



MANUAL LYNXPLANNER

Design and Simulation of Photovoltaic Systems

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1 Program

1.1 Introduction

LynxPlanner is a valuable tool to design and analyze PV systems, and to develop customer reports.

To navigate through the program, click on the arrows in the upper left hand corner or click on the above icons to go to a specific section of the program.

Error messages, warnings and tips are shown in the [Messages](#) section in the lower bar at the bottom of the screen. A summary of your design selections is displayed in the [Project Status](#) section on the right-hand side.

Design steps:

1. **Project Data:** Enter your project data and select the climate location from the meteo database.
2. **PV Module:** Select a module from the database. Layout the array or define the number of modules directly.
3. **System Configuration:** Let the program automatically size the optimal inverter configuration or enter it manually.
4. **Results:** The results are graphically displayed and can be printed as a customer presentation.

1.2 Definitions of Terms

Internal Rate of Return

Total cash flow after tax.

Energy Yield

Annual energy yield describes the solar energy fed into a (public) electricity grid.

Mounted

Mounted systems are those with modules installed on a mounting system, either free-standing on the ground or on a flat roof

Maximum system voltage

This value states the maximum voltage which may be applied to a PV array. Modules may only be configured in series to the point at which their maximum system voltage at maximum open circuit voltage (link: see configuration thresholds) is reached. The maximum system voltage is taken into consideration in the inverter configuration.

MPP (Maximum Power Point)

The output of a module is dependent on the irradiation, temperature, and voltage it is operated at. The Maximum Power Point is the point on the current/voltage diagram at which the module produces its maximum output.

MPP tracker

The MPP tracker automatically sets the solar array's working point at its maximum.

Open Circuit Voltage

A module's open circuit voltage U_L is usually given by the manufacturer for standard test conditions (STC). As the module voltage is also temperature-dependent, maximum open-circuit voltage occurs at low temperatures, e.g. -10° , and maximum irradiation.

Orientation of PV Modules / Azimuth

The azimuth angle describes the angle of deviation of the module surface from the south. South is defined as 0° , east = -90° , south-east = -45° , south-west = 45° , west = 90° etc.

Parallel operation

With inverters which allow for parallel operation of the MPP trackers, the MPP trackers can be interconnected so that the current and power range are added together.

Pay-back period

Period of time in which the capital value of the investment is positive for the first time.

Performance Ratio

The Performance Ratio is a measurement of the energy losses that occur within the system in comparison with the system's optimal operating conditions. The actual solar energy produced is measured against the nominal output. The nominal output is calculated from the irradiation onto the tilted PV surface multiplied by the efficiency of the module under standard test conditions (25°C , 1000 W/m^2).

PV Array, Irradiation

The irradiation onto the tilted PV array surface is the solar energy available without shade.

PV Array, Generated Energy (AC Side)

The energy generated on the AC side of the PV array is the energy produced by the inverter and, with full feed-in, fed into the network. Module, cabling, and inverter losses are taken into account.

PV Array Output

The PV array output of a solar array is the maximum output it can produce with vertical irradiation with 1000 W/m^2 . It is therefore given in Wp or kWp. "p" stands for "peak".

Internal Rate of Return

The Net Yield is calculated according to the Internal Interest Rate Method. Capital interest is increased up to the point at which the Net Present Value of the investment becomes less than zero. The result can be interpreted as follows: Providing one's own capital (self-financing) for the investment is as good as investing one's own capital in a bank at the interest rate of the internal rate of return.

Roof-Integrated

Roof-integrated means that the roof cladding has been partially removed and replaced by the modules themselves.

Roof-Parallel

Roof-parallel means that the modules are mounted a distance above the roof cladding, but are parallel to it.

Short Circuit Current

A module's short circuit current I_K is usually given by the manufacturer for standard test conditions (STC). As the module current is also temperature-dependent, the maximum short circuit current occurs at low temperatures, e.g. -10° , and maximum irradiation.

Solar fraction

The solar fraction states the percentage of the annual energy requirement which can be provided by a solar system.

System Efficiency

The system efficiency is the quotient of the electrical energy produced on the alternating current side and the solar energy irradiated onto the PV array surface.

Specific Annual Yield

To calculate the specific annual yield of a PV system, the annual energy generated on the alternating current side is measured against the PV area or output of the system. For example, the annual yield is divided by output in kWp. In this way, systems of different sizes can be compared with each other.

STC (Standard Test Conditions)

Standard test conditions were introduced to enable uniform (output) comparisons of modules. They describe the general conditions under which the parameters given on the data sheets were determined. These are a temperature of 25°C, 1000 W/m² irradiation, and an AM factor of 1.5. (AM, "Air Mass", describes the entrance route of the irradiation through the atmosphere and thus the spectral composition of light).

Tilt Angle / Inclination

The tilt angle describes the angle between the modules and the horizontal plane. For facade mounting, the tilt angle is 90°.

2 Pages

2.1 Welcome

This page gives you a brief introduction to the program's range of functions.

There is a link to the website of Dr. Valentin EnergieSoftware GmbH where you can find information on current releases and program updates for [PV*SOL basic](#) as well as on our other products.

2.2 Project Data

Options

Project-wide settings can be changed under Options

User data

Here, you can enter your company name and address, and insert a company logo. These appear on the title page and in the header of the presentation.

Internet Update

When starting, the program can check whether a new release or an updated database is available on the internet, and on request download and install them. You can deactivate the functions under automatic updates if you do not have an internet connection or want to run the update manually via [Check for Updates](#) at regular intervals.

If required, you can start the internet update via a proxy by activating the check box

Use Proxy URL In this case, please enter the port and URL.

If you have no internet access at your workstation, the database can be downloaded from another computer and imported (button Databases > [Import Database](#)) Checking for new releases is not possible in this case.

More information on internet updates can be found here.

Directories

If you want to move directories, e.g. for filing projects, you can enter a new path via the category [Directories](#).

Units

Here, you can set the unit system used to display values in the program and the report. Please open the current dialog again to update the unit format.

2.3 PV Modules

On this page, you can set the parameters for your module area by selecting the PV module from the database and defining all relevant parameters for it. You can give the module area name by clicking on the left-hand field.

Further module areas can be designed, copied, or deleted via the toolbar or the shortcut menu.

PV Module Selection

You can load the PV module into your project. By clicking on the [Selection](#) button, the database dialog for the PV modules is opened. The data records are regularly maintained and expanded via a database update.

Module Parameters

Set parameters for the module by entering the desired tilt angle and orientation of the modules. Under [Tilt Angle of PV Modules](#), 0° corresponds to horizontal mounting, 90° to vertical mounting. The [Orientation of PV Modules](#) is entered as the deviation from the south: 0° corresponds to south, -90° east, 90° west, with respective reference to the northern hemisphere. Diagrams illustrate your entries. You can select from four [Installation Types](#). Mounted means that the modules are mounted freely, either with a mounting support even with the ground, or on a flat roof. Roof-parallel is selected when the modules are mounted a distance above the roof cladding, and roof-integrated, when they themselves constitute the roof cladding. For roof-integrated systems, [rear ventilation](#) can act as cooling for the modules.

Calculating Array Output

The number of modules can be entered using the following methods:

- you can calculate the number of modules by entering the roof area with respective blocked-off objects. There is a separate help file for this dialog.
- the number of modules can be entered directly.

The resulting [PV generator output](#) is calculated and displayed at the end of the page.

2.4 Configuration of the PV system

The system configuration for the project is defined on this page. The module surfaces can be configured individually, or several module surfaces can be interconnected with one inverter. For this, select the corresponding module surfaces (ctrl. + left mouse button) and click the button [Configure module surfaces together](#) in the toolbar or shortcut menu.

There are two different approaches to defining a system configuration:

1. One valid configuration is calculated per module surface by the programme.
2. The configuration of each module surface is edited or set by the user.

The validity of the configurations is checked on the basis of the set configuration thresholds.

If a system configuration value exceeds the set configuration thresholds, warnings or error messages in the error status bar provide information on suitable corrective measures.

For 1.) Calculation of a module surface configuration by the programme

By selecting the module surface in the left-hand tree, the input form for the configuration of the entire module surface is activated. Under select configuration, you can let the programme calculate a valid configuration in accordance with the viewed inverter. The configured modules and the number of configured inverters are displayed in the information area. Qualitative information as to whether the configurations lie within the design, tolerance, or blocked-off range of the inverters is dependent on the set configuration threshold ranges.

For 2.) Editing or setting the configuration

The configuration of the system is illustrated with the help of a tree. If the modules are individually configured and not interconnected, the following applies: Up to three inverter types can be defined. In the tree, it is also possible to display how often the defined inverter configuration is present in the configuration. The toolbar or the shortcut menu can be used to create, copy, or delete inverter types. By selecting the inverter type in the tree, an input form for the configuration of this inverter is activated.

