoizCalc 2.6, but can be installed parallel.

Updates can be done in-app: Help > Updates & Downloads, e.g.: NoizCalc 2.4 | Update 15.04.2019.

You can look up the NoizCalc version here:

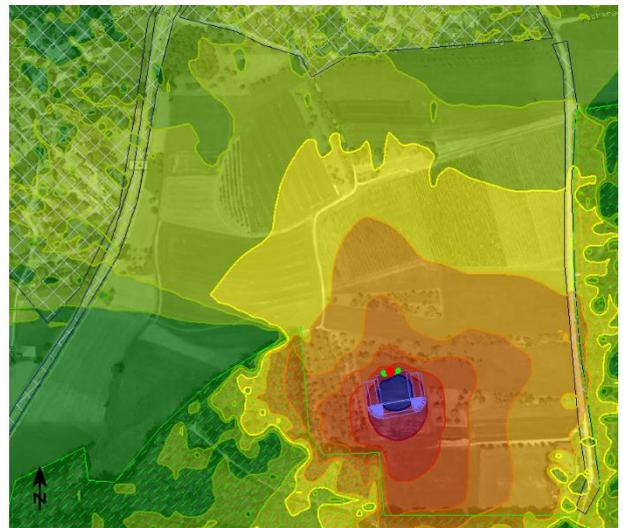
Help > About.

**NoizCalc**

## 3. Calculating the environmental noise

The sound propagation from outdoor stages defined in ArrayCalc to each grid point is calculated according to one of the standards Nord2000 or ISO 9613-2.

The modelling starts with an import of terrain data from Google and noise relevant objects from OpenStreetMap (OSM) at the desired location. Aside from the topography and buildings, the acoustical ground properties need to be defined with Ground effects. The default ground is selectable: "urban" for mostly acoustically hard paved surfaces, or "rural" for countryside or field. Especially areas with differing properties to the default ground need to be entered. Forests and walls can also be modelled. The automatic import does a lot of the work for you, but you need to check the created objects and complete the model.



**Example of the noise propagation of a venue in a landscape situation with forests and partly hard ground in the neighboring village**

### 3.1. Getting started

#### 3.1.1. NoizCalc reference point in ArrayCalc

Define the position of the NoizCalc reference point in ArrayCalc in the 3D plot. It must be initially activated in Settings > Advanced features.

Choose a representative point in the middle of the audience area at listening height, typically at front of house.

Note: The SPL in ArrayCalc is not used for the calculation in NoizCalc. The desired SPL sum and a (music) spectrum are defined in NoizCalc with the stage. For the calculation, NoizCalc will "drive" the sound system according to the demanded spectrum and SPL so that they are reproduced at the reference point.

#### 3.1.2. Integrate ArrayCalc file

Start NoizCalc and create a new project by either clicking the New project button or selecting **FILE -> NEW PROJECT**.



Clicking the Integrate ArrayCalc file button will take over the general project information such as project title and description from a selected ArrayCalc file. In addition, a move or copy dialog will appear in order to integrate the file into your NoizCalc project folder including all defined venues, sources and settings.

### 3.1.3. Calculation standards

Nord2000 provides greater accuracy – use ISO 9613-2 when requested.

Calculations with Nord2000 provide greater accuracy since they are closer to the physical reality. For instance, it uses Fresnel zones to calculate ground bounce instead of just a heuristic formula. Furthermore, in ISO 9613-2 the inherent downwind cannot be changed, which leads to a meteorological worst-case scenario.

### 3.1.4. Default ground

Select the default ground for the entire area of the event and its surrounding: “urban” for cities and mostly paved, acoustically hard ground, or “rural” for countryside with fields. These values apply where no Ground effect is defined. (Up to NoizCalc 2.4 “rural” is the default ground.

## 3.2. Modelling

After selecting an object type from the toolbar, simply enter the coordinates of an object using left mouse clicks or hold down the left mouse button while drawing a rectangle. For further details, please refer to chapter [4.2](#) “Data entry tools”.

Note: You can take advantage of the fact that the object properties are always taken over from the last object of the same type entered. As a result, you can speed up your modelling by entering identical or similar objects successively.

### 3.2.1. Import of geo data

When switching to the Editor tab in a new project, the **ONLINE MAP DATA INTERFACE** opens automatically. Search or navigate to the location of the event and adjust the viewport to obtain an overview of the venue and the surrounding areas of interest. For the bitmap, you have the choice of two map data services:

- Google Maps: aerial image, map, map with terrain Labels and points of interest can be de-/activated. Tilt view cannot be imported.
- OpenStreetMap: map

The elevation data originates from Google Maps; Buildings, Ground effects and Forests from OpenStreetMap. You can change the default building height. This value is used when no height data is available for Import.

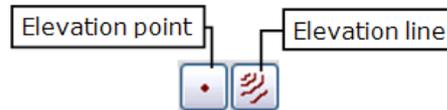
Click the “Import” button to execute an import. A Digital Ground Model (DGM) is triangulated. Objects are only imported onto a DGM. All data is saved in the project folder. After successful completion, the bitmap, the DGM and the objects are shown in

the Editor. The automatic import does a lot of the work for you, but you need to check the created objects and complete the model. It is also good practice to check the terrain and buildings in the 3D map view.

The initially imported bitmap is saved separately as Overview.bmp. Further bitmaps can be imported for detailed modelling (re-call the map window by clicking the map button  in the editor). They are named Detail.bmp and overwrite each other, whereas the overview bitmap stays available. The background bitmap can be selected in the top right corner in the editor.

### 3.2.2. Elevation-relevant objects

Topographic data is not always correct and it can become necessary to change the terrain locally. Especially if the ground around the stage is known to be flat, but the SUB array is partially “buried” by the DGM. The pre-check before the calculation run will give a warning, but not stop it. Usually, the result is only affected minimally.

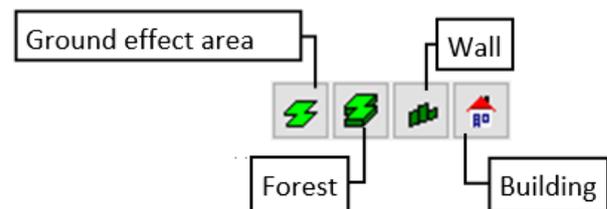


#### Elevation-relevant objects

Elevation points and elevation lines define known elevations. Elevation lines can either be contour lines with the same elevation at every coordinate or profile lines with different elevations. To model a flat venue within a changing topography, delete the elevation points within the venue and add an elevation line around the venue. The Digital Ground Model will automatically adapt itself to the changed terrain after un-selecting the object.

Select **OPTIONS -> OBJECT TYPES** to hide/display elevation objects in the Editor.

