Uponor
TechCON TD 7.0

**User manual
Smart and easy planning
of underfloor heating**

Contents

Subject to modifications.

Project data and Floors

Project data

In the dialog box **Floors** are entered basic data on the project, location, specific heat loss of the building, and the floors:

Building: Enter the name of building.

Place: Enter the construction site.

**Designer:** Enter the name of designer.

Date: Enter the date of creation of the project.

Locality: Click the button ▭ to select the site for construction. Along with the site is adjusted the exterior design temperature T_e [°C] and the average outside temperature in heating period $T_{e,heat.season}$ [°C]. These values are important for adjusting the temperature below the floor according to the type of under-floor space
→ *Type of space under the floor (temperature under floor)*

Construction: Click ▭ and select the type of building. For the chosen type, the specific heat loss of the building Q_r [W/m²] is set up, according to which the heat loss of the room is calculated.
→ *Surface, heat loss and cooling load of rooms*
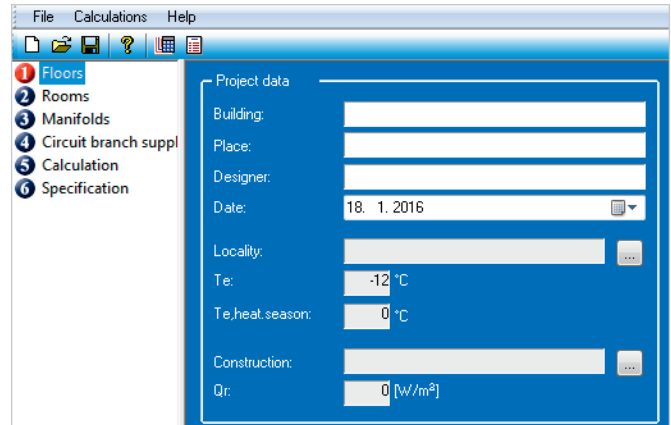
Floors

Floor is created simply through a click on the button *New*. Name of the first created floor can be edited. If another floor is created, the serial number of the floor is added and the same name is used automatically by the program. Floor is deleted through its designating in the list and clicking the button Delete.
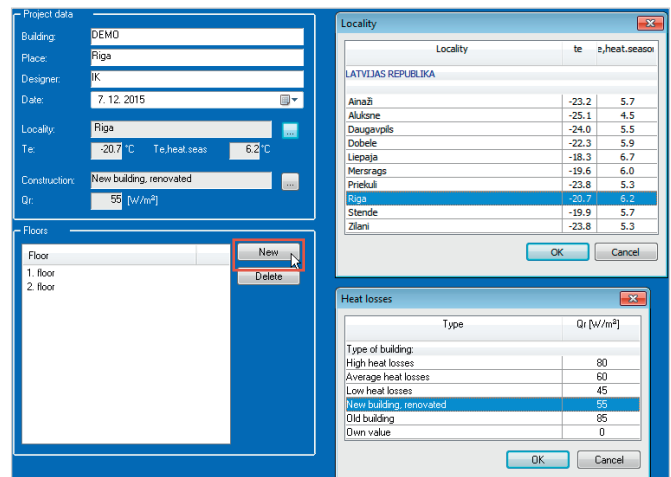
Rooms

Dialog box Rooms

In the dialog box **Rooms** are entered the data of rooms in building, under-floor heating/cooling systems along with boundary conditions of calculation and composition of floor.

To create a new room, select the floor, and then click *Add room*. A dialog box is displayed for selecting the purpose of room, the under-floor heating/cooling system along with boundary conditions of calculation, floor composition, and temperature under the floor.
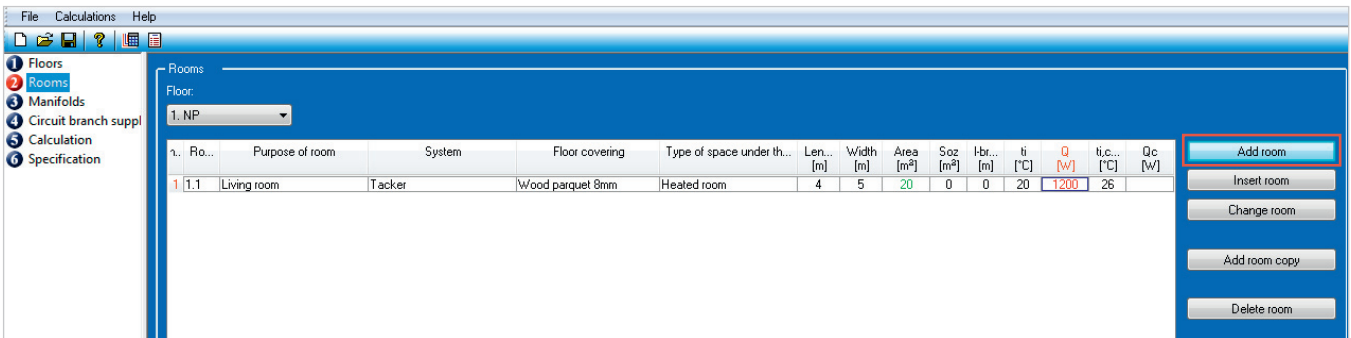
Purpose of the room

In the list on the left, select the **Purpose of the room**, along with an internal design temperature for heating t_i [°C].