Entry of inverter and configuration (right-hand side)

The inverter can be changed by accessing the database with a click on the [Selection](#) button.

The data on the selected inverter can be viewed via the [Info](#) button. If the selected inverter allows for parallel operation (definition see Terms), the operating mode of the MPP trackers is required below.

If several module surfaces are configured with one inverter, the surfaces can be assigned to the MPP trackers. The inverter can be configured via a selection list. Only those configurations are displayed in the selection list which lie within the design or tolerance range of the configuration thresholds. A detailed overview of possible configurations can be found by clicking on edit.

Information

The sizing factor and the current range of the configured inverter are displayed in the information area.

The check configuration dialogue displays the output, currents, and voltages of the inverter in the selected configuration. A link leads to the current configuration thresholds, which can be defined uniquely for the project.

2.5 Results

The results of the simulation are available as a tree structure in this window. Display of the results is controlled via the tree on the left-hand side. Select a node to display results in tabular form or a sub-node to show a chart.

Results of the yield simulation

The yields from the solar system, calculated from hourly simulation, are displayed as a result. The individual parameters are explained under terms. The diagram offers an overview of the monthly energy yield from the solar system.

Customer presentation

Via the button View Presentation › Show, you can see a preview of the customer presentation. In the [Configuration](#) dialog, you can activate or deactivate specific parts of the presentation.

3 Dialogs and Topics

3.1 Select System Configuration

By selecting a system configuration, the entered module array can be configured with a list of inverters defined by the user.

Entry Data

In the **Entry Data** display area, the module array entered is shown. All technical data on the module can be visualised via the **Info** button.

The inverters are selected via the database Selection dialog. The selection is simplified by the Favorites category in the dialog. The number of selected inverters are visualised.

Furthermore, it is possible to edit **Configuration Criteria**, which define how automatic configuration should be calculated. In this case, between 1 and 3 inverter types (per configuration) can be selected, free MPP trackers activated or deactivated, and coverings of MPP trackers entered. The configuration criteria can be saved as defaults, so that they are available every time the program is started.

In the **Display** dialog, you can define how many results are visualised per page and whether configurations in the tolerance range are shown.

In the Configuration Limits dialog, you define the extent to which inverters may exceed manufacturers' defined thresholds and thus set the size of the design, tolerance, and blocked-off ranges.

Search

By clicking on the **Start Search** button, automatic calculation of the system configuration is started.

Depending on the number of modules and inverters, the search may take a while. The search query can be interrupted in the second phase of the algorithm. The program calculates all possible configurations. Similar configurations are filtered out in the third phase of calculation.

Results

The results are ordered such that the optimal configurations appear on the first page. Whether the configuration lies within the tolerance or design range has no effect on the classification. The number of inverters the quality of the configuration and the unbalanced load are calculated for every configuration. The dialog obtained by clicking on the **Info** button shows you which factors enter into the quality of the configuration.

The visualisation of the results is laid out in a clear way. All technical data on the inverter can be visualised via an **Info** button.

The quality of every configuration with regard to the voltage range, current, and output can be displayed in a window (**Info** button at the end of every configuration result). A distinction is made between the inverter values and the values assigned to the individual MPP trackers. In this way, the user can take the qualitative differences between two configurations into account before selecting a configuration.

Click **OK** to accept the selected system configuration for your project.

3.2 File Management

In File Management, you can start new projects, open projects, save, export, and exit the program.

Under **New Project**, you can either work with the program's standard default values or begin the project with a **template** you have created yourself. Here, it is a good idea to save frequent entries, such as the climate data records or a PV module, in a template and start new projects with this template.

By clicking **Open**, you can choose whether to edit a project or a template.

This choice is also available when saving projects. Select **Save As** to store your project file outside the default directory. The save function allows you to save your project without any further prompts if the file name is already known to the program.

3.3 Database Selection

All available modules, inverters, or manufacturers are displayed in the respective dialog.

Tree (left-hand side)

All manufacturers are shown in alphabetical order on the left-hand side. A manufacturer and all its products can be added to Favorites via the toolbar or the pop-up menu. The favorites list ensures easy access to products frequently used in projects.

Layout of the Product Table

On the right-hand side, products from the respective manufacturer are shown in a table. By clicking on the column button, the products can be sorted by the respective parameter. In addition, the column can be moved to a different position by dragging and dropping the column heading. If further characteristics of the product in the table need to be visualised, the column selection dialog allows further columns to be added to the table.

Creating and Editing Data Records

New data records can be created, existing data records can be edited, copied and deleted. The program distinguishes between system data records and user data records. System data records are those included with the program. User data records are created by the user. Only user data records can be edited or deleted. Select a row and click the Edit button. In the dialogs displayed, (module parameters or inverter parameters), you can change the individual parameters.

Database Search and Filters

Individual products can also be added to Favorites. To find a data record quickly, it is possible to **search** by product type. An entered asterisk (*) as an initial wildcard can stand for any characters.

By activating a check box, only user data records or data records no longer available can be displayed.

Data Record Selection

If the dialog was started from a page in the assistant, the data record can be imported into the project by selecting OK.

With automatic system configurations, it is possible to select several data records with a check box at the start of the table and view the selected data records via the option "Selection" in the left tree. The data records are imported into the project by pressing OK.

3.4 Databases

Via the menu item **Databases**, you can maintain databases for the PV modules, inverters, and manufacturers. It is also possible to export and import databases.

Editing, selecting, and grouping databases is executed in the respective database selection dialog.

To share the database with other users, please use the Import Database or Export Database functions (export format *.sdf).

If you have access to the internet, you can update your databases. The update is started via **Help > Check for Updates**, and is executed automatically. Data records you have created yourself are not affected by this.

3.5 Internet Update

The program is regularly updated via the internet. When starting, the program checks whether a new release or an updated database is available on the internet. On request, the update is automatically downloaded and installed. You can switch this function off in **Options**.

Database update

The manufacturers of PV modules and inverters receive online access from us and can expand and maintain their data records via the internet. These additions are checked by us and made available to you in regular database updates. You therefore always receive the current and valid PV modules or inverters.

Program update

The program is extended with new product characteristics and known problems are fixed. These improvements result in regular releases available via a program update.

3.6 Climate Dialog

Selection of a climate data record

In the selection field **Country Selection**, you can set the required country. Only locations in this country are shown.

Click on the table's column heading to sort the database by city, postal code, longitude, or latitude. This will help you to find the data record closest to the project location.

Click again on the same column to sort in the opposite direction. If you enter the first character of the text you want to find in the column that has been selected, you will jump directly to the first entry with this character.

Click **OK** or double click to select the data record.

3.7 Messages

An area for messages is located at the bottom of the main program window.

There are four types of message:

1. **Information:** offers you tips and help for the optimal design of your project.
2. **Warnings:** occur when data in your project are inconsistent or the program experiences unexpected events.
3. **No simulation:** your entered data contain errors, and no simulation can be started. This means that you can no longer open the results page.
4. **Error:** your entry is incorrect. You can only leave this page when the entry has been corrected.

3.8 PV Module Parameters

The module parameters are laid out across several tabs in this dialog. The data are checked at the end of the entry to ensure you have correctly filled out the data sheet.

Tab Basic Data

Manufacturer and type may not exceed a length of 255 characters.

Output Tolerance [%]

The module values given are subject to certain fluctuations in manufacture. This is primarily important for the current, voltage, and output data.

Cell Type

Most cells are made of either monocrystalline or polycrystalline silicium and a few are of amorphous silicium.

Dimensions Height [m], Width [m]

Height and width determine the PV module area and thus the area of the PV array. This area, which relates to the module dimensions, is called the gross surface area in the program.

Tab UI Characteristics at STC

The entries on this page are only valid for standard test conditions (STC), i.e. 25° module temperature, sunlight spectrum of AM 1.5, and 1000 W/m² irradiation.

MPP Voltage [V], MPP Current [A]

The power output of the modules is dependent on the module temperature and irradiation, and the module voltage. There is a current/voltage characteristic curve for each module temperature and irradiation. The working point on this curve determines the module's power output. The MPP is the working point on this curve (see also the UI characteristic curves button on the UI Characteristics at Partial Load page) at which the module's power output is at a maximum (maximum power point). The MPP voltage and MPP current are dependent on temperature and irradiation. This means that the voltage and current entered here are only valid for standard test conditions. For all other irradiation and temperature values, there are other MPPs. This has to be determined by the program (see page UI Characteristic Values at Partial Load). In the PV system, this job is done by the inverter. The inverter controls the PV array in such a way that maximum output from the current and voltage is obtained (MPP tracking).