### 3.2.3. Noise-relevant objects



#### Noise-relevant objects

Objects absorb, reflect or scatter sound waves at sources, along their propagation and at receivers and are vital for a realistic model.

Caution: The standards have different parameters for Ground effects and Forests. Manually entered objects need to be checked. The import saves both sets.

### 3.2.3.1. 🌿 Ground effects

Ground effects define the acoustical ground properties. They affect the sound propagation especially near sources and receivers. The available parameter settings are listed below for each standard. The default values of "urban" / "rural" are highlighted grey / green. They apply where no Ground effect is defined. Make sure the import did not miss an important area.

#### Nord2000 Impedance and roughness class

Imp.Class	Ground	Description
A	very soft	snow, moss-like
B	soft forest floor	short, dense heather-like or thick moss
C	uncompacted, loose	turf, grass, loose soil
D	normal uncompacted	forest floors, pasture field
E	compacted field and gravel	compacted lawns, park area
F	compacted dense	gravel road, parking lot
G	hard surface	most normal asphalt, concrete
H	very hard and dense surface	dense asphalt, concrete, water

Roughness class	Representative $\sigma$	Range of heights
N: Nil	0	± 0.25 m
S: Small	0.25 m	± 0.5 m
M: Medium	0.5 m	± 1 m
L: Large	1 m	± 2 m

#### ISO 9616-2 Ground factor

G	Ground	Description
0	hard	paving, concrete, tamped ground, water, ice
1	porous (soft)	any vegetation, grass, trees, farming land
0 < G < 1	mixed	fraction of porous to total ground
0.2	20 % porous	"urban": 80 % of ground is hard

**Note:** Crossing outlines of Ground effects with different values are ambiguous and prevent any calculation. Although, NoizCalc can handle a Ground effect defined entirely within another. Example: paved area within a park.

**Ground definition**

Effective Flow Resistivity [kNsm<sup>-4</sup>):

N2k: A: very soft (snow, moss-like) ▼

Roughness class

N: Nil +/-0.25 m ▼

**Ground definition**

Ground factor (0=hard, 1=soft): 0,60

#### Ground definition for Nord2000 / ISO9613-2

### 3.2.3.2. 🌳 Forest

The effect of forests on sound propagation depends on the acoustical path length, its height and density. Single trees (and line of trees) have no effect.

The shape and height of forests can be defined. With Nord2000 properties such as mean tree density and mean stem radius can be modified. (The default values in Nord2000 are the result of a best fit to the specification in ISO 9613-2):

**Forest**

Effective height [m] 10,00

---

**Nord 2000**

Mean tree density [1/m<sup>2</sup>] 0,20

Mean stem radius [m] 0,15

Factor kp 1,25

Mean absorption coefficient 0,100

#### Forest parameters

The attenuation A is calculated using the path length through the forest, d [m]:

$$\text{According to Nord2000: } A = d \cdot a(f)$$

a(f) is calculated from the mean tree density, mean stem radius, factor kp and mean absorption coefficient.

According to ISO 9613-2:

d [m]	A [dB]
< 10	0
10 ... 20	A10-20
20 ... 200	d · a(f)
≥ 200	200 m · a(f)

A10-20 and a(f) are fixed frequency dependent values in the standard.

### 3.2.3.3. 🏠 Building

**Building**

Main building

Ground floor elevation 0,0

Building height 6,0

Reflection

Reflection loss 1,0

#### Properties of a building

A building is described by its outline, its height relative to the ground height (above sea level) and its reflection loss. (Reflection loss = 1 for smooth facades, loss = 2 for structured facades). Building heights may be estimated by the number of stories / floors. If you do not want reflections to occur on a building, deactivate the checkmark **REFLECTIONS**.

Activating the checkmark for Main building will assign a layout to the graphic plot: "Main building" (e.g. residential) and "auxiliary building" (e.g. garages). To define the layout, select options -> object types.

Corners of buildings form right angles and are calculated accordingly by default unless the right angle mode is deactivated. When entering buildings, it is advisable to start digitizing with the longest side. The right angle mode can be (de)activated while entering a building.

Symbol for the right angle mode (F11): 

### 3.2.3.4. Wall



#### Properties of a wall

A wall is described by its base line, its height and its reflection loss on either side. The screening edge results from the wall height above the base line. A wall height of 0.0 meters already has a screening effect (screening edge = base line).

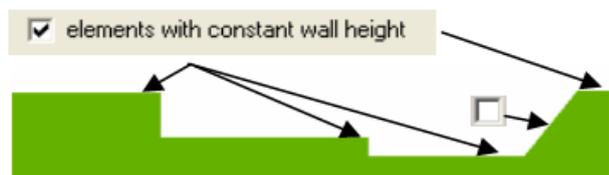
For the reflection loss, the left and right assignments are related to the data entry direction. The following reflection losses can be taken as standard values (values are taken from a German guideline for road noise, RLS-90):

Wall type	Reflection loss
Acoustically hard surfaces (concrete, glass)	1 dB(A)
Absorbent walls	4 dB(A)
Highly absorbent walls	8 - 11 dB(A)

If you do not want the wall to be calculated as a reflecting object, deactivate the reflection check boxes for each side.

The height of the wall can change over the course of the wall. The coordinates in the coordinate list where the properties change are marked in red. In the Editor, those coordinates are marked by small double circles.

Click the mark for **CONSTANT WALL ELEMENT** if you want to define a height jump at a certain coordinate.



#### Wall – element definition

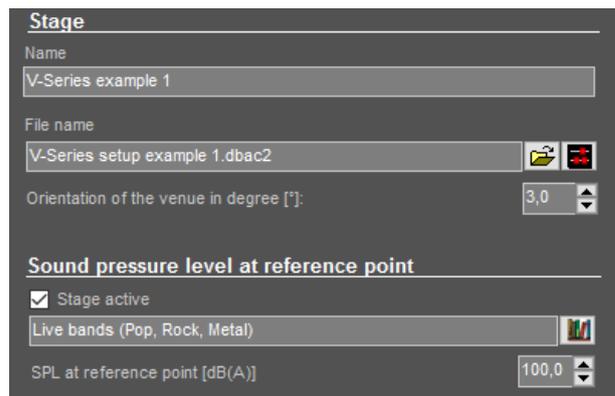
#### NoizCalc

### 3.2.4. Calculation area

The size of the noise color map (=result) is either determined by the DGM or by defining a calculation area. A smaller area reduces calculation time.

### 3.2.5. Stage (ArrayCalc file)

A stage contains all loudspeakers, with their location and orientation in arrays or singularly, electronic filters including ArrayProcessing and listening planes as defined in ArrayCalc. Select the stage object from the tool bar. Place one on the map with a left mouse click. You will either see the ArrayCalc file saved in the project folder or the Open dialog in which you can select an ArrayCalc file. Adjust the orientation of the stage.