Note: The purpose of room and the internal design temperature can be changed later in the list of rooms.
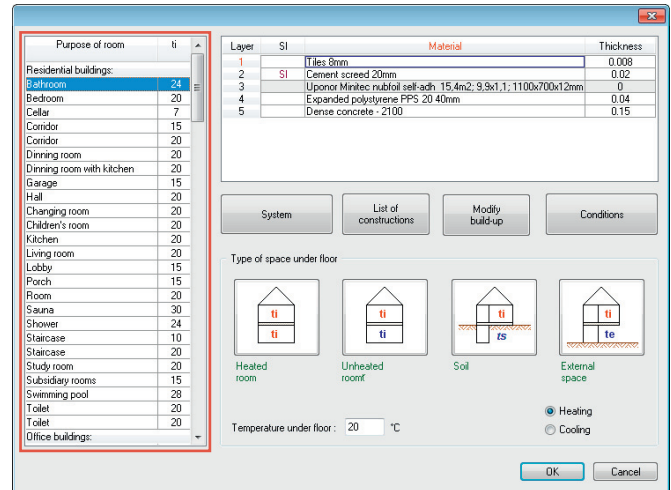
Underfloor heating / cooling

Click the *System*. A dialog box is displayed for selecting the floor heating system. Select the system board, and the pipe for the under-floor heating/cooling system.
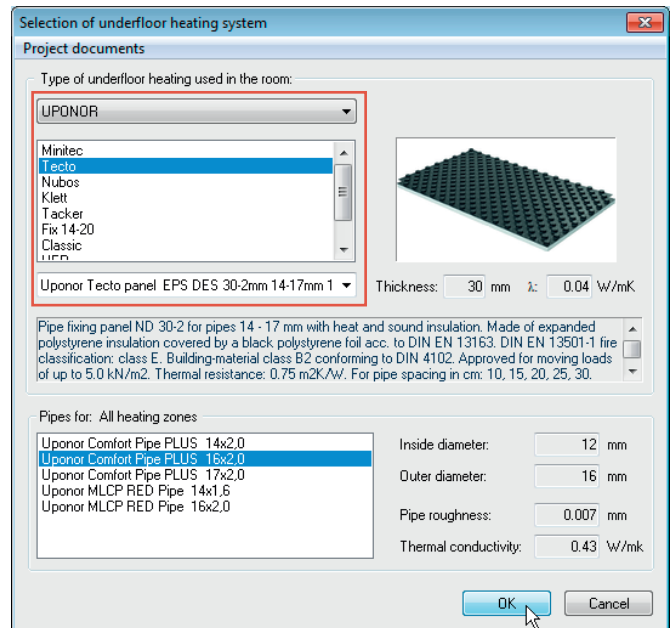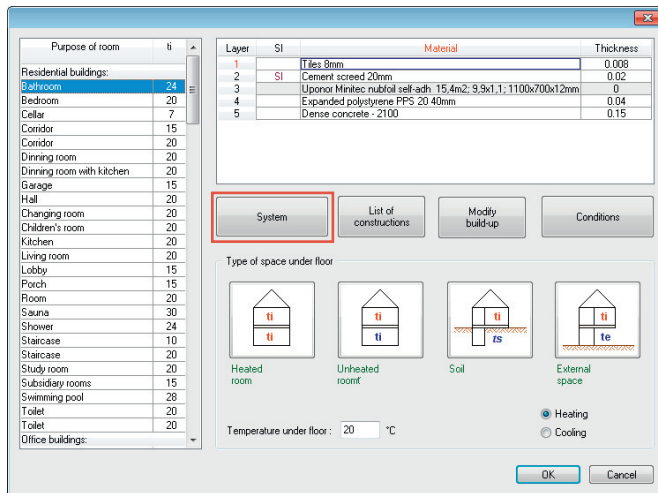
Types of floor construction

For selected system, the program sets the predefined composition of the floor structure. The program differentiates a wet system, wet system with low overall height, dry system, and the system HEP (Heat Emission Plate).

Predefined composition of the floor structure can be changed in two ways:
• by adjusting the individual materials, or
• selecting a different structure from the default one.
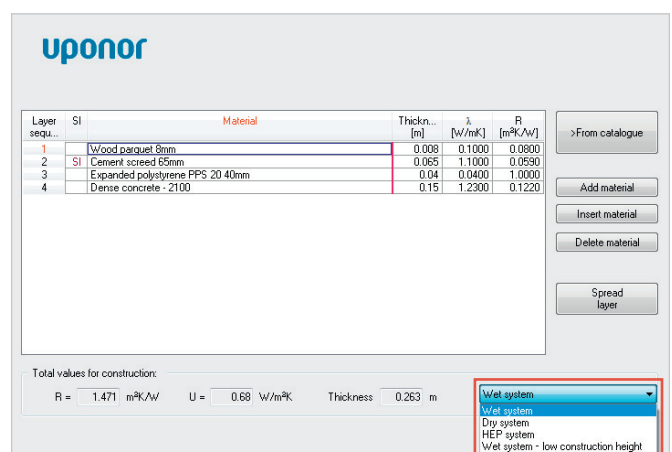
Adjustment of materials in the composition of floor structure

Click the *Modify build-up*. A dialog box is displayed with the list of materials in the composition of structure. There can be edited name, thickness [m], thermal conductivity λ [W/mK], and thermal resistance R [m²K/W] of single materials.

From catalogue: Material can be selected directly from the catalog of materials. The catalog of materials can be edited – you can add, edit, and delete the material or the group of materials; export and import the catalog.

Add material: Material is added to the end of the list.

Insert material: Material is inserted before the material indicated in the list.

Delete material: Material is deleted.