Open Circuit Voltage [V]

The voltage level for a module with no load. This is also dependent on temperature and irradiation.

Short Circuit Current [A]

The current flowing through a short circuited module This is also dependent on temperature and irradiation.

Power Rating [W]

Module output under standard test conditions (STC).

Efficiency [%]

Module efficiency under standard test conditions. For the simulation, the program uses the following formula to determine the Active Solar Surface Area from the Calculated Output and Efficiency: $\text{Power Rating (STC)} = 1000 \text{ W/m}^2 * \text{ETA(STC)} * \text{Active Solar Surface Area}$

Tab UI Characteristics at Part Load

On the page UI Characteristics at Part Load, enter voltage and current for a second working point The values at lower irradiation are important to be able to calculate the efficiency curve of the module The efficiency given on data sheets relates to a module temperature of 25 °C and irradiation of 1000 W/m², although, for most of the year, this is not reached by the PV system This is why the efficiency at lower irradiation is very important for the simulation results Via the Standard Part Load Behaviour button, you can let the program calculate the second working point.

Tab Other Parameters

Temperature Coefficients: Voltage Coefficient [mV/K]

This value expresses the increase in voltage when the module temperature increases by one degree. The warmer the module, the smaller the voltage, i.e. this coefficient is negative.

Current Coefficient [mA/K]

This value expresses the increase in current (amperes) when the module temperature increases by one degree. The warmer the module, the higher the current, i.e. this coefficient is positive.

Power Coefficient [%]

The warmer the module, the lower its power output The power coefficient is negative and is given as a percentage of the power rating.

3.9 Options

Project-wide settings can be changed under Options

User data

Here, you can enter your company name and address, and insert a company logo. These appear on the title page and in the header of the presentation.

Internet Update

When starting, the program can check whether a new release or an updated database is available on the internet, and on request download and install them. You can deactivate the functions under **automatic updates** if you do not have an internet connection or want to run the update manually via "Check for Updates" at regular intervals.

If required, you can start the internet update via a proxy by activating the check box

Use Proxy URL

In this case, please enter the port and URL. If you have no internet access at your workstation, the database can be downloaded from another computer and imported (button "Import" under Databases). Checking for new releases is not possible in this case.

More information on internet updates can be found [here](#).

Directories

If you want to move directories, e.g. for filing projects, you can enter a new path via the category "Directories".

Units

Here, you can set the unit system used to display values in the program and the report.

3.10 Configuration Thresholds

In the Configuration Thresholds dialog, you can enter the boundary conditions for the inverter configuration.

Tolerances

In the Tolerances tab, you can enter the fluctuation range for the **sizing factor** which is acceptable to you. Here, the program distinguishes between a tolerance area and the design area. You can thus differentiate between the desired design area and an edge area which is just in the tolerable range. The resulting configurations are labelled differently.

The sizing factor can be automatically calculated by the program from the location and set-up if you activate the relevant check-box.

You can set whether or not the manufacturer value for the **MPP voltages** and the **maximum input current** may be exceeded.

Other

In the Other tab, you can enter whether the **unbalanced load** in the system configuration should be taken into account and the level of the threshold value.

You can also enter the **working point** to check the MPP voltage and the open circuit voltage. The position of the working points can be called up for every configuration by clicking on configuration check.

The temperatures of a module are dependent on installation location, ambient temperature and irradiation to the modules.

The configuration thresholds can be saved as a default, and are then available every time the program for system configuration is started.

3.11 Presentation Preview

The presentation contains the most important information for a customer solar system offer.

Content of the presentation

Depending on the configuration of your presentation, parts of it can be activated or deactivated.

The following parts can be displayed:

- **View Cover:** The title page contains your address information and your company logo, customer data, and a project description and illustration.
- **Show system structure:** this page shows the main benchmark figures of the PV system, the primary yield results.
- **View Roof Plan:** This presents the detailed set-up of the PV system and the configuration of the module surfaces. This page contains an illustration of the roof plan, displaying the blocked-off areas and the position of the module surfaces you have created.
- **View inverter Datasheet:** All manufacturer data on the inverters used are listed in a table.
- **View PV Module Datasheet:** All manufacturer data on the PV module used are listed in a table.

Features in the preview editor

Via the navigation bar, you can navigate through the presentation, enlarge or reduce the view, and start an on-screen presentation. In addition, you can print the current page or the entire presentation. You can launch the save as dialog or send the preview in a selected format by mail.

These features can also be accessed from the menu. The menu also contains the option Save as RTF.

The following export formats are supported by the preview editor .pdf, .rtf, .tif, .txt, .emf, .xps, and .ll

3.12 Inverter Parameters

Parameters for the inverter are defined in this dialog. If you would like to enter an inverter that can be switched to various voltage levels, you must enter the different voltage ranges as separate inverters with respective parameters.

Parameters Manufacturer, Type

Manufacturer and type may not exceed a length of 255 characters.

DC Power Rating [kW]

DC stands for direct current and refers to the input side of the inverter. The nominal output is the output specified for the inverter when in continuous operation. In continuous operation, the inverter power output is top-limited by the DC power rating and the corresponding efficiency. For this reason, the efficiency of the inverter is reduced with higher input power.

AC Power Rating [kW]

AC stands for alternating current and refers to the output side of the inverter. The AC nominal output is the output specified for the inverter when in continuous operation. In continuous operation, the inverter output power is top-limited by the AC power rating.

Max. PV Power [kW]

Inverter and PV power must be aligned with one another. If the PV power is greater than the power rating of the inverter, the inverter may shut down. The maximum PV power is the maximum DC output the inverter can convert. In the program, this value is not required to calculate the simulation but only to check the system.

Stand-by Consumption [W]

If the inverter does not supply energy to the grid or appliances, the inverter's own power consumption must be taken into consideration. In addition to stand-by consumption, there is also night consumption.

Night Consumption [W]

The inverter turns itself off at night, but still requires a minimum level of energy.

Feed-in from [W]

There is a minimum output which has to be supplied by the input side (PV generator) before the inverter can operate.

Max. Input Voltage [V]/Max. Input Current [A]

This voltage or current threshold may not be exceeded. If it is, the inverter will be destroyed. In the program, this value is not required to calculate the simulation but only to check the system.

Nominal DC Voltage [V]/Nominal DC Current [A]

The inverter input voltage or current, when the inverter supplies the nominal output.

Number of MPP Trackers

The number of independent MPP controllers. With multi-string units, this value is greater than 1.

Max. Recommended PV Output per MPP Tracker [kW]

See Max. Recommended PV Output [kW]

max. input current per mpp tracker [a]

This current threshold per MPP tracker may not be exceeded. (only active when number of MPP trackers >1)

Upper and Lower Voltage Thresholds for MPP Range [V]

The inverter can control the MPP tracking within this voltage range. This means that the inverter searches for the optimum voltage for the PV array within this voltage range, so that the array produces the maximum power output.

Change in Efficiency if Input Voltage Differs from Nominal Voltage

The inverter efficiency characteristic curve is given for the nominal voltage. If the inverter is not operated at the nominal voltage, the inverter efficiency changes. Whether the efficiency curve goes up or down depends on whether or not the inverter has a transformer. As a rule of thumb, the following applies:

- With an increase in input voltage, the efficiency of an inverter with a transformer decreases by c. 1% per 100 V.
- With an increase in input voltage, the efficiency of an inverter without a transformer increases by c. 1% per 100 V.

Efficiency Characteristic Curve

The conversion efficiency is the ratio between the output power and the input power, and is dependent on the current output of the inverter. On data sheets, the figure for the efficiency is related to the nominal output, although, for most of the year, this is not supplied by the PV system. The part-load operation is therefore very important for the simulation results.

To determine the characteristic curve, the program requires 7 checkpoints, i.e. the efficiency at 0, 5, 10, 20, 30, 50, and 100% of the nominal output.

3.13 Edit Inverter Configuration

The configuration can be edited in this dialog. All boundary conditions for the configuration are shown with colors. This helps you to enter a valid configuration.

Table to move MPP trackers

A table is presented. The horizontal axis illustrates the number of modules in series which can be connected to an MPP tracker (and the resulting MPP voltage). The number of strings (and the resulting MPP current) is shown on the vertical axis. The MPP trackers can be placed in the matrix by drag and drop or via a pop-up menu. The colors (green = design range, orange = tolerance range, red = blocked-off range) make clear whether the MPP tracker is optimally designed or not. The design optimum for the number of modules in series is marked blue on the vertical axis. The configured number of modules per MPP tracker is indicated in a notice area and by the grey marking in the table fields.