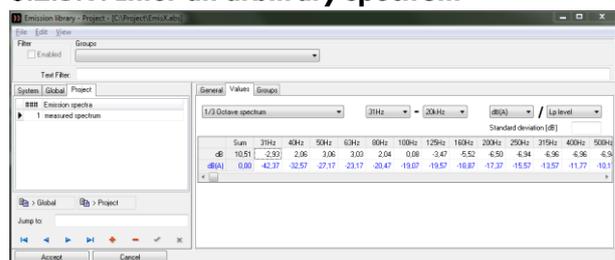


#### Properties of the Stage object

In order to select a frequency spectrum, click the library symbol  to open the Emission library. Go to the System tab, select a spectrum suitable for the event and click Accept. Enter a meaningful SPL at the reference point.

A stage can be deactivated for calculations within projects using the **STAGE ACTIVE** checkmark.

### 3.2.5.1. Enter an arbitrary spectrum



#### Emission Library screen

If you want to use an arbitrary spectrum (for example, from a measurement), access the library by clicking the library symbol , go to the Values tab in the Project library and enter a name for a new spectrum. You can select the following:

- Bandwidth: 3rd-octave or one-octave spectrum
- Frequency range
- Frequency weighting: A, B, C or D
- Spectrum type: sound pressure level or sound power level

Enter the values in the appropriate frequency band. Click Accept to assign the spectrum to the stage.

### 3.2.5.2. Calibration of the Stage

You can adjust the NoizCalc reference point in ArrayCalc in the 3D plot. (You must initially activate it in the Settings > Advanced features, if you have not already done so.) NoizCalc uses this reference point to adjust the overall sound pressure level of the sound system. Typically, it is positioned at the front of house at listening height (for example, 1.7 m standing audience). Before the actual calculation starts, the level is calibrated at the reference point. (The height of the reference point must be at least 0.1 m above the terrain - check z coordinate in the 3D plot in ArrayCalc).

## 3.3. Calculation

NoizCalc calculates grid noise maps.



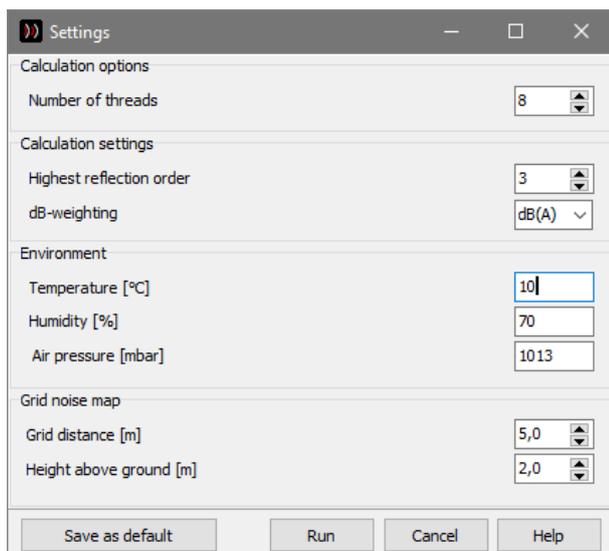
Click the abacus symbol (or select calculate -> calculations), check the calculation settings and start the calculation with Run.

### 3.3.1. Calculation settings

The **NUMBER OF THREADS** defines how many threads of a multi-core computer are used for the calculation. By default, NoizCalc uses all available threads (cores).

The **HIGHEST REFLECTION ORDER** determines how many reflections from obstacles (buildings, walls) are calculated. If reflections occur, this parameter influences the calculation time. According to both available standards, the reflection order should be 3.

The calculation can be performed with the **DB-WEIGHTING** settings dB(A) or dB(C).



### Calculation Settings

**HUMIDITY, AIR PRESSURE, TEMPERATURE:** The environmental parameters are important to calculate the air absorption and, considering that the sound speed is a function of temperature,

they influence the wavelength and therefore the screening calculation.

Nord2000 provides additional **METEOROLOGY SETTINGS**.



The Beaufort scale classifies wind speeds from 0 (calm) to 12 (hurricane). Typically, events are evacuated at wind classes higher than 4 or 5. The Downwind option enables a hypothetical and non-physical worst case scenario, which is quite commonly used for calculations of environmental noise such as traffic noise and industry noise: The calculation includes downwind in every direction from the source to the receiver (like a vortex)! For open-air events this is not very fitting due to the short duration of the event. Different specific scenarios should be considered, e.g. two different wind directions or no wind.

The Temperature gradient defines the vertical temperature change. It affects distant receivers.

The grid noise map is calculated at a specified height above ground with a user-defined equidistant grid distance. Reasonable values lie between 5 m for calculations that include buildings and walls and 20 m based on free fields. Keep in mind that halving the grid distance will quadruple calculation time.

**SAVE AS DEFAULT** changes the presetting permanently.

When calculating the grid noise maps, the program shows statistics on the duration of the calculation. The statistics can be deactivated by selecting **CALCULATIONS -> SHOW GRID STATISTICS**.

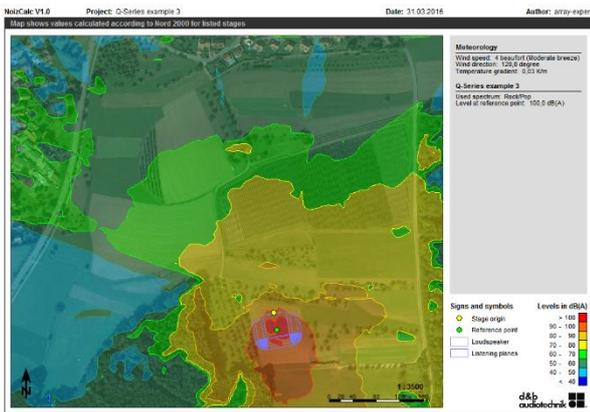
Abort calculation: Click the button "Abort calculation"  to stop a running calculation, if necessary.

### 3.3.2. Calculation messages

During the calculation, the Editor displays messages in the bottom part of the screen. Error and warning messages are presented in red. Double clicking a message will open and activate the object in question, which means that an error in the definition of the object or the geometry can be fixed easily.

## 3.4. Graphic plot

The calculation result is presented on the Graphic Plot tab together with the model geometry and the geometry bitmap.



### Formatted graphic plot of the calculation result

The layout of the graphic plot is fixed and contains information on the calculation parameters and calculated stages.

Only the sheet size, the background color of the description block, north pointer and length scale as well as the color scale are adjustable. Additionally, the objects for the graphics plot can be selected/deselected and the colors of the objects can be changed individually. For further information, please refer to "Customizing the Graphic Plot".

## 4. In-detail description

Chapter 3 describes the general workflow of calculating the environmental noise from a stage. Here, formatting and handling are described and also less frequently used processes such as importing objects and initializing individual bitmaps.