Spread layer: Material indicated in the list is designated as a spread layer (the layer which contains the pipes of the heating system).
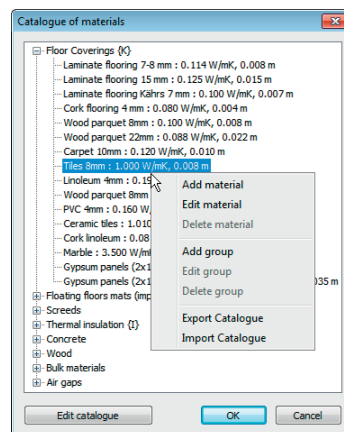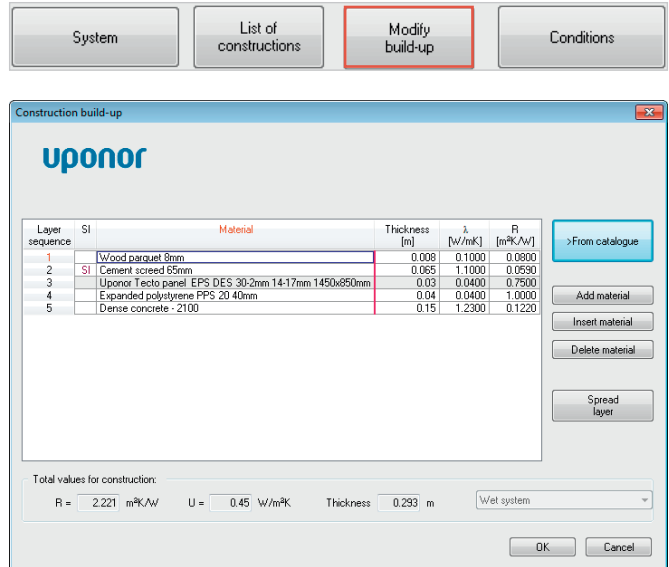
The choice of structure composition of the floor

Click the *List of constructions*. A dialog box appears with a list of structures. You can choose other composition of the floor than the predefined one.

Build up of construction: The dialog box is displayed for editing various materials, described in → *Adjustment of materials in the composition of floor structure.*
When creating a new and/or editing the existing structure composition, it is also necessary, to choose the type of system, for which the structure composition is intended. The type of system is evident from the number entry in the column Number in the list of constructions 0 - wet system; 1 - dry system; 4 - system HEP; 5 - wet system with low construction height.

Add construction: Construction is added to the end of the list.

Insert construction: Construction is inserted before the construction indicated in the list.

Copy of construction: creates a copy of the structure identified in the list.

Delete construction: Deletes the structure indicated in the list.
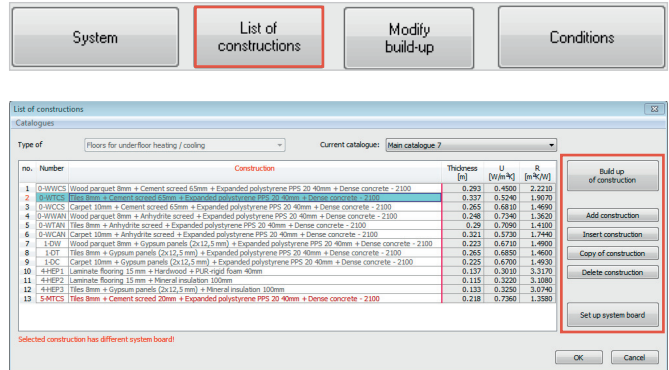
Set up system board: It is used for selecting of the system board into the indicated structure**.**

Boundary conditions for calculation

Click the *Conditions*. A dialog box appears; here you can enter the boundary conditions for the calculation of the chosen system of floor heating / cooling.
→ *Under-floor heating / cooling system.*

System: Under-floor heating / cooling system.

Max. circuit lenght: Enter the maximum length of the pipes for the heating / cooling circuit.

Max. pressure loss: Enter the maximum pressure loss of the heating / cooling circuit.

Pipes spacing in living area: Enter the min/max spacing for the pipes in the living zone.

Pipes spacing in boundary: Enter the min/max spacing for the pipes in the boundary zone.

List of allowed pipe spacing: Select the allowed spacing (applies to the both living and boundary zone).

Type of space under floor (Temperature under floor)

This section defines the type of the space under the floor of the room. According to the selected type and location
→ *Project data* the program sets the temperature under the floor. The temperature underneath the floor is to be entered separately for heating and cooling.

Temperature under floor for heating

Heated room: For this option, the program sets the temperature for the specified room as the design temperature.
→ *Purpose of the room*

Unheated room: For this option, the program sets the temperature for selected unheated space. The temperatures of unheated spaces depend on the outside design temperature of the selected location (T_e).

Soil: For this option, the program sets the temperature of the floor as the average outdoor temperature in the heating season for the selected site ($T_{e,heat.seas.}$).

External space: For this option, the program sets the temperature beneath the floor as the outside design temperature for the selected location (T_e).

Temperature under floor for cooling

The temperature under the floor for calculation of cooling is set to 26 °C for all types of space under the floor.

For both the heating and cooling, your own value of temperature under the floor can be entered.

Surface, heat loss and cooling load of rooms

Other data for the room are entered directly in the dialog box **Rooms**.

Area [m²]: Room area is entered directly into the column Area [m²], or you can enter the length and width of the room (Length [m], Width [m]) and the room area is calculated by program.

S_{oz} [m²]: Boundary zone area is entered into the column S_{oz} [m²].

I-branch pipe [m]: Length of connection for the room is entered as the distance of the connecting pipes between the manifold and the room (supply + reverse / 2) into the column I-branch pipe [m]. This value is designed for the preliminary calculation of under-floor heating / cooling within the design of manifold.
→ *Manual and automatic connection of the circuits to the manifold*.
Length of connections of each circuit is entered in the dialog box **Circuit branch supply pipes**.
→ *Circuit branch supply pipes.*

Q [W]: Calculation of the heat loss of room Q [W] is based on the desired area of the room Area [m²] and the specific heat loss of the building Q_r [W/m²] for the selected type of building. → *Project data*.

