

Instal-san

**Indoor water supply system design software
with graphical editing of schematic and plan views**

Version 4

Rev. 2005-08-16

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1. INTRODUCTION

1.1. Purpose

Instal-san supports the process of designing indoor cold and hot water supply systems in residential and public buildings. Data entry is realised by drawing a diagram – a schematic view, isometric drawing or by superimposing system drawing over plan view. Subsequently complex hydraulic and thermal calculations may be done, including:

- sizing of pipe diameters and optionally adjustment of diameters to specified available pressure when the specified available pressure is too low,
- automatic sizing of tees, manifolds, pipe fittings and couplings,
- determination of pressure required in the system,
- calculation of systems with pressure reducers and governors and calculation of systems with pressure boosting systems,
- determination of flow rates in hot water circulation system in order to maintain temperature drops within required limits,
- adjustment of circulation flow rates by setting control components.

The software package, within the scope of calculation methods, is based on the valid standards and professional literature. It does not cover calculations of fire-fighting systems. However, it does enable to include indoor hydrants into the system and to take them into account in flow calculations. The software does not carry out calculations of hot or cold water sources (booster pumps, heat exchangers) and does not contain symbols of components included in such devices.

The software operates on catalogues of pipes and fittings, control valves and insulation of defined manufacturers. The pipe and fittings catalogue contains all data that are required for calculations and to draw up bill of materials, including information on applied connections between components within one system or with components of another system.

Calculation results are presented in the form of tables. It is possible to paste tables of results into the graphical editor. It is also possible to print plans of building with installation and a graphical diagram of the system, which illustrates the arrangement of taps, risers and connecting pipes. Sized diameters and other calculation results are automatically inscribed in the drawings. The printout, of both tables and graphics, is configurable in a very wide scope.

When water supply system diagram is drawn, it usually also includes components of the drainage system. These, however, are not taken into account during computation.

This program is a continuation and integration of previous applications Instal-san 2.0 and Instal-san 3.0 which retains all their features and enables calculation of water supply systems on the basis of only a schematic view or isometric drawing. *.san files can be loaded onto Instal-san 4.5, their calculation, however, may at first be impossible or interpretation thereof may be different from that provided by version 2.0 or 3.0. Users who want to recalculate files created with version 2.0 or 3.0 are referred to the

information on the most important differences in interpretation of data derived from previous versions which can be found at the end of this manual.

1.2. Communication with other applications of the InstalSystem package

Instal-san is a component of the InstalSystem package, which also includes Instal-ozc and Instal-therm.

Instal-therm is intended for the design of hydronic single- and double-pipe central heating systems with convectors or radiators and for aiding the design and adjustment of double-pipe cooling medium circuits in air-conditioning systems.

Instal-ozc is designed for calculating heat losses and seasonal heat demand in buildings.

Using all applications of the package enables the carrying out of precise thermal calculations of buildings and the design of modern heating, cooling and water supply systems.

Data exchange between applications is effected by means of data files with .isb extension, which are common to Instal-san, Instal-therm and Instal-ozc applications.

Therefore, when an *.isb file is edited in one application, the data entered into it may be used by the other applications. For instance, data applying to thermal calculations are used in the design of the heating system, while graphical plan views of building storeys may be used in the design of both the water supply and the heating system. After opening an *.isb file in InstalSan you can edit and calculate the water supply system and view the heating system.

The graphical design of the water supply system is displayed on the appropriate edit tab. When designing the water supply system you can monitor its arrangement in relation to the heating system by displaying the shadow of a selected worksheet.

The package is supplied with an application for scanning base building drawings and for pasting together and scaling the scanned drawings. Files saved with that application are of bitmap format and may form a background which facilitates the drawing of the plan of the installation and also the drawing by the user of storey plan using program objects (walls, rooms, etc.).

Another component of the package is Instal-mat, which gathers information on materials from one or more projects created with Instal-therm and Instal-san and on that basis draws up a collective bill of materials and materials order. At this stage the bill is appended with prices.

1.3. Communication with other engineering software

The base drawing (plans of individual storeys) may be drawn directly in the application, or may be imported from one or more DXF or DWG files created with engineering graphical software. The files may be imported with or without having the walls, windows and doors interpreted. In the first case the individual objects are recognised and rooms will be defined. In the latter case the imported material will form just a background drawing on which the plan may be drawn. In order to enable proper interpretation of the file and identification of walls, windows and doors and creation of

rooms, it is important that defined principles of graphical design are observed within the application where the building design is created. These principles are described further in this manual.