Bar above the table

There are two graphical bars above the matrix (flowing from green to red), which represent the inverter current range and the valid sizing factor. In this way, all relevant checking mechanisms in configuration of an inverter can be visualised on one page. The user can also define a suitable configuration.

The number of configured modules is displayed at the end of the dialog. The configuration check can also be launched here.

If the configuration contains invalid values, these are reported in the error message window at the bottom of the assistant.

3.14 Inverter Configuration Values

For every configuration, the quality of the voltage range, current, and output can be shown in this dialog. A distinction is made between the inverter values and the values assigned to the individual MPP trackers. In this way, the user can take the qualitative differences between two configurations into account before selecting a configuration.

4 Roof View

4.1 Overview - Roof View

The Roof View window is divided into the following sections:

- Toolbar
- Tree view
- Roof visualisation
- Messages
- Input field

4.2 Toolbar



The toolbar contains the buttons listed below. The current cursor position is also displayed under **Coordinates**, which allows you to find the position of an object point, for example.

The area of the toolbar to the right shows the distance of a selected barred area point or PV area point from the outer borders of the roof area.

Create a New 2D Object

The **Create a New 2D Object** button opens the **New 2D Object** dialog. Here you can define new roof areas, barred areas or PV areas.

Copy 2D Object

Once you have selected a barred area or a PV area you can copy this to the clipboard by clicking the **Copy 2D Object** button (or pressing CTRL+C). You can then paste the copied barred area or PV area into your roof area by right-clicking and selecting the **Paste** command (or pressing CTRL+V).

Delete 2D Object

Click the **Delete 2D Object** button (or press the Delete key) to delete selected barred areas, PV areas, modules or module formations.

Delete All PV Areas

Attention! Clicking the **Delete All PV Areas** button deletes all the PV areas.

Delete All 2D Objects (except roof)

Clicking this button deletes all the 2D objects except for the roof area.

Enlarge view

This button enlarges the view of the roof area.

Reduce view

This button reduces the view of the roof area.

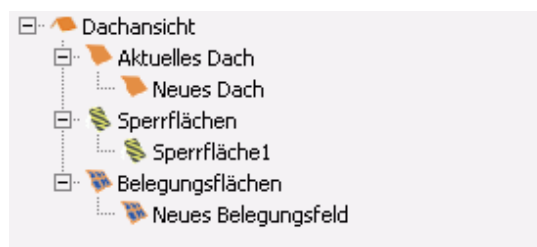
Zoom - Select Best View

Clicking this button sets the optimum zoom factor.

4.3 Tree view

The tree view gives you an overview of the 2D objects that are used in your PV system.

Left-click on an element in the tree view to select the 2D object. Right-click on a 2D object in the tree view to open a pop-up menu with all the available commands for the selected 2D object.



4.4 Roof visualisation

The roof visualisation shows your current roof project including the PV areas and barred areas.

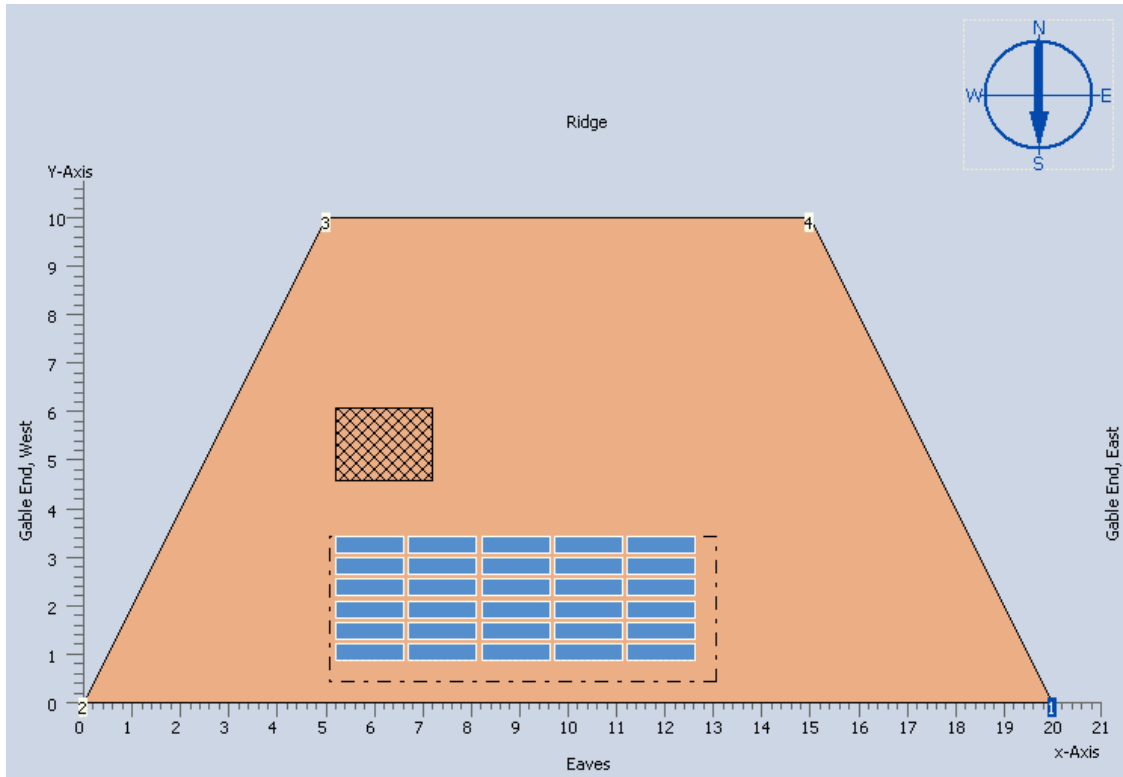
- You can drag and drop PV areas and barred areas to move them.
- If a 2D object is selected, its corner points are shown and can be edited in the [input field](#).
- The compass rose at the top right of the image is available for projects with mounted PV modules. It shows the direction that the roof faces.

The following keyboard shortcuts are available when you are editing the module formations:

- CTRL + left mouse key: Multiple selection
- SHIFT + left mouse key: Row selection

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- ALT + left mouse key: Column selection



4.5 Messages

The messages area shows you the following information:

1. Type of installation
2. PV generator power
3. Number of modules

You are planning a mounted system!

PV Generator Power: 2,52 kWp

Module Number: 70

Messages about any conflicts in the roof coverage are also displayed here.

1. No conflicts exist.
--- No Error ---
2. A PV area overlaps with a barred area.
Object "Barred Area1" collides with PV area modules "PV Area 1"!

- At least one module in a PV area is located outside the roof area.

One or more of the PV area modules "PV Area1" are outside of object "Roof"!

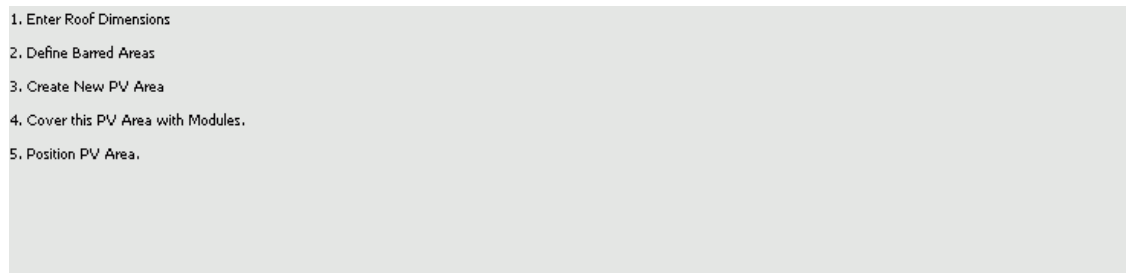
- The modules of various PV areas overlap.

One or more of the PV area modules "PV Area1" collide with one or more of the PV area modules "Copy of PV Area1"!

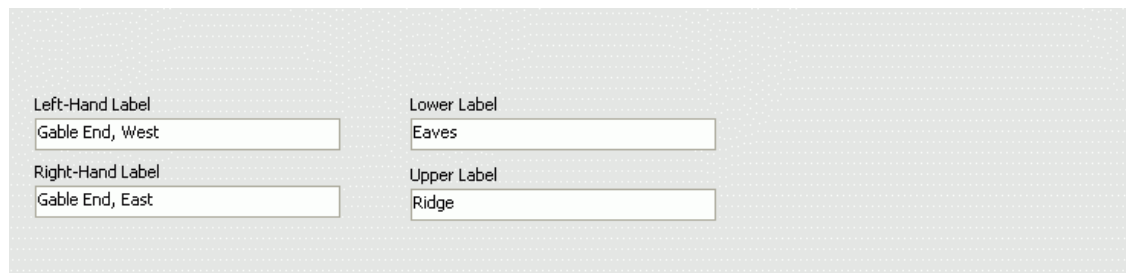
4.6 Input field

The appearance of the input field varies depending on the type of object that is selected in the [tree view](#).