Qc [W]: The cooling load of the room is typed into the column Q_c [W]. The calculation of under-floor cooling shall include only the room, for which the cooling load is entered. Design temperature for cooling the room, $t_{i,cool}$ [°C] is set to 26 °C, but you can enter your own value.

Add room: A room is added to the end of the list.

Insert room: Inserts a room before the room marked in the list.

Change room: Allows you to change parameters of the room marked in the list (purpose of room, under-floor heating / cooling system, boundary conditions of calculation, floor structure, and temperature below the floor).

Add room copy: Creates a copy of the room designated in the list.

Delete room: Deletes the room marked in the list.

Rooms
Floor: 1. floor

no.	Room number	Purpose of room	System	Floor covering	Type of space under the floor	Length [m]	Width [m]	Area [m²]	Soz [m²]	I-branch pipe [m]	ti [°C]	Q [W]	ti,cool [°C]	Qc [W]	
	1.1	Bathroom	Tecto	Tiles 8mm	Soil	3.63	2.4	8.71	0	4.3	24	479	26	0	Add room
	1.2	Corridor	Tecto	Tiles 8mm	Soil	0	0	16.28	0	0.2	20	895	26	0	Insert room
	1.3	Living room	Tecto	Laminate flooring 7-8 mm	Soil	4.9	4.15	20.34	4.15	6.6	20	1118	26	923	Change room
	1.4	Dinning room with kitchen	Tecto	Laminate flooring 7-8 mm	Soil	4.9	4.05	19.85	4.05	8.2	20	1091	26	915	
	1.5	Bedroom	Tecto	Laminate flooring 7-8 mm	Soil	6.2	4.05	25.11	0	2.3	20	1381	26	1104	Add room copy
															Delete room

Manifolds

Preliminary calculation

In the dialog box **Manifolds** are designed manifolds that the circuits of under-floor heating / cooling are later connected to. There is also possible to adjust the length of the connections of the individual circuits that you have previously entered for the room.
→ *Surface, heat loss and cooling load of rooms*.

At the transition from the dialog box **Rooms** to the dialog box **Manifolds**, the program automatically starts the calculation, by which it allocates the individual under-floor heating for the rooms, if necessary. In this preliminary calculation, it must be determined, whether it is a design for the under-floor heating or cooling, and also, whether the program is to calculate the minimum required supply temperature.
→ *Principle and debugging of the calculation*.

If not, it is necessary to specify the supply temperature in [°C]. Details of the calculation are in the next section.
→ *Calculation.*
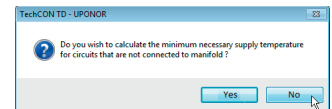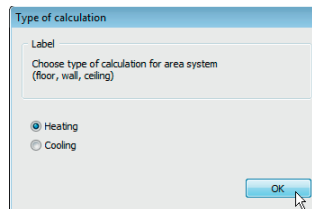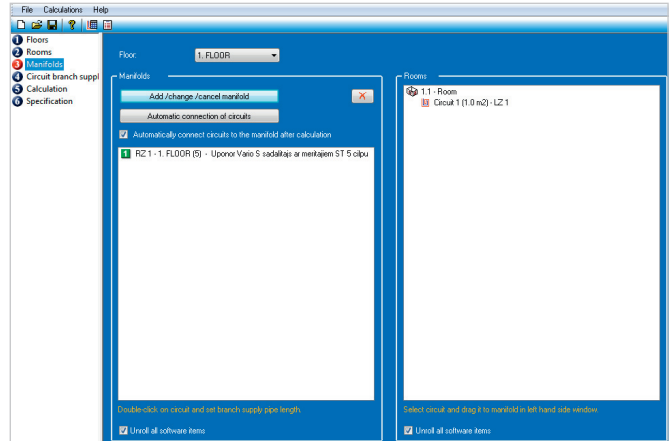
Design of manifold

After calculation, a list of circuits of rooms is displayed in the section Rooms. Surface and allocation to the zone (LZ – living zone; BZ – boundary zone) is given for each circuit. In the section Manifolds click *Add/change/remove manifold* – a dialog box for the design of manifolds is displayed. Bottom left, you select type of manifold. Select a single manifold with the required number of outlets, or click *Design manifold* – the program will design the number of outlets according to current number of lines in the rooms on that floor. On the right, in the section *Technical data*, set the temperature of the inlet, the valve on the right and/or left side of the manifold, and the manifold box.

Add manifold: A manifold with set parameters is added to the project.

Change data: Parameters of the manifold marked in the list are changed. It is possible to change the number of outlets, supply temperature, the valve on the right and/or left side of the manifold, and the manifold box.