When plans, schematic views and calculations of the system are complete, the drawings with calculation results may be printed, or saved (exported) to DXF or DWG files. These files may include just the base drawing and the system, or the export may comprise the remaining contents of the DXF or DWG files from which the plans were imported, and then new layers will be appended with the components designed. This way the documents created may be adapted to a specific standard, where all graphical information (including other system drawings) is included in one DWG / DXF file.

1.4. Arrangement of the Manual

The sections of this Manual are arranged in a manner that enables a beginner to start working with the software right away and to let every user get acquainted with its advanced functions.

Section 2 describes shortly how to work with the software. The information given there is sufficient to start working with the program and to create projects with the use of its basic functions. The arrangement of information follows a typical scheme of creating a project.

Next sections of the complete Manual describe all functions of the program arranged in a more encyclopaedic way. Information provided there is, to some extent, a repetition of what is included in section 2, but it is much more detailed.

Full text of the Manual is provided on the installation disk of the software in the form of easy-to-browse HTML files and a PDF file, which enables printout of selected sections. Microsoft® Internet Explorer version 4 or higher is recommended to look through the Manual in the HTML format. To view or print the Manual in the PDF format, Adobe® Acrobat® Reader or Adobe® eBook Reader software is required.

1.5. Abbreviations and symbols used

Paragraphs marked with “◆” indicate lists of actions required for performing a function. For instance:

- ◆ In order to place a component in the project:
 1. Click the button on the toolbar representing the component
 2. Move the mouse pointer to the workspace. The mouse pointer takes the shape of [...]

Paragraphs marked with an exclamation mark and printed in bold and italics contain particularly important information. For instance:

- ! Remember that you must deduct from the heat loss to be covered by underfloor heating the heat loss to the heated floor [...]***

The following notation:

» “File / Save project” (**Ctrl+S**, “Program” -> ). «

indicates the selection of the command “Save project” from the “File” menu. The combination of **Ctrl** and **S** keys is the shortcut to this command – this means pressing the **Ctrl** key, keeping it depressed and pressing the **S** key. This command can be called from the “Program” toolbar by pressing the  button.

This Supplement describes the auxiliary application that supports the use of the software as well as the updating of the software itself and of the folders. Updating may be done from a disk or from InstalSoft’s web page. This application also plays the role of a package integrator, which provides access to all package components and enables arranging data files with reference to projects carried out and archiving of those projects. The Package Manager can be installed only after the main part of the package (set of applications) has been installed. Because of that its installation is not an integral part of the package installation and it must be launched from the level of the utility that provides access to the contents of the CD. If the Package Manager is not installed, the main part of the package includes its simplified, limited and older version called “Catalogue Manager”. The Catalogue Manager can only be used to install new catalogues or update existing catalogues, whereas the source of the new catalogues is a disk with catalogue files downloaded from InstalSoft’s web page or obtained in a different manner - from the package supplier, for instance.

The Package Manager fulfils the following functions:

- creates a working environment for many users of the package,
- integrates all package components, enables launching them from one menu,
- informs about available catalogues and enables updating thereof, also via the Internet,
- enables updating package applications, also via the Internet,
- facilitates managing of multiple data files that make up one project.

1.6. Terms and abbreviations used

The following terms are used in the Manual and in the help files:

- **Sheet** – part of a project on one drawing board of the graphical editor. Components drawn on one sheet of plan should make up the so-called one graphical storey. Every other sheet of plan constitutes another graphical storey.
- **Shadow** – a component (receptor, pipe-run, source) duplicated in another worksheet and assigned to the original component, that is to an identical component in terms of its functions, drawn in the worksheet from which the complete structure of connections is loaded. These components are not tested for the correctness of their connections.
- **Pipe-run** – segment of piping through which water is delivered at a defined flux which is constant along the entire length of that segment.