### 4.1. Create and open projects

A NoizCalc project consists of several files, which are stored jointly in one project folder. When you create a new project, you create a folder not a file.

Each folder that is recognized as a NoizCalc project is displayed with the NoizCalc logo.



Select **FILE -> NEW PROJECT** to create a new project folder. Enter the name of the project folder. As a default the project title is automatically taken over from the name of the project folder but can be changed. Use project number, project engineer and customer to add information for the project. The description field may host e.g. the telephone numbers of the customer or other project notes.

You can also initialize a project via a stage you have already configured in ArrayCalc. The project settings of the venue are taken over and the stage is copied into the NoizCalc project.



When the program is started, it automatically loads the last project used. If you want to open another project, select it via **FILE -> OPEN** or pick it from the list of recently opened projects in the menu file.

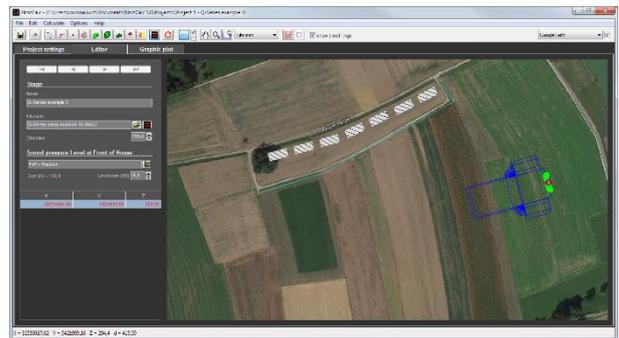
Pressing the right mouse button activates a popup menu with additional functions such as copy, delete or pack.

## 4.2. Data entry tools

### 4.2.1. General

The Editor manages the entry of all noise relevant data and geometry for your project and prepares the data for the calculation of the venue. You can prepare the geometry data on the basis of Google Earth, a scanned and geo-referenced bitmap or by importing data from DXF, ESRI Shapefile or ASCII files. Object attributes which might be part of Shape files or ASCII files will not be taken into account.

NoizCalc works with global Cartesian coordinate systems or a user defined local coordinate system. The base unit is meter. Import data that use cm, inch or feet need to be converted. For the DXF import you can enter a conversion factor.



### The NoizCalc editor

The toolbar at the top of the graphical entry field contains icons for entering the geometry, controls for zooming and editing, and symbols for selecting the background graphics.

In the block on the left side of the graphical entry field, the properties and coordinates of the currently active object are listed. In case an object (i.e. elevation lines) does not contain any properties, only the coordinate list is displayed.

### 4.2.2. Enter objects

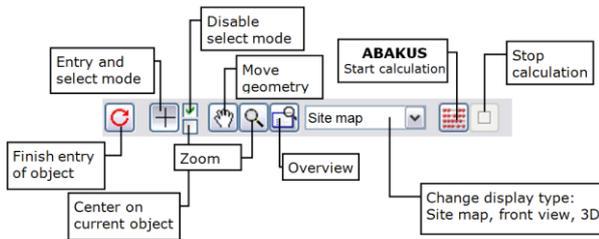
Click the desired object type icon in the toolbar. With the crosshair cursor activated, enter the first coordinate with a left mouse click the screen and enter the z coordinate in the coordinate table. If a DGM is already present, the elevations from the DGM are automatically entered in the coordinate table. For line-type or area-type objects, enter additional coordinates at the desired position.

End the data entry for the line and area objects by double clicking or use the **FINISH OBJECT** (F2) icon. For buildings entered with the right angle mode, you can close the building with a double click the third coordinate; the fourth coordinate will be added by the program and the building will be closed.

North oriented, rectangular objects can be entered by drawing a frame with the left mouse button. You can also enter coordinates using the keyboard in the coordinate list or correct them afterwards. To enter objects, the mode "Select object or create new object" must be active.

### 4.2.3. Edit objects and object properties

The following toolbar depicts the entry and edit functions in NoizCalc:



#### Edit objects toolbar

Enter objects by clicking the items describing the object with the left mouse button.

✚ The crosshair cursor is visible when entering objects. If the crosshair cursor is close to another object...

☞ ... it will change its appearance into the selection cursor to select the object and display its coordinates and properties on the right side.

Notes:

- If you want to digitize new coordinates but other objects are too close and the cursor changes, disable the selection cursor in the checkbox "Disable select mode".
- If objects are stacked on top of each other and the wrong object is activated, click the icon of the desired object type in the toolbar. The active object type is always found first.
- Use the navigation bar above the properties to move from object to object within the object type selected. Use this feature to check properties and coordinates of the objects.



- If you have started digitizing a new object but meant to activate an existing object, pressing the ESC key will delete the new object if it has not yet been finished.
- If you want to place an object directly on the edge of another (e.g. for terraced houses), disable the selection cursor in the checkbox "Disable select mode". The cursor changes into a capture circuit and snaps the edge or the corner of the previous object:



The **OVERVIEW** icon zooms out to display all entered objects. The "hand" icon moves the data; the "magnifying glass" with left click or right click zooms in and out.

Even if a large bitmap is active in the background, you can still use the **OVERVIEW** icon to zoom out to the entire size of your investigation area. The program will maximize the already entered model. If you want to enter data outside the area, click the "hand" symbol to move the viewport or use the "magnifying

glass" and right click to decrease the scale of the plan and thus move the extended area into view.

The mouse wheel functions are available in addition to the icons: Turning the mouse wheel zooms the data, holding down the mouse wheel moves the geometry. Additionally, you can press the Ctrl key to rotate the data.

If the checkbox "center to current object" is checked, the geometry moves and the object is displayed in the middle of the screen.

#### 4.2.3.1. Selection of multiple objects

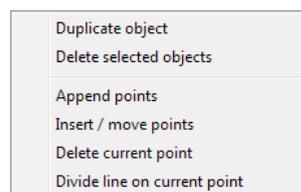
Holding down the Ctrl key and left clicking the object selects multiple objects. As an alternative, you can draw a frame around the objects by holding down the right mouse button – all objects that have at least one coordinate within the frame are marked. Marked objects can be deleted jointly (popup menu right mouse button or Ctrl+Del), they can be moved (by moving the pink diamond with the left mouse button) or rotated (Ctrl+ left mouse button on pink diamond).

Hold down the shift key and draw a frame with the right mouse button to only select the objects of the current object type. Holding down the shift and Ctrl keys, additional objects of this object type can be selected (draw a frame or use a left mouse click).

If multiple objects of the same type are marked, it is also possible to jointly modify the objects' properties. This however is not possible for objects that have the ability to change properties within the object (road, railway, wall or berm).