When **Roof View** is selected, an overview of the workflow appears.




By selecting **Current Roof** you can rename the roof boundaries that appear in the [roof visualisation](#).



By selecting the roof object (default: **New Roof**) you can edit the coordinates of individual points of the selected object.


You can use the   buttons to add or remove points from the selected roof object.

Click the  button to open the [Edge Distances](#) window.

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Enter Coordinates (Unit in m):

Point	X	Y
1	0.000	0.000
2	5.000	10.100
3	15.000	10.100
4	20.000	0.000



If you are planning a mounted PV system, you can also enter the roof orientation and the roof angle.

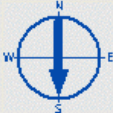
Enter Coordinates (Unit in m):

Point	X	Y
1	0,000	0,000
2	12,000	0,000
3	12,000	6,100
4	0,000	6,100


Roof Orientation:

Roof Orientation α °

Roof Angle β_1 °



Attention! With this the modules' azimuth always remains 0°!



By selecting a barred area object (default: **Barred Area 1**) you can edit the coordinates of individual points of the selected object.

Under **Enter position** you can enter the position of the entire selected object.


Enter Coordinates (Unit in m):

Point	X	Y
1	15,115	4,206
2	13,115	4,206
3	13,115	5,706
4	15,115	5,706


Enter Position:

x = m

y = m



By selecting a PV area object (default: **New PV Area**) you can edit the coordinates of individual points of the selected object.

Click the  button to open the **Module Coverage** dialog.

Enter Coordinates (Unit in m):

Point	X	Y
1	8,648	1,620
2	2,648	1,620
3	2,648	5,620
4	8,648	5,620

Position of PV Area:


x = m

y = m

Position of PV Modules:


x = m

y = m

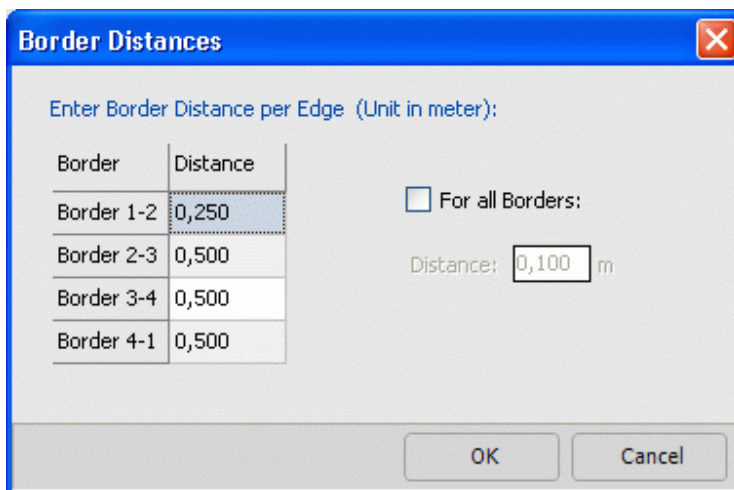


4.7 Border Distances

In the **Border Distances** window you can specify barred areas of a certain width for the borders of your roof.

To open the **Edge Distances** dialog: In the **tree view** select the roof area and in the input field click the **Edge Distances** button . Alternatively you can right-click on the roof area in the roof visualisation or open a pop-up menu in the tree view and click on **Edge Distances**.

- If you want to define equal border distances for all the boundaries of your roof, then use the option **For all Borders** on the right-hand side of the window.
- In the left-hand area of the window you can specify individual border distances for each border of the roof.



Enter Border Distance per Edge (Unit in meter):

Border	Distance
Border 1-2	0,250
Border 2-3	0,500
Border 3-4	0,500
Border 4-1	0,500

For all Borders:

Distance: m

OK Cancel

4.8 New 2D Object

4.8.1 New 2D Object

The **New 2D Object** dialog lets you define new 2D objects for your project. First of all, select the type of the new 2D object in the drop-down menu at the top left. Then enter a name for your new 2D object where it says **Reference**.

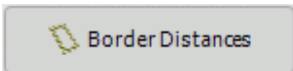
Depending on the object type you selected, various different options are now available for defining the new 2D object. For more information, click on one of the three links below.

- New roof area
- New barred area
- New PV area

4.8.2 New roof area

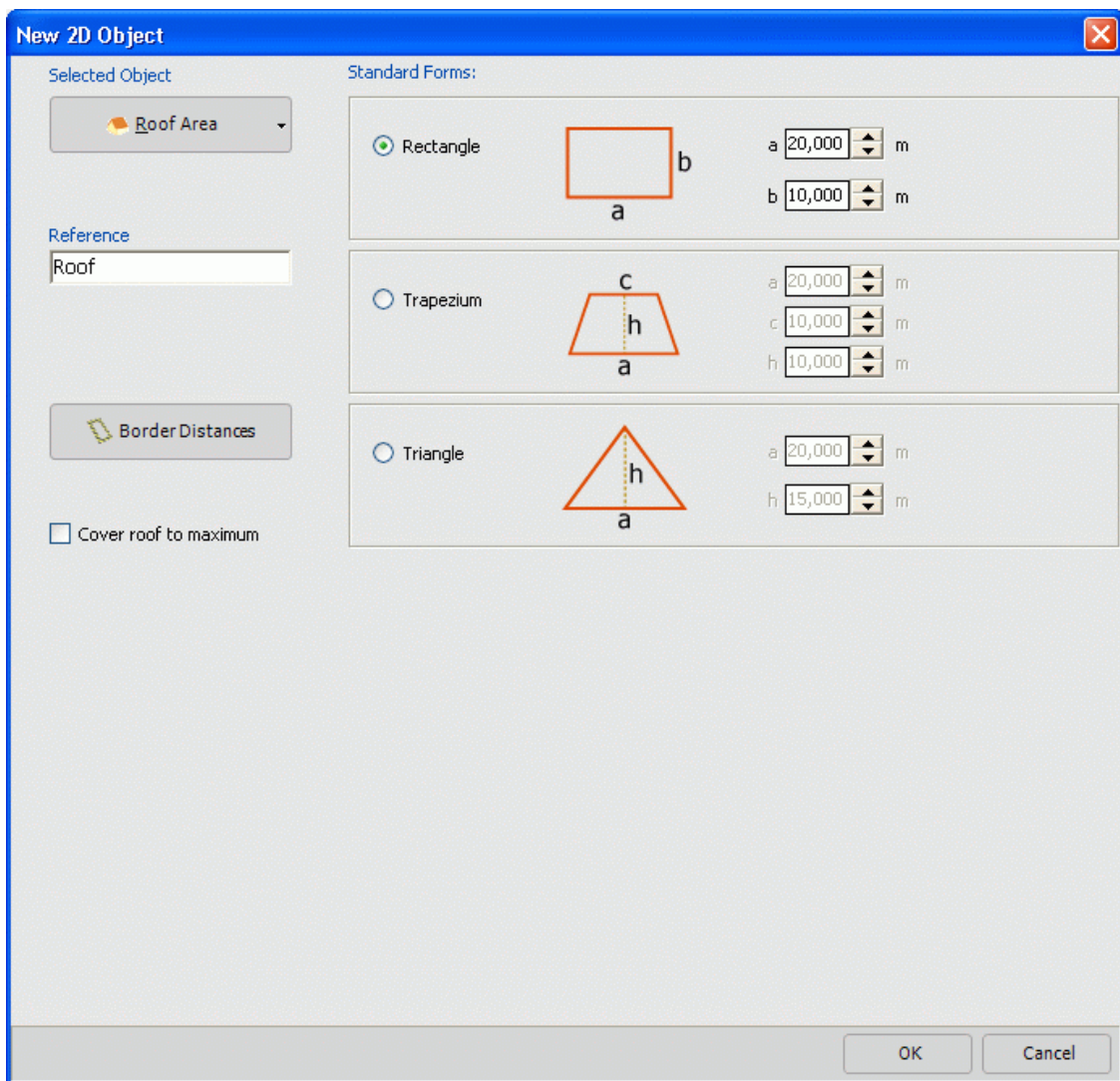
Various geometric shapes are available for designing a new roof area:

1. Rectangle
2. Trapezium
3. Triangle



Click the **Border Distances** button to open the Edge Distances window where you can specify barred areas for the borders of your roof.