Remove manifold: It deletes the manifold marked in the list.
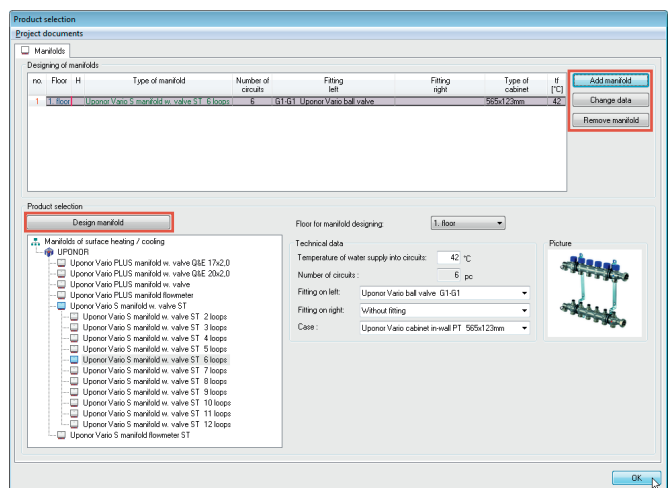
Connecting circuits to the manifold

Manual and automatic connection of circuits to the manifold

There are two basic ways to connect the room circuits to the designed manifold(s), **manual** and **automatic** connection of lines to the manifold. Circuits can be supplied manually by dragging the circuit from the section *Rooms* to the selected manifold in the section *Manifolds*. The program supplies such connection under priority and therefore always retains the connections performed manually. Circuits are connected **automatically** by selecting manifold in the section *Manifolds* and clicking the *Automatic* connection of circuits. This feature will connect all the lines to the manifold so that when there is a free connection of the manifold, then, that manifold is used. If all the outlets on the manifold are occupied, the program tries to change the distributor for the same with a larger number of outlets. If successful, then, it uses the available outlets. If the manifold is no longer possible to extend (to have more outlets), then, the program inserts into the project a manifold with the same data and continues in the same way. So, it is looking for a free outlet, expanding the manifold or making copies. The result of this automatic connection is that all circuits in the room are connected. And all manifolds have the required number of outlets. At the end of the list of manifolds there may be manifolds with free outlets. It can be so after recalculation supply, if the number of required manifolds was reduced, because these manifolds are not removed by the program itself. For a room, it can be specified the length of the circuit connection. This value is taken into account even if the system is not connected to the manifold. This ensures that after connection of the circuit, there will be no further fragmentation (compared to preliminary calculations before connecting). The length of connection can be adjusted after connecting the circuit by means of double click on the name of the circuit in the section *Manifolds*. This length will be given priority over the length of the room.
→ *Surface, heat loss and cooling load of rooms.*
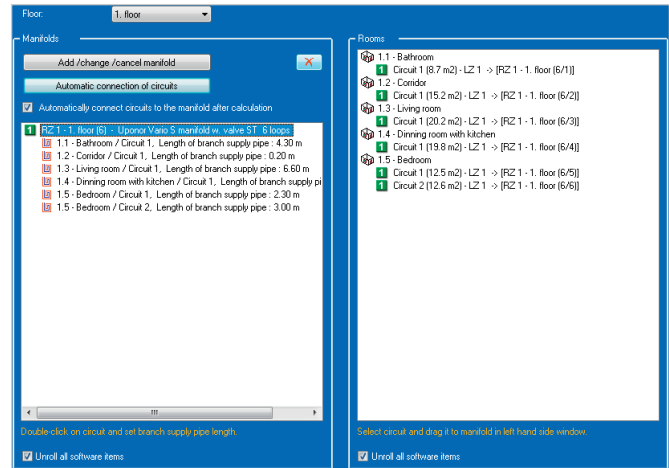
Connection of circuits to the manifold during calculation

After launching calculation, the program calculates all heating of floor in the project and then applies automatic connection of circuits to the manifold. If project has been changed (e.g. in a room has been added a circuit), the whole calculation is repeated. So, it again recalculates under-floor heating and automatically connects the circuits, until it finds that the project has not been changed – i.e., that all circuits are connected in the same way as before the last recalculation of underfloor heating.

Other options for automatic connection of circuits to the manifold

Automatic connection of circuits during the calculation can be disabled by checking the check box **Automatically connect circuits to the manifold after calculation**. After calculation, the program conducts only recalculation of under-floor heating. In the connected circuits, there are essentially no changes. It may happen that following the computation, in a room will be added some circuits; they remain unconnected, or the number of circuits can be reduced, and thus circuits are removed from the manifold that have previously been connected, and actually, they no longer exist.

When a manifold is inserted, a list of rooms is filled in the manifold, from which the lines will be automatically connected to the manifold. At the insertion, there are in this list all the rooms from the floor, in which the manifold is inserted, existing at the time of insertion of the manifold in the project. (NB. If you add a room when manifolds are already inserted, then, you must also add this room to the list of rooms to be supplied by the manifold). This list can be changed by marking the manifold in the left box, and then, by right-click the menu appears. Click the left mouse button in this menu on the option **Modify the list of rooms to be connected to this manifold** and you will get the box **Room selection**, in which you can change the list of rooms of the manifold at will.

Example of use: We have a project involving five rooms and designer decides that the rooms 1, 2 and 3 will be supplied from one manifold and the remaining 4 and 5 from the other. This is accomplished so that after inserting, the list of rooms is adjusted for each manifold. The first manifold will have in the list only the rooms 1, 2 and 3, and the second one the room 4 and 5. Let the first three rooms have 15 circuits and the last two 7. After automatic connection, there will be

3 manifolds in the project. Twelve circuits of the rooms 1, 2 and 3 will be connected to the first. The second manifold will be connected to 7 circuits of the rooms 4 and 5 and the third manifold will be connected to the last three circuits of the room. In fact, the program, after the automatic connection, supplies the circuits in the manner as described above, but along the way, it controls the lists of the rooms. That is, for an unattached line, it is looking for the manifold, which has the room in the list, to which the circuit belongs. If it has a free outlet, so this outlet is connected. If it has no free outlet, it tries to expand the manifold to more outlets. If even that is impossible, it keeps looking for another manifold with this room in the list. If connection of the circuit failed for all manifolds, it will insert the copy of the last manifold that had the searched room in the list.