#### 4.2.3.2. Object operations

A right mouse click on an object opens the following menu options:



Move object(s): The pink diamond appears as soon as at least one object is activated. Move the cursor to the diamond, the shape changes into the move cursor. Selected objects are moved holding down the left mouse button.



Rotate object(s): The pink diamond appears as soon as at least one object is activated. Hold down the Ctrl-key and move the cursor to the diamond, the shape changes into the rotation cursor. Selected objects are rotated holding down Ctrl +left mouse button.

When objects are moved or rotated, they are automatically re-referenced to the DGM. If the DGM is deactivated, the object elevation (z-coordinate) is not updated to its actual new position.

Duplicate object: Right click the object you want to duplicate. **DUPLICATED OBJECTS** are positioned with a slight offset to help placing them. The duplicated object is activated and can be moved holding down the left mouse button.

Objects can be deleted using the popup menu Delete selected objects or the Ctrl+Del keys. Single coordinates are deleted in the graphics window by right clicking and selecting the option → **DELETE CURRENT POINT**. It is faster, however, to delete a coordinate in the coordinate list using the Del key.

Append points is only active for line type objects so that additional coordinates can be digitized at the end of the object. Select insert/move points to move single coordinates or insert coordinates at the cursor position. The cursor will change into an arrow with a small „+“ sign.

Divide line objects: Go to the coordinate, where you want to divide the line with the right mouse button and select **DIVIDE LINE AT THE CURRENT POINT** from the popup menu. The new object receives the properties that are valid at the point where the object is divided. Lines can only be divided, if the resulting two line parts have more than 2 coordinates.

Distance indicator: The distance between the current cursor position (in world coordinates) and the coordinate last digitized is presented in the status bar in [m].

X = 1206,24 Y = 1017,30 Z = 0,0 **d = 4,00**

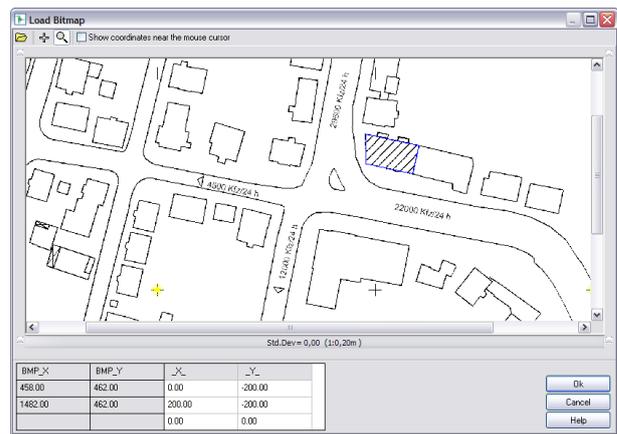
Note: The more you zoom into the plan, the more exactly you can define the spacing.

#### 4.2.4. Initialization of background bitmaps

Digitizing on top of scanned background graphics is the most common mode of data entry unless the data are already present in a usable form in digital format. When scanning a map, the resolution and especially the color depth should not be selected too high as this will slow down the operation. You can use any number of background bitmap graphics in any of the formats BMP, JPG, PNG or TIF.

A geo-reference must be established between the pixel formatted bitmap and the world or local coordinate system. If the bitmap already came with its geo-reference transformation, NoizCalc will detect it and read the geo-reference file as soon as the file is opened.

Open **EDIT -> INITIALIZE BITMAP** and open the scanned map.



#### Bitmap initialization

The reference points should be as far apart as possible and should enclose the investigation area as much as possible. Enter world coordinates of the first reference point using the keyboard and then left click the graphics to assign the location on the bitmap. To digitize more accurately, the first click opens an enlargement around the reference point so you can position the cursor more precisely and digitize again. Define the second reference point and click OK.

In the Editor, you can switch between different background bitmaps in the selection list and also temporarily deactivate a bitmap. With the click box next to the active bitmap, the current bitmap can be displayed or suppressed.



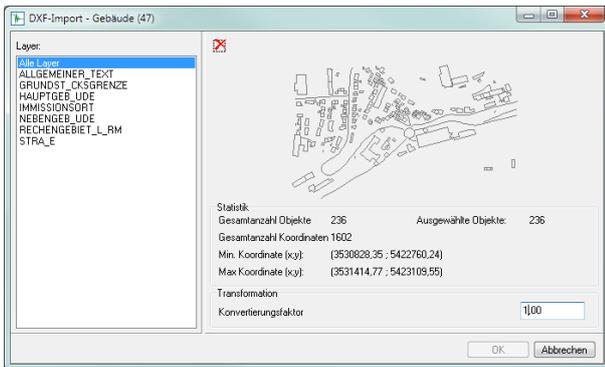
#### Bitmap selection list

#### 4.2.5. Import

The model geometry can be imported in the DXF, ESRI Shape file or ASCII formats. The objects must be organized in individual files (Shape files) or layers (DXF).

Select the object type for which you want to import the data. In the property declaration block, you can assign default properties to the new objects so you do not have to manually define each value that might be covered by the default settings. Start the import via **FILE -> IMPORT** and the required format. Select the file and click OK. After importing, customize the properties of the imported objects.

As DXF files contain different layers, an additional window is provided to select the appropriate layers for import. Use the shift key or the control key to mark multiple layers of the same object type for import. The assignment to the different layers is lost.

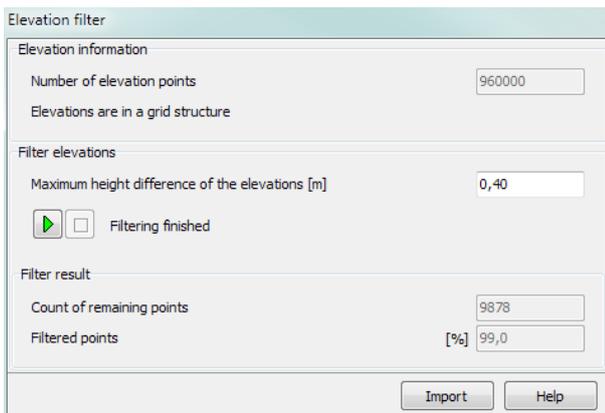


### DXF import

When importing a DXF-file, you can enter a conversion factor if the drawing was for example set in millimeter or feet.

#### 4.2.5.1. Filter elevation points prior to import

If you have elevation spot heights to be imported as ASCII or DXF data, they often are present as either a grid or a cloud with very small spacing (for example 1x1 [m] grid with little variance in elevations). The amount of elevation information far exceeds the need to correctly model the terrain. As the number of elevation coordinates has a large influence on the size of the DGM and also on the calculations, it is useful to filter the elevation information and thus minimize the number.