- **Fitting component** – a component placed visually on a pipe-run, which may be a fitting in the common meaning, or a fitting in a wider sense, e.g. a fixed point or a partition crossing.
- **Flow-through component** – a component of the installation through which water flows. Includes circulation, hot/cold water pipe-runs as well as such components as water source or water heater.
- **Group** – a specific type of module with additional features, such as border (frame) outside of which group components cannot be moved.
- **Expandable group** – a group for which the manner of auto-duplication (adding subsequent components during group expansion) has been specified.
- **Installation** – a set of interconnected water circuits, receptors and fittings originating from one source. One project file may comprise several installations.
- **Module** – a set of components connected with each other available in the toolbar for multiple use.
- **Receptor** – component of the hot or cold water supply system enabling utilization of water.
- **Heater** – a component which is a receptor of cold water and a source of hot water.
- **Virtual pipe** – shown in some catalogues, used to assign pipe type to pipe-runs which are actually non-existent, but symbolize direct connection of components, e.g. a faucet connected directly to a tee.
- **Data table** – table where data of a component or components of the same type may be edited.
- **Editing scopes** – planes, which form the whole project when superimposed. It is also possible to view the heating system on a separate editing scope. A plane shown on a separate tab – Printout – is designed for previewing and configuring the printout.
- **Junction** – a point in the diagram which comprises a connection of a pipe-run with a preceding or a following pipe-run, usually with more than one pipe-run, where water streams converge or diverge and fitting components are sized.
- **Remote connection** – used to link two parts of a system placed on separate sheets or on one sheet. Remote connection can be used for any configuration of pipe-run connections.
- **Source** – a spot where cold, hot or circulating water is supplied or prepared.

Abbreviations are applied in the Manual and the program for names that are often used:

Full name:	Abbreviation:
Standard flow rate at cold water supply point [dm ³ /s]	Qn CW
Standard flow rate at hot water supply point [dm ³ /s]	Qn HW
Continuous flow rate at cold water supply point [dm ³ /s]	Qc CW
Continuous flow rate at hot water supply point [dm ³ /s]	Qc HW
Minimum pressure drop at valve	Δp min
Pressure reducer/governor setting	Setting (p/ Δp)
Circulation water flow rate in pipe-run [dm ³ /s]	Qcirc
Water flow rate in heater [dm ³ /s]	Q
Available pressure of cold water at source	Avail.press.CW
Available pressure of hot water at source	Avail.press.HW
Required hot water pressure upstream of supply point	Req.press.HW
Required cold water pressure upstream of supply point	Req.press.CW
Required hot/cold water pressure upstream of supply point	Max.press.
Pump head	Head
Circulation pump pressure	Circ.pump.pres s.
Source flow resistance for circulation	Source circ.res.
Required pressure downstream of pressurizing system	Req.press.dow n.
Inlet diameter	In.diam.
Outlet diameter	Out.diam.

! Some parts of the Manual may include terminology applicable to other design trades than the one this application is intended for. This is a consequence of the increasing degree of integration of Instal-therm and Instal-san.

2. SHORT DESCRIPTION OF THE STAGES OF CREATING TYPICAL PROJECTS

2.1. Introduction

In this section the basic stages of creating and calculating a water supply system project with the use of Instal-san are presented. The subsequent subsections provide a short description of each of these stages, whereas the detailed description of the many functions and mechanisms of the program is given in the following sections of the Manual.

The basic stages of creating a project include:

- setting up a new project and configuring its general data, and selecting a list of system component catalogues,
- creating storey plans as background for the project,
- arranging the installation on the plans and selecting the manner of drawing it (plan, isometric drawing) on the schematic view together with source and riser arrangement,
- drawing schematic view of the installation,
- appending data on the schematic view and on the plans,
- starting calculations and analysing data diagnostic messages. At this stage you can go back to editing the drawing (previous stages) or you can carry on with the calculations,
- setting calculation options and executing calculations,
- reviewing data tables,
- printing or exporting the tables, reconfiguring them if necessary
- upon reverting to the graphical editor – configuring printout settings for project drawings with calculation results.

2.2. Creating a new project

To create a new project you must launch the graphical editor. A new project is created by means of the “File / New project” command or by clicking on the “New

project” button  - first button on the “Program” tab. You can also use the “New project” button in the welcome window, which is displayed after launching the program.

After creating a new project the “Project options” window is displayed. Mark data editing categories displayed as a list to open basic data editing fields in the right part of the window. Proper configuration of these data, particularly the default values, enhances design work and helps avoid mistakes and oversights when entering data.

Specify the default pipe type here for circulation, hot and cold water. This pipe type will be adopted for all pipe-runs in the project if no other type has been specified in the data table. The type of building should also be specified here and the default cold/hot water temperatures should be checked.