The user can also prevent the program changing the number of outlets on the manifold. This is achieved by marking the manifold in the left box and then the menu appears by right-click on the mouse. By clicking the left mouse button on the option **Disable automatic manifold adjustment** in this menu, the change is prevented. By repeating the process, this can be re-authorized. This setting does not change anything in the very procedure of automatic supply; it does not change only the number of outlets. So if the manifold has no other outlets available, its copy is right made along with the opened one.

Example of use: When you insert in the project a manifold with seven outlets and there will be 19 circuits in the project, then, there will be 3 manifolds in the project with seven outlets; the first two will have seven circuits connected each and the last one will have so the remaining five.

Circuit branch supply pipes

Connection pipes from manifold to room

In the dialog box **Circuit branch supply pipes**, the lengths of connections of the various circuits are entered and it is defined, through which rooms and/or circuits the connections are passing through and what their length is.

In the list on the left side of the dialog box, there is an inventory of circuits in the rooms for the selected floor. In the column *I-branch pipe [m]* are the lengths of connections that you specified as the axial distance of the connecting pipes between the manifold and the room/circuit (supply + reverse / 2) when creating rooms
→ *Surface, heat loss and cooling load of rooms.*
and/or in the dialog box **Manifolds**
→ *Connecting circuits to the manifold.*

For defining the room/circuit, through which the connection passes, mark the circuit in the list and click *Add branch supply pipe*. The program adds an entry to the list on the right side of the dialog. In the column *Through room*, select a room/circuit, through which the connection passes. In the column *I- branch pipe [m]*, specify the length of connection as an axial distance between the connecting pipes running through the room/circuit (supply + reverse / 2). In the column *Spacing [mm]*, enter the spacing of the connecting pipes. In the column *Output [%]*, you can enter a reduced power (e.g. in the case of insulated attachment piping. *Delete branch supply pipe* deletes the connection marked in the list.
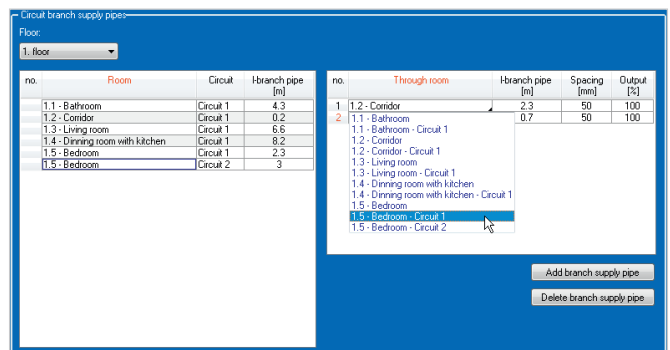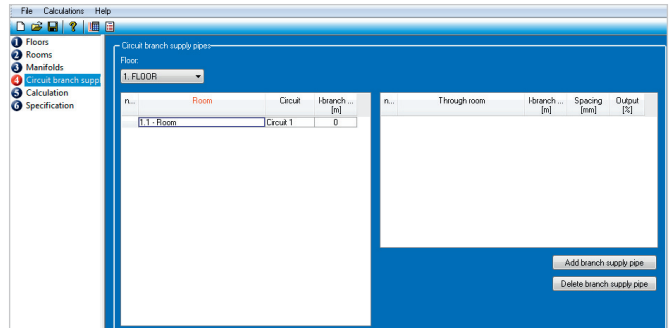
Calculation

Starting calculation

The dialog box **Calculation** displays the results of the calculation of floor heating/cooling system with possibility to adjust several parameters and debug the calculation. Here too, the system and individual elements of the regulation are set up.
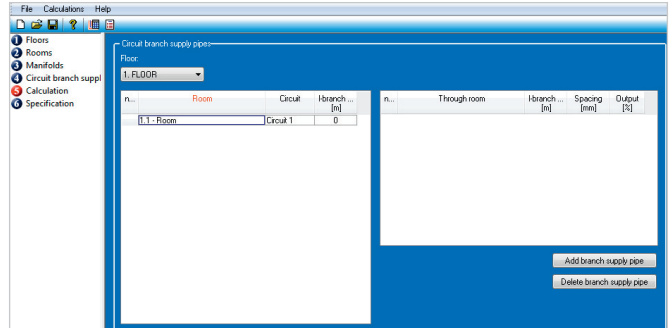
Setting basic parameters calculation

When calculating is started, the dialog box for setting parameters of calculation appears. For manifold marked in the list on the left, the set parameters are displayed.

Disposable pressure: Enter the available pressure in [Pa]. When the option *Calculate* is checked, the program after calculating sets the pressure loss of the most unfavorable circuit.

Temperature of supply: It is taken from the preliminary calculation, and/or from the design of manifold → *Manifolds*. By using the key *Setup*, you can set the minimum required value for the inlet flow temperature.
→ *Principle and debugging of calculation*.

Temperature of return: Impossible to enter; this value is calculated by the program on the basis of temperature differential of the circuits in project.