### Filter elevation points

In the dialog that opens after selecting the import file, the number of elevation points and the structure (grid or cloud) is presented as the file information. If you want to keep all spot heights 1:1, click Import. If you want to filter the data, you need to enter the maximum deviation between the elevation data given in the import file and the elevation model that will be used after filtering the data. Enter the max difference in [m]. With the pre-set max deviation of 40 cm, a tolerance of  $\pm 0.40$  m is guaranteed between the raw data and the model to be created. Click the green arrow to start the filtering and import. The filter result will show you how many elevation coordinates will remain and what percentage of the original data will remain.

### 4.3. Digital Ground Model

A Digital Ground Model (DGM) is the basis for creating a 3D noise model. It is generated from elevation lines and elevation

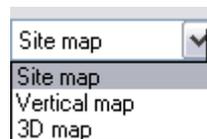
points. NoizCalc automatically calculates the DGM from the geometry data.

All objects that are now entered or imported are automatically placed on top of the triangulated surface. If the DGM triangles are visible in the background, objects moved to a new location will automatically adjust to the elevation at the new location.

The terrain elevation can be assigned manually selecting **EDIT -> SET CURRENT OBJECT ON DGM** or **EDIT -> SET ALL OBJECTS OF CURRENT OBJECT TYPE ON DGM**. Check the model data in the 3D map.

### 4.4. Display types: Site map, vertical map, 3D map

The geometry data is entered in the site map. It is always advisable to review the integrity of the data model in the 3D map or using the projection in the vertical map. Change the map using the selection list.



#### View selection list

To toggle between site map and 3D map you can also use F10.

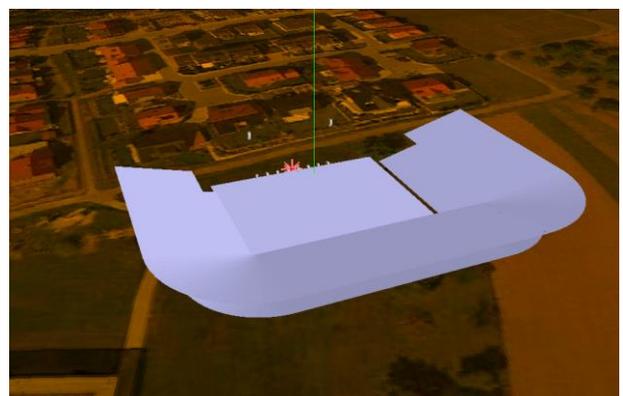
The object properties of a selected Object can be edited in all display types if the selection mode is active.

Use the mouse wheel to freely move and zoom in the model data:

- Move mouse wheel: Move the world.
- Rotate mouse wheel: Zoom in and out.
- Shift + move mouse wheel: Change distance.
- Ctrl + move mouse wheel: Rotate and tilt the world or light.

You can also use the right mouse button in the "hand mode" to select the various movements and view modifications.

Initially the **MOVE** mode is active.



In **CHANGE LIGHT** mode, you can move the position of the light source by pressing the left mouse button and moving the cursor across the screen.

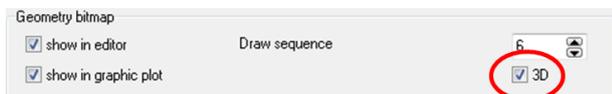
For the **DRAWING TYPE**, select between wire frame model and hidden lines and surfaces and in the **PROJECTION** TYPE between orthogonal and perspective projection.

The presentation of the DGMs in the 3D map can be activated or de-activated.



Note: The color to paint the DGM is set in the "Elevation line" object type.

If a geometry bitmap is in the background in the Editor, it can also be displayed in the 3D map. Please activate the 3D check box in the menu bar of the 3D map and the 3D check box in the Geometry bitmap object type.



#### 4.4.1. Further settings

In the top view you can configure the presentation to show area fillings. Areas are then either filled or only show the line around the areas. Suppressing the filling may be helpful when digitizing on top of a background bitmap.



#### 4.4.2. Coordinate list

The coordinate list shows the x and y coordinates and depending on the object type the base height or the relative height, all in meters. The terrain elevation of the objects is only displayed for information purposes and cannot be edited as it is either 0 or it is derived directly from the digital terrain model.

In the coordinate list you can:

- Correct x and y coordinates.
- Insert coordinates with the right mouse button -> **INSERT POINTS**. The point is inserted in the middle of the two coordinates, the elevation between both points is interpolated. (This is, for example, useful to divide a wall in smaller, regular sections.)
- Delete coordinates (DEL key).
- Delete changes in the property definition within roads, railways, walls and berms (right mouse button -> **DELETE PROPERTIES**).

If a line contains only a single coordinate after deleting, then the entire object is deleted. This also applies to areas with only 2 coordinates.

#### 4.5. Additional objects

Click the icon for the desired object and select the coordinates with the left mouse button on the screen.

#### 4.5.1. Text



Texts are used to write descriptions or annotations for the graphical output (e.g. source name, house number). The texts are linked to the entry coordinate.

#### 4.5.2. General line

You can, for example, import all lines from a DXF file to the "General line" object type and digitize the required objects in a similar way to digitizing them from a background bitmap.

Deactivate the checkbox "Select objects"  when digitizing the objects.

After finishing digitizing, you can hide the lines by selecting **OPTIONS -> OBJECT TYPES**. Deselect Show in editor or use them as background data in the graphics plot.

#### 4.6. Customizing the graphic plot

##### 4.6.1. Set sheet size

Before you determine the viewport of your map, select the sheet size so that the program knows the active drawing area and can determine the length scale.

Open **GRAPHICS -> SHEET SETTINGS** or click the white frame of the sheet to define the settings.



##### Sheet settings

Select the sheet size and define the background color of the description block.

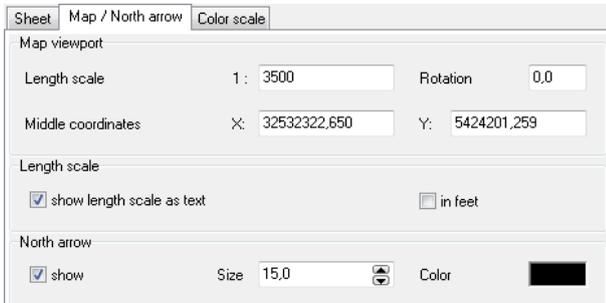
You can access the elements on the respective tabs in the graphics menu or by clicking the element.

##### 4.6.2. Set viewport and length scale

As default, the map will be scaled to present the entire grid noise map area. Use the right mouse button or the graphics menu to select the proper viewport for your map.

- Exit viewport editing
- Move map viewport
- Zoom map viewport
- Rotate map viewport
- Reset map viewport

Click the scale bar (or **GRAPHICS -> EDIT MAP VIEWPORT**) to numerically set the scale, rotation and center coordinates, and to format the north arrow.