In the “Catalogues” window you should select installation component catalogues from among those available in the program. From among the available components the pipe types, valves, faucets, etc. are selected.

Project options can be changed at a later stage of design work. To do this select “Project options / General data” (F7) or “Project options / Info” – each of these commands displays the appropriate project options window.

When selecting items from the list you can also configure the appearance of the project components – select pipe-run colour, line style, line thickness, types of fields displayed, etc.

You’ll find a detailed description of the project options window in section 3.3.

2.3. Creating plans of storeys as base for project

A plan of floor can be drawn directly in the program by means of available tools and objects or it can be imported from DXF or DWG file, with interpretation of walls, windows and doors. It is also possible to load a scanned drawing (or loading a DWG/DXF file as a drawing, i.e. without interpretation) to obtain a background, on which walls, windows and doors can be drawn by means of program tools and objects or it is possible to mark only the area of individual compartments on such base plan. The last method does not enable to calculate the heat loss in the project including thermal calculations of the building.

! If the building has many floors and we want to have the plans of floors for all of them in the project, it is necessary to make a separate worksheet for each floor.

2.3.1. Drawing the plans of floors in the program

If it is necessary to create a new worksheet, select “Worksheets” from menu “File” and click the button “New”, select the worksheet type (in this case “Plan view”) and press the buttons “OK” and “Close”. A new created worksheet will become the edited one.

Structure edition consists of following sub-stages:

1. Inserting the bitmap base plan
2. Drawing of walls and creating the compartments by means of component “Wall”
3. Drawing of ready diagram of rooms
4. Possible completing the structure with components: “Window”, “Door” and “Opening in wall”
5. Final configuring of partitions and compartments data with windows and doors assigned to them (concerns the project including heat losses as well).

Ad. 1. Inserting the bitmap base plan

In the lower set of tabs – project edition scopes go to edition scope “Base plan”. From the upper toolbar from the tab “Graphics” select a component “Picture”



. Click on the picture area, on which a small rectangle will appear.

In data table in field “Drawing” select “Add new” and the window “Drawings gallery” will appear. By means of function “Read” localise the floors base plan and open it.

! Drawings gallery has a possibility of scaling the drawing base plans. If the base plan from BMP file is used, scaling is necessary.

Clicking the button “Close” you can close the drawings gallery window and the file is simultaneously loaded on the tab “Base plan”. A base plan in form of an uniform drawing will appear (without distinguishing of any objects).

Ad. 2 Drawing of walls and creating the compartments by means of component “Wall”

Go to edition scope “Base plan”. On the toolbar select the tab “Components” and then select a component named “Wall”  clicking once a button on the toolbar. Program will go to the component inserting mode, in this case a wall. You can recognise it by appropriate message on the status bar (in the middle, on lower part of screen) and “under the cursor” a schematic fragment of the wall  will appear. In this moment, clicking the cursor in any place on the drawing area will cause start of inserting the building wall. Next click will determine the final point of the wall and the program will go back to selection mode (standard mode).

! It is possible to determine with high precision the coordinates of initial or final point of the wall by clicking (while drawing) the area of status line, in which the coordinates are displayed. Program will ask then for X and Y coordinates and will insert a point in this place.

The thread cursor, made of intersecting horizontal and vertical lines, is a kind of “sight” helping in precise cursor location towards reference point (vertical and horizontal scale) and towards other components located already on the drawing.

! During inserting of components it is possible to edit in data table such fields as e.g. “Length”, “Width” and “Angle”. Giving a specific value in these fields enables precise determining of parameters of wall inserted on the drawing.

After inserting the first wall it is necessary to select again the component “Wall” from the toolbar or press the key **F3** for the function “Repeat the last inserted component” and start to insert the next wall. The walls should connect with each other to create closed areas, which will be automatically recognised by the program as rooms. Creating of a room can be recognised by appearing of label (rectangle with rounded corners) including its description and cross-hatched room area.

During edition, very useful is application of special working modes of program: REPT, AUTO and ORTO. The mode REPT means continuous selection of the same component to be inserted. Mode AUTO causes that the program proposes possible connection points of inserted component (e.g. a wall) with components which have been inserted on the drawing before. This enables efficient connecting of components without precise operating with the mouse. It is possible to connect components when

the AUTO mode is switched off, nevertheless this requires more precised mouse cursor positioning. The ORTO mode causes, that the program enables inserting of horizontal and vertical walls only, which makes edition of rectangular rooms and inserting of walls under the angle specified in Project options/ AUTO, ORTO, GRID by declaring of angle increment much easier.