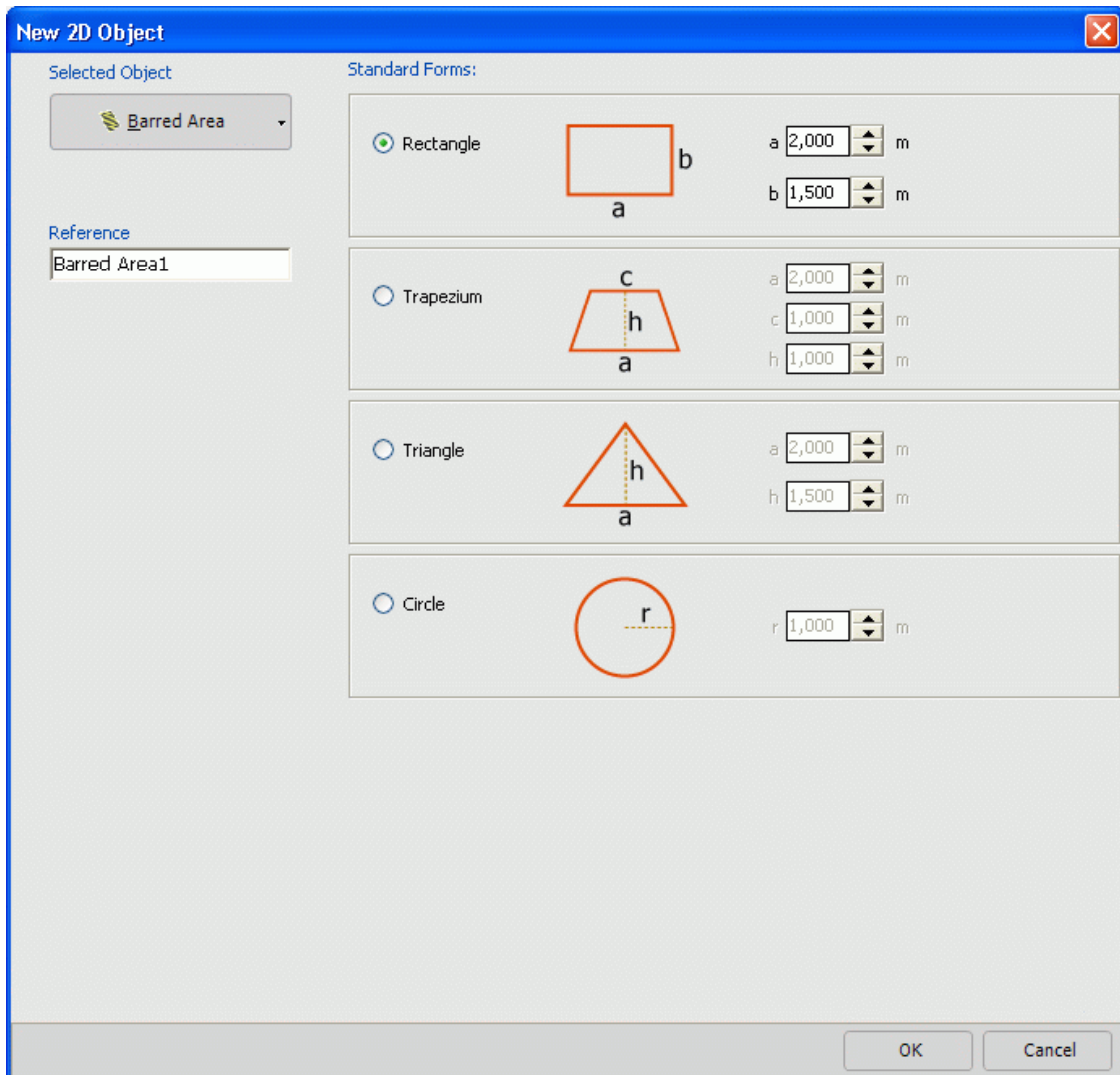
Tick the **Cover roof to maximum** box to give the new roof area a PV area the same size as your roof. PV modules will then be added automatically when you click on OK.



4.8.3 New barred area

Various geometric shapes are available for designing a new barred area:

1. Rectangle
2. Trapezium
3. Triangle
4. Circle



4.8.4 New PV area

Various geometric shapes are available for designing a new PV area.

1. Rectangle
2. Trapezium
3. Triangle

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4. Fit to roof area
The new PV area takes the shape and dimensions of the existing roof area.
5. Based on number of modules
The size of the new PV area is determined for a specified module formation. Enter the number of rows and columns in the planned module formation.

Tick the **Cover roof afterwards** box to add PV modules to the new array area automatically after you click on OK.

New 2D Object

Selected Object: PV Area

Reference: PV Area2

Cover Roof Afterwards


Standard Forms:

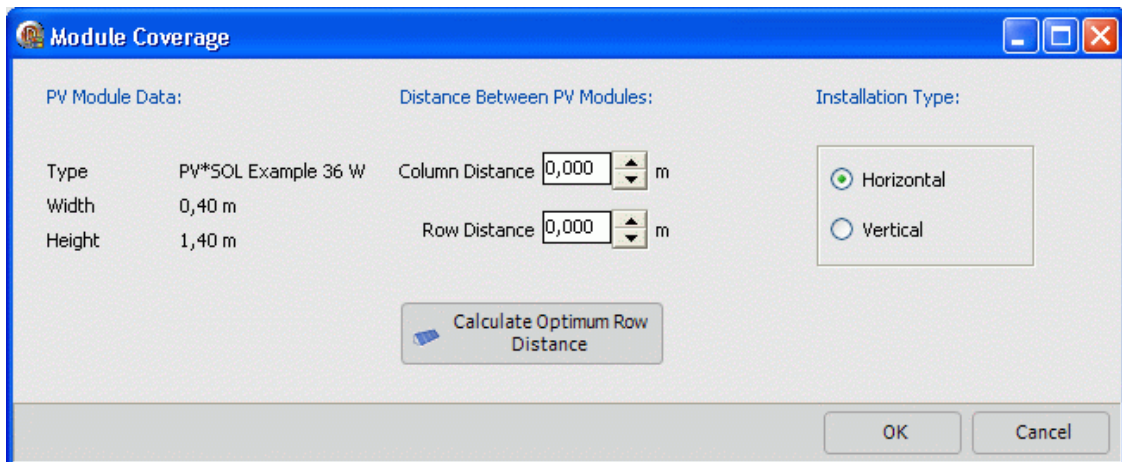
- Rectangle
a: 6,000 m
b: 4,000 m
- Trapezium
c: 3,000 m
a: 4,000 m
h: 4,000 m
- Triangle
a: 4,000 m
h: 4,000 m
- Fit to Roof Area
- Based on Number of Modules
Number of Modules in X Direction: 3
Number of Modules in Y Direction: 3
Resulting Power: 0,32 kWp

OK Cancel

4.9 Module coverage

4.9.1 Module coverage

- To open the **Module Coverage** dialog: In the **tree view**, select a PV area and click in the input field on the **Edit coverage** button . Alternatively you can right-click on a PV area in the roof visualisation or open a pop-up menu in the tree view and click on **Edit coverage**.
- The **Module Coverage** dialog lets you specify the column distances and the row distances for the PV modules. The minimum distance for both values is 0.05 m = 5 cm.
- Under **Installation type** you can specify the module orientation (horizontal or vertical).
- The **Calculate Optimum Row Distance** command is only available for mounted PV systems (Installation type: Free-Standing). By finding the optimum row distance you can minimise mutual shading caused by mounted module rows.