### Map/North arrow settings

The Map length scale is automatically adjusted when zooming. When rotating the map, the north arrow and the background graphics are also rotated. The length scale can be displayed in meters or feet. The scale bar can be moved to a new position pressing the right mouse button.

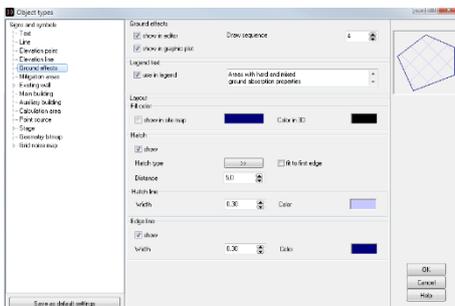
Ratio: 1:1000 = 1 meter represents 1000 meters (no mixture of units).

The **NORTH ARROW** can be moved to a new position by pressing the left mouse button while moving the arrow to its new position.

### 4.6.3. Edit legend, format objects

Open **OPTIONS -> OBJECT TYPES** or click the legend and select the object type you want to customize.

The layout of all objects is defined in the object type file: Geometry object types (i.e. buildings), the grid noise map object type, as well as geometry bitmaps. A set of default definitions for all object types is delivered with the program. You may customize these as you like.

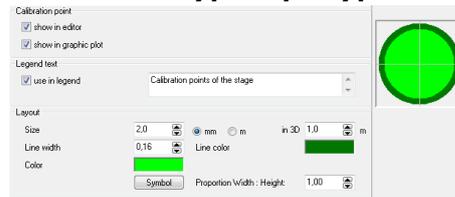


### Object types file

For each object type, select whether this particular object type should be visible in the Editor and in the graphics display. You can alter the object name that appears in the legend in the

Legend text section. The higher the Draw sequence, the later the object is drawn (and may hide objects of a lower sequence number).

### 4.6.3.1. Point type object types

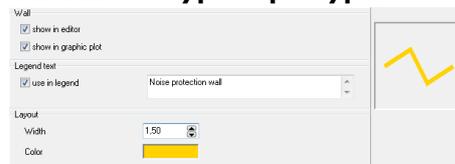


### Point object types

Define the size in [mm] (plan size) or in [m] (world coordinates). If you select millimeters, the object will be drawn irrespective of the scale of the drawing. If "meters" is selected, the size of the sign depends on the scale. The sign will be as large as the selected number of meters in the world coordinates scale. For the symbol size, an imaginary rectangle is drawn around the symbol. The longest side will determine the symbol size.

Click the **SYMBOL** button to select a different symbol than the one proposed. Also select the symbol line width and border lines.

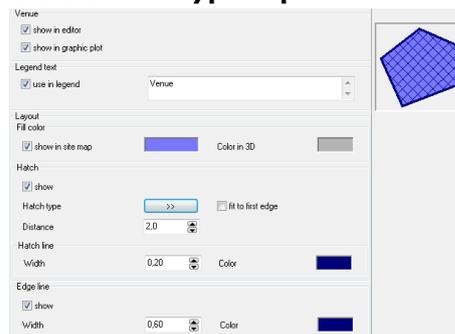
### 4.6.3.2. Line type object types



### Line object types

Enter line width and line color for the line.

### 4.6.3.3. Area type objects

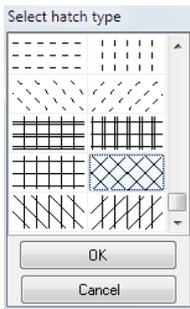


### Area object types

For area object types, define the fill color and border and hatch pattern separately.

### 4.6.3.3.1. Hatch pattern

With the double arrow, select the hatch pattern and confirm it with OK.



### Hatch patterns

If Fit to first line is checked, the hatch pattern will be parallel to a line through the first 2 coordinates of the object.

### 4.6.4. Texts

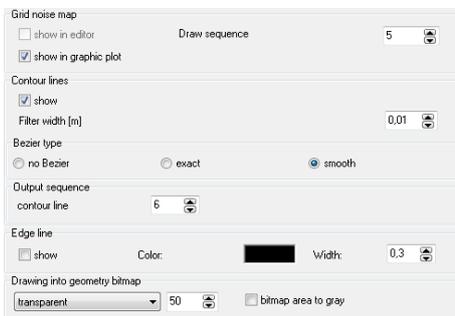
The text layout is set in the editor. All settings (color, font type) in the graphics are taken from the definitions made in the Editor. In the object types, you can adjust the sizes of all texts using the parameter **SIZE AS FACTOR** of the sizes selected in the Editor.

### 4.6.5. Grid Noise Map

The Grid Noise Map shows noise contour areas filled with a user defined color scale. The appearance of the noise map can be edited (contour lines and color scale).

#### 4.6.5.1. Edit the appearance of contour lines

Go to options -> object types and select the object type grid noise map.



### Grid noise map settings

Show contour lines should always be set to „show“ except when you want to present the grid cells. When the check box is deactivated, even for the main interval, no contour lines and contour fills are drawn.

The **FILTER BANDWIDTH** [m] defines a bandwidth within which points controlling the contour lines are deleted; this procedure smooths the contour lines.

The **BEZIER TYPE** defines the form accuracy of the contour lines. With exact Bezier curves, the contour lines will move through the calculated interception points. The smooth Bezier option means the interception points are only used to pull the curve in its direction, but will not force the curve to go through it.

The exact Bezier curve moves through the calculated points of the contour lines. However, when the lines have strong and changing curvature, this option will make the line less accurate.

The edge **LINE** displays the calculation area border. This option defines the layout of this line. Please specify the color and line width.

#### 4.6.5.1.1. Definition of intervals



### Interval settings

**FILL CONTOURS** fills the areas between the contour lines according to the scale colors. You can also choose to have the contours themselves presented as lines, and choose the color and line width.

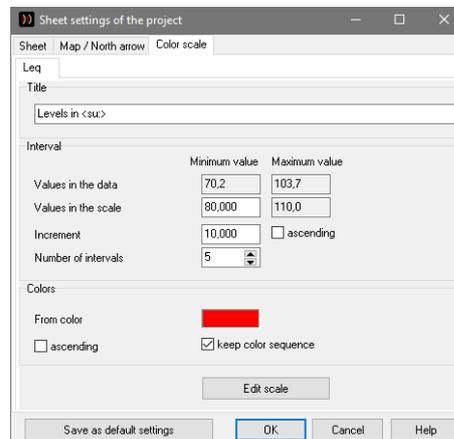
Additionally, you can disable the **FILL CONTOURS** and display the contour lines according to the scale colors.

#### 4.6.5.2. Edit the colored scale

When the grid noise map is loaded, the program determines the minimum and maximum values of the grid noise map levels and suggests a sensible scale covering the value range of the map. The color sequences are chosen from the color palette.