Calculation type: Specifies the calculation type of heating/cooling. Program removes from the memory the last entered values for both types of calculation.
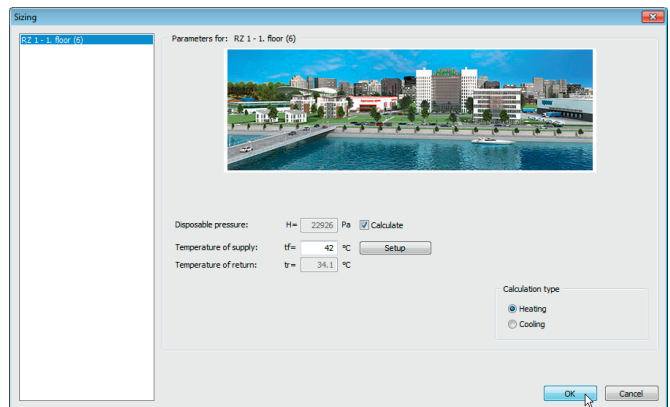
Display of the calculation results

In the calculation results, the individual circuits are arranged according to connection to the manifold outlets. Not connected circuits are placed at the end of the list. Through the main menu *File* you can export the results of calculation, through *Overall results*, the different parts of project, through *Units*, you can set the units for the display of flow rate. At the bottom of the calculation dialog box, the error messages appear which you can also view in a separate dialog box using the key *Error messages*.
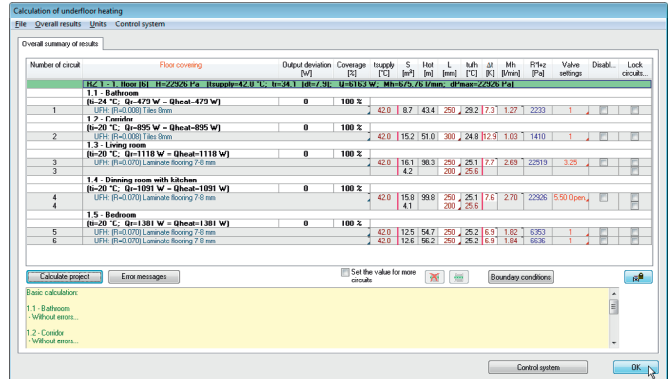
Boundary conditions of calculation

Boundary conditions of **rooms and zones** are displayed using the pushbutton *Boundary conditions*.
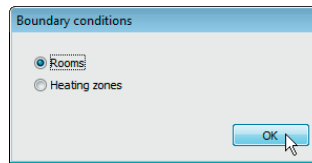
Within the boundary conditions of **rooms**, the maximum surface temperature and the minimum and maximum temperature gradient of living (LZ) and boundary (BZ) zone are entered. The program uses default values, each of which can be edited.

Room number	Purpose of room	LZ: Max tufh [°C]	BZ: Max tufh [°C]	LZ: Min Δt [K]	LZ: Max Δt [K]	BZ: Min Δt [K]	BZ: Max Δt [K]	Setup
1.1	Bathroom	33	35	5	15	5	10	
1.2	Corridor	29	35	5	15	5	10	
1.3	Living room	29	35	5	15	5	10	
1.4	Dinning room with kitchen	29	35	5	15	5	10	
1.5	Bedroom	29	35	5	15	5	10	
						Mark/unmark everything:		
								OK

Within the boundary conditions of the **zones**, the maximum pipe length, pressure loss of the circuit, and the minimum and maximum spacing of pipelines for living (LZ) and boundary (BZ) zone are specified. The program uses the values that you set for the chosen system to create the rooms (→ *Boundary conditions for calculation*), each of which can be edited.

Room number	Purpose of room	Zone	Max l-tot [m]	Max R*l+z [kPa]	LZ: Min L [mm]	LZ: Max L [mm]	BZ: Min L [mm]	BZ: Max L [mm]	Setup
1.1	Bathroom	LZ 1	120	25	100	300	100	300	
1.2	Corridor	LZ 1	120	25	100	300	100	300	
1.3	Living room	LZ 1	120	25	100	300	100	300	
1.4	Dinning room with kitchen	LZ 1	120	25	100	300	100	300	
1.5	Bedroom	LZ 1	120	25	100	300	100	300	
							Mark/unmark everything:		
									OK

In both cases it is possible to set required values for several rooms at once so that, before changing the value, the room by checking the box in the last column *Setup* is indicated.

Principle and debugging of calculation

The principle of calculation in the program is based on the desired performance for the room (heat loss / cooling load of the room), whereas the program uses two basic algorithms of calculation according to the inlet temperature setting → *Setting basic parameters of calculation* and boundary conditions → *Boundary conditions of calculation.*

If you enter a **particular value of flow temperature**, the program reaches the desired power trough setting the temperature gradient variables and the spacing of pipes between the minimum and maximum values, specified in the boundary conditions of calculation.
If you enter a request for calculation of the **minimum required flow temperature**, the program sets the minimum permissible value for the spacing of piping and temperature difference, and determines the minimum required temperature to achieve the desired performance.

Dividing of circuits is automatic. The program divides the circuit into more circuits with the same surface to meet the boundary condition of the maximum permissible pipe length and pressure drop → *Boundary conditions of calculation*. The program does not divide circuits, when the division in the last column of calculating *Lock circuits* is locked.

If the room in the project is **under-heated or overheated**, it means that it is not possible to attain the required performance (heat loss / cooling load), despite the fact that the value of the temperature gradient and the spacing is set to minimum (for under-heated room) or maximum (for overheated room) value of the boundary conditions. The program highlights this fact through shading the box pipe spacing and/or temperature gradient green.

The exceeded values of the boundary conditions are highlighted by the program in the errors massages and by red- shaded boxes in calculation as well.

Calculation can be debugged directly in the calculation by changing parameters for various circuits:

Pipe spacing L [mm]: Click the box and select pipe spacing. *Auto* returns the value calculated by the program; *Lock* locks up the current value.

Temperature gradient Δt [K]: Re-enter the value in the field. The value of 0 returns the temperature gradient calculated by the program.

Valve settings: Click the box and select a setting of the valve. After changing the value, the box in the next column is ticked off. To return to the setting proposed by the program, uncheck this box.