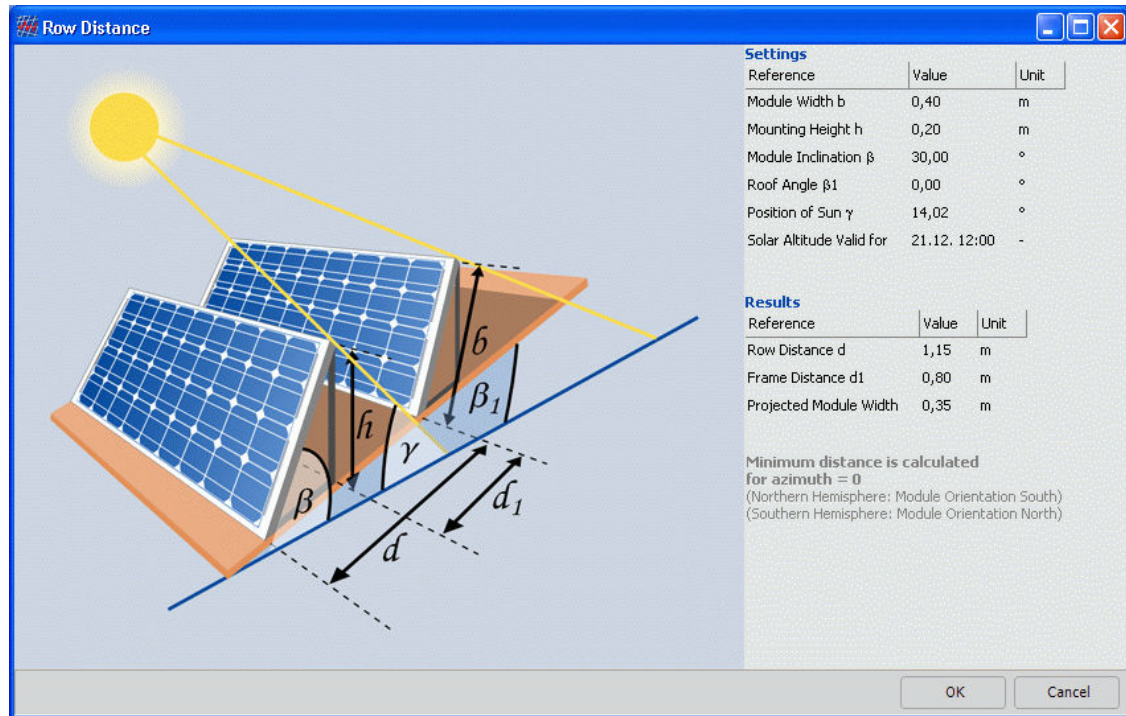
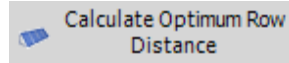
4.9.2 Calculate Optimum Row Distance

For mounted PV systems (Installation type: Free-Standing) you can calculate the optimum row distance. This minimises mutual shading between rows of mounted modules.

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The suggested clearance is a function of module inclination, position of sun on 21.12. at 12.00 p.m. and the mounting height h of the module.

To open the Row Distance dialog, open the [Module Coverage](#) dialog and click on



4.10 Workflow

Example for a mounted PV system.

1. Specify the installation type:

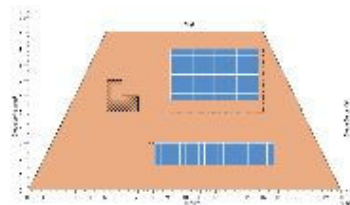
Installation Type




2. Now select "Roof Area with PV Modules" and then click the "Input" button.

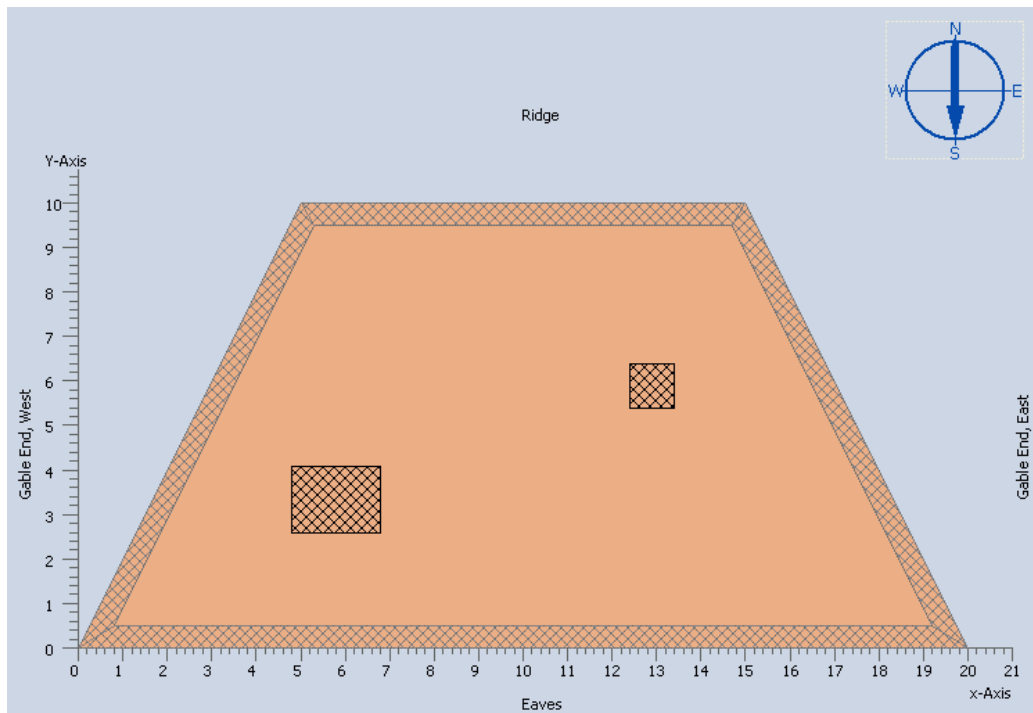
Roof Area with PV Modules

Number of PV Modules


PV Generator Output

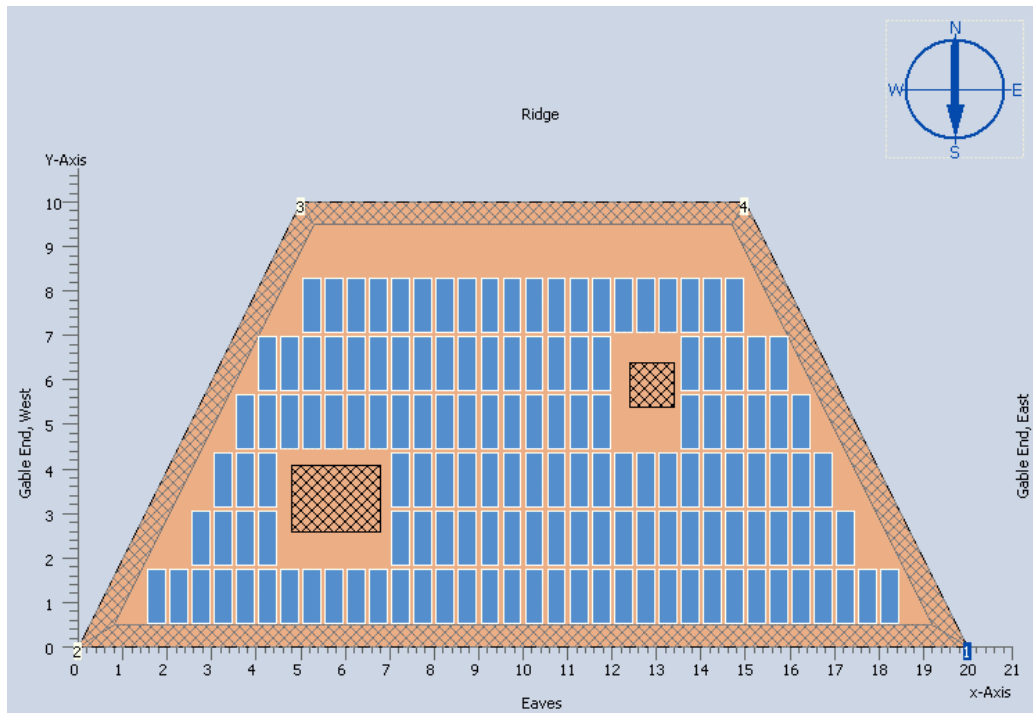


3. Specify the size of your roof area. To do this, select the roof area by left-clicking on the roof area in the roof visualisation or select your roof area in the tree view (default: New Roof). You can now specify the size and shape of your roof in the input field.
4. First of all, delete all 2D objects by clicking the **Delete All 2D Objects (except roof)** button . Alternatively you can delete particular 2D objects by clicking the  button, for example to obtain a barred area that you require.
5. Specify the barred areas for the borders of your roof area. To do this, select the roof area by clicking on the roof area in the roof visualisation or select your roof area in the tree view (default: New Roof). Now in the input field click on the  button and define the required barred areas in the Edge Distances dialog.
6. Now create a new barred area (e.g. skylights and chimney). Your roof might look something like this:



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- To define a PV area that is matched to the roof area, click the **Create a New 2D Object** button  to open the New 2D Object dialog. Make sure that **PV Area** is selected in the drop-down menu at the top left and select the **Fit to roof area** option for the new PV area. Now tick the **Cover roof afterwards** checkbox and PV modules will automatically be added to the roof area when you click OK. Now your roof might look something like this:



- Now you can specify the installation type (horizontal or vertical) and the distances between the PV modules in the Module Coverage dialog.