Working modes can be switched by clicking the left mouse button on fields located in the right lower edge of the screen, below the tabs of edition scopes of the project. More information you can find in chapter 2.5.

! If there is a plan of another floor and you want to use it as a master, you can switch off its contour in menu “View/Show the shadow of another worksheet” – selected is the position with plan closest to the left by default.

If we want to design a heating or water supply installation on the basis of simplified structure of plans, the program enables a schematic edition without precise reflection of real dimensions and rooms layout. In such case it is necessary to impose manually proper rooms area. Such solution enables acceleration of structure edition (edition does not require big accuracy), but this is not recommended since it causes, that received drawing has much lower value as a scheme of installation assembly and can not be used as a base for heat loss calculation. It is also necessary to complete data for all connections, which can require more working time as precise edition of room layout.

More about inserting of walls – see chapter 6.4.16.4.1

Ad. 3. Possible completing the structure with components: “Window”, “Door” and “Opening in wall”

To place e.g. a window on the wall, select the component  from the toolbar „Components” and insert on the wall clicking the left mouse button, when the cross of the sight is located on the line marking the middle point of the wall in place, where the middle part of window is to be located. The window is an additional component of the wall, so it is possible to move it and change its direction only in the scope of original wall. Data of window or other completing components, e.g. dimensions, are located below the wall data in data table.

Ad. 4 Additional completing the structure with components: “Horizontal partition: floor or ceiling” (this concerns only the project including heat losses calculations).

Program enables completing the plan construction with horizontal partitions – this is useful, when the User wants to make heat losses calculations in Instal-OZC program. You can select two horizontal partitions from the toolbar : floor and ceiling



. After selecting the component and switching to drawing area, it is necessary to click in any place on area of selected room and the wall or ceiling will be inserted on entire room area determined in axes. This operation is to be repeated for every room.

! Internal ceilings must be inserted and described in the project only once. The User inserts internal ceiling as a component type “Ceiling” on lower floor or as

“Floor” on upper floor (the second option is recommended, also inserting of floor).

Ad. 5. Final configuring of partitions and compartments data with windows and doors assigned to them (concerns the project including heat losses as well).

Each component, i.e. wall, window, door or opening in the wall assigned to the wall, floor, ceiling and a room recognized by the program has specific parameters, which can be reviewed and changed by means of data table. Data table can be switched on and off by means of the function key **F12** or with command “View///Display/Hide data table”. In data table you can see fields appropriate for actually selected component. To select a component, click it with left mouse button and to select the wall click the middle line of the wall; to select a room or a horizontal partition, click its tag. It is also possible to select several components simultaneously, clicking and holding the **Shift** key. If several components of the same type will be selected, e.g. two rooms, then it is possible to change their data simultaneously.

Majority of data of each component is inserted by default. Some of them must be completed, others are optional.

! Many data and values are read by the program from a drawing or are determined by means of other data. These units are shown in brackets. The User can overwrite them with imposed value. To come back to default value (determined by the program) enter in appropriate field the interrogation symbol “?” and press “Enter”.

Any data edition in data table of project structure components must be confirmed with “Enter” key. Otherwise the change will not be saved. This rule applies in case of edition of all project data.

Depending on appropriation of the view (as a base plan for the water supply installation, radiant heating or radiator heating, or for heat losses calculations), the scope of complete data will differ.

! Information about construction of all types of partitions, necessary for determining their thermal properties are completed in data table on edition scope concerning the structure, after previous loading the file into Instal-ozc program, creating of individual, necessary partitions definitions and saving.

2.3.2. Import of plan from DWG/DXF file

Importing of DWG/DXF file is performed to actual sheet of plan, which should be empty.

To import a plan from file, from menu “File” select “Import plan of building from DWG/DXF file”, then select the file. Overview of its content is very helpful here. In case of encoded files, program will ask for a password enabling acces to the file. During the first import program will ask for the file of fonts used in construction projects 9with extension .shx). In this moment it is possible to:

- indicate the file location on the drive, if a file with base plans has been supplied
- download necessary fonts from the webpage <http://www.cadresource.com/library/fonts.html>, the link to which is located in lower part of window,

- or select an option “Cancel”

Selection of option “Cancel” does not interrupt the file import operation, but causes using a default font by the system. When there are more non-standard fonts in imported file, additional window will be displayed several times (adequately to the number of fonts).