To change the values above for more rooms at once, before changing a value, check the box *Set the value for more circuits*. After each change, click *Calculate project*. The values proposed by the program are displayed in brown script; the values changed by user are in red lettering.

Set-up of the control system

In the dialog box Calculation of surface heating, click *Control system*.
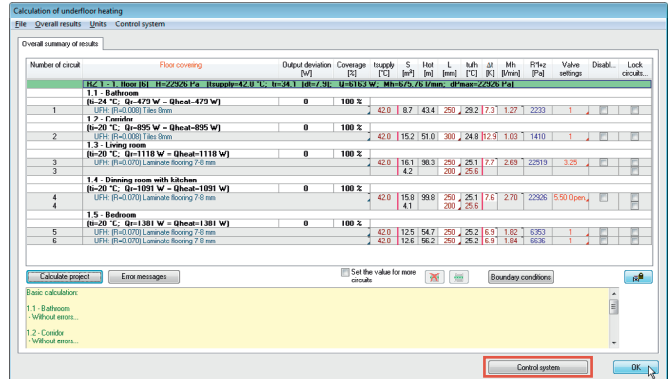
A dialog box appears for the design of floor heating/cooling regulation. In the list of manifolds, mark **manifold** and select **regulating system** and check the **required functions**. By means of *Set up regulation system for multiple manifolds*, the selected type of control can be set including the selected functions for other manifolds in the project.

In the bottom list, the rooms connected to the designated manifold appear. Select a **room** from the list and set the **thermostat** and the **actuator**. Some types of thermostats have the option for connection of the **floor temperature sensor** – check the box in the column *Floor temperature sensor* for specification. Using *Set up for multiple rooms*, you can set the selected type of thermostat for other rooms connected to the manifold as well.
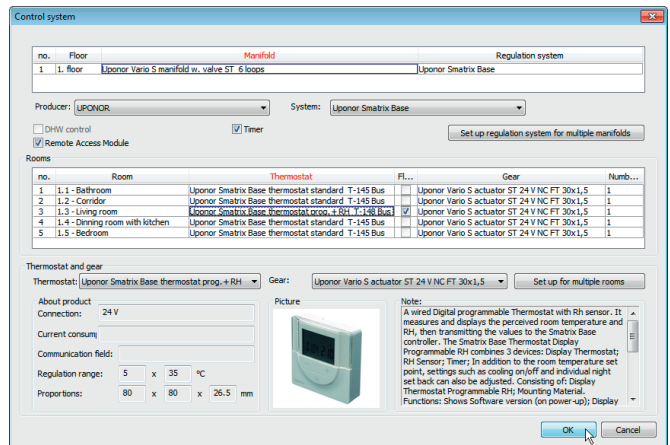
Specification

Material specification list

Specification generates the list of elements of the under-floor heating / cooling system in the project. In the *display All the products* is the list of all the products from the program database. Products used in the project are highlighted in red lettering and have the quantity data in the column *Quantity* filled.

NB.: Product that has not been used in the project is added to the specification by entering the quantity. All products in the database of the program are without prices. Product price can be entered in the column *Unit price* (without VAT). Prices are stored in the text file *c:\Program Files\ Atcon systems\TechCON TD - UPONOR\db\TABPDLceny.txt* and they are loaded in other projects as well. The display *Designed products* filtrates the list only to the products used in the project. Export in several formats (pdf; html, xls) is created through the menu *File*.
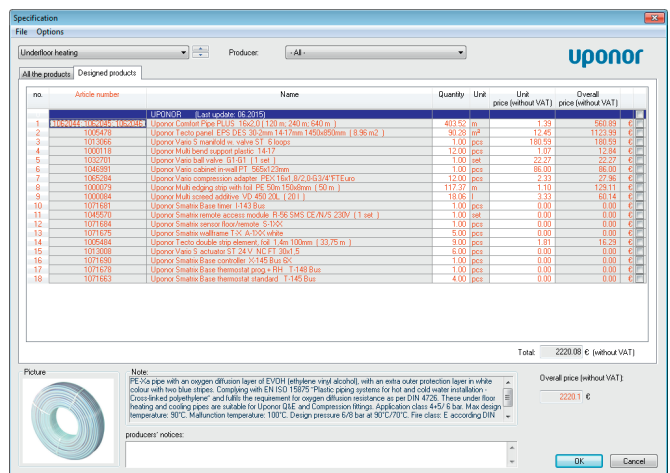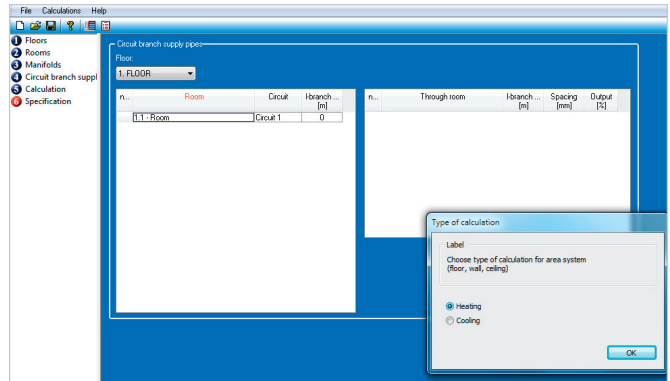
uponor

This software is available for download in

Poland	www.uponor.pl		
Hungary	www.uponor.hu	Ukraine	www.uponor.ua
Romania	www.uponor.ro	Estonia	www.uponor.ee
Czech	www.uponor.cz	Latvia	www.uponor.lv
Slovakia	www.uponor.sk	Lithuania	www.uponor.lt

www.uponor.com