5 Meteosyn

5.1 Options

5.1.1 MeteoSyn, import climate data from a .wbv file

MeteoSyn > Location Data

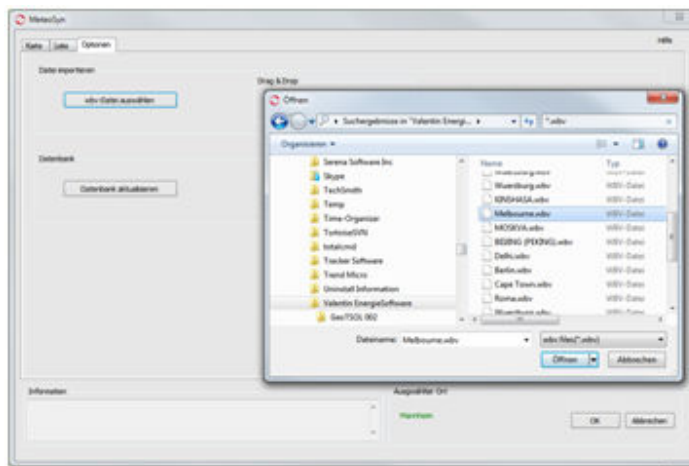


Image: *MeteoSyn > Options*

How to add a climate data file to a location:

1. Click on the *select .wbv file* button and navigate to the desired file. Select one or several files and confirm by clicking *Open*. These files are imported to the database and copied to the application data folder `MeteoSynModul_userfiles\country`, e.g. `C:\Users\All Users\Valentin EnergieSoftware\Meteo_UserFiles\DEU\`.
2. Exit the dialog by clicking *OK*.

5.1.2 Update MeteoSyn Database

If the content of the MeteoSyn module application data folder has been changed outside of MeteoSyn (in the file explorer) while you have been working with MeteoSyn, you can rebuild the MeteoSyn database by clicking the *Update Database* button. The database is then automatically rebuilt following reinstallation of the MeteoSyn module. Depending on the number of climate data records and your computer's processing power, this may take some time.

5.2 MeteoSyn

MeteoSyn

The MeteoSyn module provides location-dependent climate data used in the simulation programs from Dr. Valentin EnergieSoftware GmbH.

5.2.1 Select climate data from a map

MeteoSyn

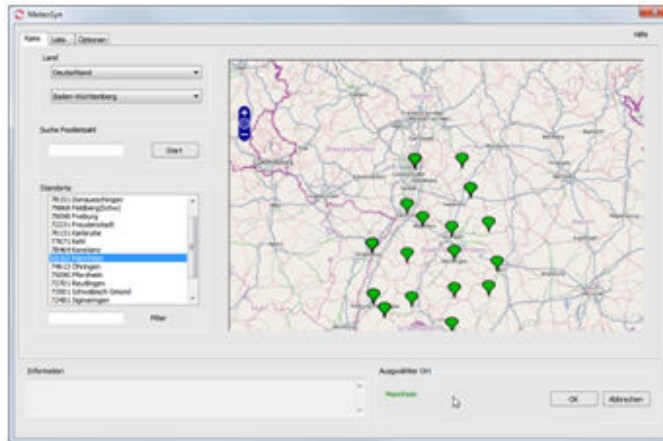


Image: *MeteoSyn* > Map
Load climate data records

Using the *MeteoSyn* climate data generator, you can select a location

- *map*: from an interactive map.
 - This only works with an internet connection!
 - The geographical data of a location can be specified using the ZIP code search.
- *List*: select location from a list or
- *Options*: load other climate data record files in .wbv format.

How to select climate data:

1. Select a country. The map shows the selected country if you have a connection to the internet. Otherwise see below.

The country list contains those countries for which climate files are available.
The location list contains the locations in these countries for which climate files are available.

If federal states have been entered in the climate data, you will see a dropdown box for the federal states.

There are various ways of shortening the location list:

2. Select a federal state.
3. Enter part of the location name in the filter below the location list.
Example: filter = "Au" -> The list shows Augsburg and Aurich, but also Braunlage, Braunschweig and others.
4. Enter a ZIP code. Click *Start*.

The location found is marked in red 📍, available climate data locations in the geographical vicinity green 📍. The location list is reduced to these nearby locations and the town, if available.

If the ZIP code search returns no results, this is displayed in the information field.

Working with the selected location

5. Click on a green mark 📍 to view the location name and further information. Click on the location name in the pop-up to select this location. This location is then listed under *Selected Location*
6. Or click on a location in the location list. This location is then listed under *Selected Location*, moved to the center of the map, and highlighted on the map with a mark 📍.

Click on the mark to view further information such as average temperature and global radiation.

Right-click on a location in the location list to open the corresponding folder in the file explorer.

7. Click on *OK* to continue working with this location. The selected climate record is imported into the program.
8. Click the *Cancel* button to cancel your changes.

! The interactive map requires a connection to the internet.

If you do not have an internet connection, MeteoSyn opens with the *List* page

On the *Map* page, the map is grayed out and a button to test the internet connection is shown.

Reestablish the internet connection, click on *Test Internet Connection* and update the website to regain access to the map.

5.3 MeteoSyn, select climate data from a location table

MeteoSyn > List

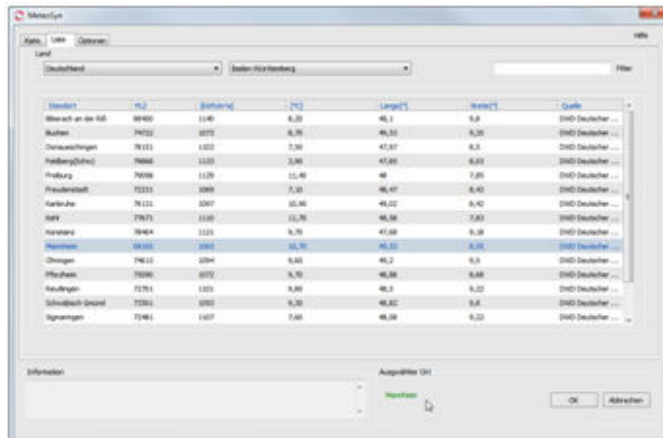


Image: *MeteoSyn > List*

No internet connection is required for this dialog.

The country list contains those countries for which climate files are available.

How to select climate data from the location table:

1. Select a country or federal state and enter a filter for the locations.

The locations shown in the table correspond to your entries

The parameters displayed include ZIP code, irradiation, average temperature, latitude and longitude, and data source.

2. Click on a column heading to sort the table by a specific parameter.

You can right-click a location in the table to open the corresponding directory in the file explorer (this is not required for the selection here).

3. Click on the location in the table to select it.
4. Exit the dialog by clicking *OK*.

The selected climate record is then imported into the program.

Click the *Cancel* button to cancel your changes.

5.4 Generate climate data for a new location

MeteoSyn > New Location

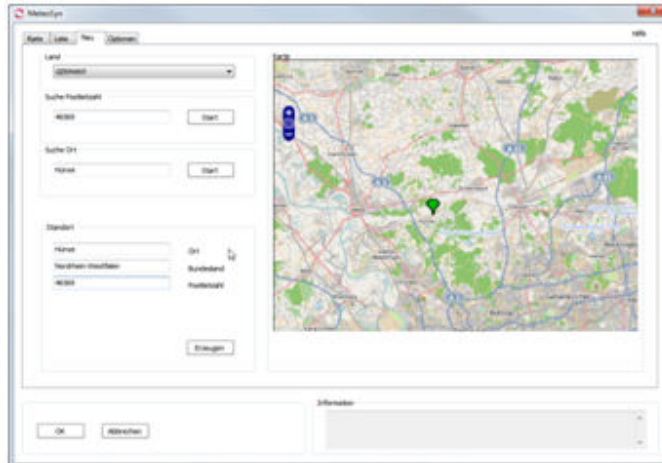



Image: *MeteoSyn*
New Location

Note: The *New Location* page is not displayed in Express or Basic program versions.

On the *New Location* page, you can generate new climate data by interpolating available measurement values from the Meteonorm database.

How to interpolate new climate data:

1. Select a country.
2. You can search by ZIP code or location name.

When searching, for example for "New town", each result is shown with a green mark  on the map.

3. Click on the mark to view the location name on the map.
4. Click on the location name to note this location for interpolation.
5. You can enter the ZIP code and a federal state for this location.
6. Click on the *Generate* button to create a new climate data record and add it to the database.

The data record is preselected.

A copy, where required, can be found in the directory C:\Users\Application Data\Valentin EnergieSoftware\MeteoSynModul_userfiles\country, e.g. C:\Users\All Users\Valentin EnergieSoftware\Meteo_UserFiles\DEU\

7. Exit the dialog by clicking *OK*.

The most recently generated data record is then imported into the program.

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Click the *Cancel* button to cancel your changes to location. This does not delete the created data record.

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