Depending on the dB weighting (dB(A) or dB(C)) selected for the calculation, the correct scale unit is displayed. "<su:>" is a variable for the scale unit in the title of the color scale.

Click the color scale in the description block or go to **GRAPHICS** -> **EDIT COLOR SCALE**.



### Color scale definition

Enter the value of the smallest interval, the magnitude of the intervals (in dB(A)) and the number of intervals. **ASCENDING** defines whether the lowest noise levels are shown at the top or at the bottom of the scale.

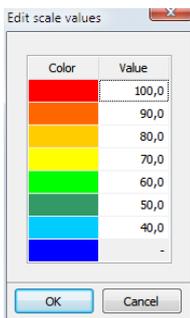
For the **COLOR SELECTION**, a color palette is used. A line in the palette has 16 color fields so you can manage your scales and store the color sequences properly. NoizCalc is delivered with a default color scale. You can define your own scale color progressions any time selecting **OPTIONS -> COLORS** (see Color palette).

The scale uses the colors starting from the field marked **FROM COLOR**. **ASCENDING** defines whether the colors start from the marked field to the left or to the right (with „ascending“ deactivated).

If less than 16 intervals are used, NoizCalc selects a color sequence from the following 16 colors. Select **KEEP COLOR SEQUENCE** to disable the automatic assignment of colors.

#### 4.6.5.2.1. Manually modify scale intervals

The interval size of the color scale is pre-set linearly according to the noise values found in the grid noise map, however it is possible to manually customize the scale, either the interval size or the scale colors. Click the color scale and set the colors and values in the Edit scale dialog.

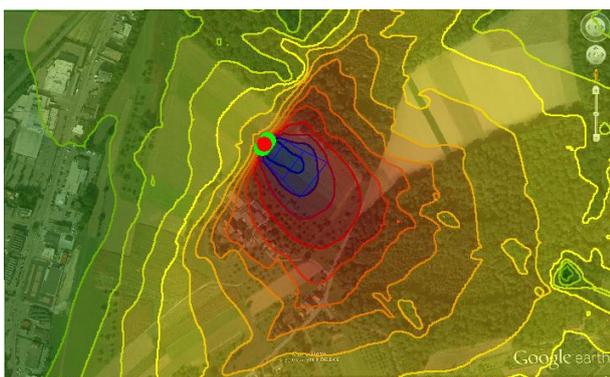


#### Edit colors and values of the color scale

In the color scale Value column, you can change the upper interval limit. The interval sizes do not have to be constant.

#### 4.6.5.3. Transparent grid maps

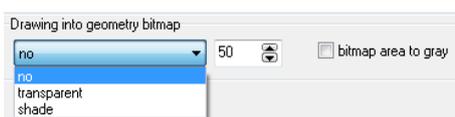
If a geometry bitmap is in the background of the Editor, the grid map can be displayed in the geometry bitmap, either in a transparent or in a shaded form provided that the geometry bitmap is larger than the calculation area.



#### Transparent grid noise map with contour lines in color scale

The contour lines are drawn on top of the bitmap in the selected color or in scale color.

Go to the object types (mouse click the legend), select “transparent” or “shade” in the settings for the grid noise map and enter the desired percentage for both.



You can additionally select whether the colors of the bitmap should be taken into account or only the gray values (check box Bitmap area to gray) should be considered.

Transparent is suitable for fully colored darker geometry bitmaps (aerial photos). Shaded is suitable for digital base maps in which only lines and bright colors (e.g. light gray for built-up areas or light green for forests) are included. If the result colors are too distorted, you can change the settings in the geometry bitmap object type and select either Brighten (useful for aerial photos) or Contrast (useful for base maps).

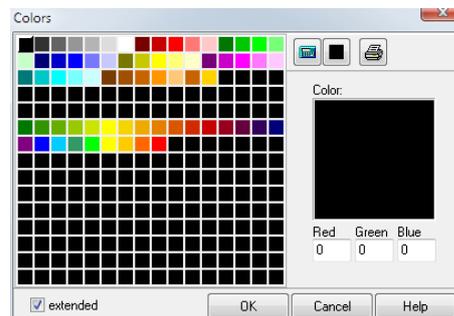
Note: In the background, the geometry bitmap is automatically set to "normal" in the Settings object type and the output sequence of the contour lines is set to higher than the output sequence of the grid noise map.

#### 4.6.6. Color palette

The color palette is used to define the colors of the objects and elements and the scale colors. 16 consecutive colors are used as scale colors.

Open the colors selecting **OPTIONS -> COLORS**. The values are defined as RGB values.

RGB = Red-Green-Blue-components for each color range from 0 to 255.



#### Extended Colors dialog

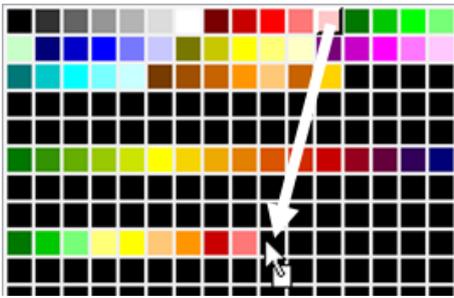
The extended Colors dialog is opened automatically when you click a color field that is not using a color previously set as favorite.

#### 4.6.6.1. Define colors / compile scale colors

Click “extended”. Enter the numerical value for the RGB components, click on an existing color, drag and drop it to the extended color field and modify it.

Drag and drop the new color to the desired position.

You can compose color sequences for a colored scale in the same way. Move the colors in the desired sequence to free (black) fields in the matrix.



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#### 4.6.6.2. Interpolate colors



To generate color gradients for scales or to detail color settings for objects, NoizCalc interpolates colors between two given color values. Click "extended". Select the first color and place it into an empty black field. Select the second color and place it to the right of the first color, leaving as many black spaces as you want to have interpolated in between. To fill the gap with interpolated colors, click the pocket calculator icon.



For a gray scale, the first value cannot be black (0,0,0). The program would ignore this. Select a very dark gray as the first color, for example, 5,5,5.

#### 4.6.6.3. Set colors to black



Click the set black icon. It remains active as long as you hold down the left mouse button. This allows you to quickly erase color favorites no longer wanted with the left mouse button.

#### 4.6.6.4. Print color values

The entire palette can be printed using the PRINT icon. The colors are shown with RGB values. The colors on the printer depend on the saturation, the resolution and the printer paper.

#### 4.6.7. Export and print graphic plot



Click the Print icon to print out the map or to save it as a pdf file.



You can save graphics sheets as bitmaps or Windows Meta files using the Save as icon. The sheet displayed on the screen is exported.

### 5. Troubleshooting

In case the map data import is not successful, change the coordinate settings to the southern hemisphere and repeat the import:

Options > Coordinate settings > UTM coordinates (southern hemisphere)

### 6. Legal notice

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