After file selection, next import stages will follow. You can switch between them by means of buttons “Next” and – if necessary – “Back”. Import stages are performed in individual windows, in which following operations are performed:

- determination of unit of measure of the drawing
- selection of layers to be imported, on which the walls or walls axes are located.

On this stage it is necessary to determine minimum and maximum wall thickness, if they differ from the default value

- selection of layers to be imported, on which windows and doors are located.

Additionally it is necessary to define the scope of windows width and select from available list the drawings types of doors and windows, which are present on the floor drawing

- select optionally layers, which can be previously loaded as a drawing – without interpretation of its content as a set of building objects

! Selecting of unit of measure adequate to the size of real object is important because of the graphical editor, which always shows and reads dimensions in meters. For this it is important, that the imported drawing is properly scaled during importing.

Selection of layers is performed on lists with fields - selection boxes. Indicating the list component switches on the layer overview only and selection for import consists in clicking the box associated with the name of list component. Overview of imported file is available in adjacent window all the time.

For the main overview window of imported drawing there is a set of auxiliary display options, collected in a pop-up menu, which can be opened with right mouse button click.

Loading of a layer (one or more) as a drawing has following practical applications:

- if a layer contains useful practical information or additional components, e.g. not interpreted stairs, location of equipment etc.

- if we do not want to load a base plan with interpretation (e.g. because we do not understand the layers structure in this file or when previous trials have shown that interpretation is performed not properly) and we need the graphical background only, on which the the installation plan will be drawn or on which our own plan of floors will be created by means of objects offered by the program.

After termination of interpretation, overview window and project layers list of source project will disappear and on the graphical editor screen the imported drawing will appear. Program will automatically load interpreted objects on the tab “Construction” independent on the tab previously worked with.

Imported graphical objects are initially locked for modification, but after unlocking them they can be freely shifted, deleted or new components can be added in manual edition mode.

On the tab “Base plan” all components will appear, which where located on layers selected to be loaded as a drawing. These components will keep the layer structure from file DWG/DXF. In data table you can change the visibility of entire base plan and individual layers.

The User can select, for which layers the AUTO mode should be taken into account (by default all layers are selected). Practically it means that while drawing the rooms or manual inserting of components at switched on AUTO mode, edges of these inserted components are attracted to the points from selected layers.

! Important information about vertical building structure: ordinates and height of individual floors, ceilings thickness etc. are saved in tabular form, i.e. there is neither graphical edition of these data, nor their import from DWG/DXF files.

Data concerning vertical structure of the building are displayed in edition window of these data – command “Project options/Building structure”. Working screen used for this edition enables parallel assigning of these rooms to flats.

2.4. Creating plans and schematic views of the installation

2.4.1. General information

As already mentioned in the foreword calculations of installation only on the basis of schematic view and for straight lines included in the frames of one installation floor – on the basis of the plan only (network plan). In this description we will assume that the User wants to have the set of drawings at his disposal. In such case the pictures of the same components – terminals, pipe-runs and fittings can (but they don't have to) appear simultaneously on both drawings: schematic view and one of plan views.

In this description one of many possible conventions of connecting of schematic views and plans into common project has been taking into account. The leading scheme of this convention is the schematic view and the plan views are only complementary.

Because on schematic view the original components will be present, this implies automatically presence of components shadows on plan views only.

There is a rule in the program saying that the installation structure is constructed from so called originals of components, which can be placed on a plan view or on schematic view and they have to be connected with originals of other components (e.g. original of terminal with original of pipe-run) until connection with source. It does not mean that entire installation must be described by means of originals only on a plan view or only on a schematic view, because remote connections enable any required and multiple switching from one worksheet to another, this concerns as well worksheets of type “Plan view” and “Schematic view”. Particularly, part of installation can be described on plan views and other part on schematic view (or schematic views) and none of components will appear on two drawings simultaneously.

When the User wants to dispose of a schematic view including all installation and simultaneously wants to have drawings of terminals on plans of floors (e.g. to describe their size and integrated valves settings) and additionally the course of distribution network on the cellar plan views, then it is necessary to use the duplicates of components – so called shadows on the stage of creating the drawing. They can be inserted on drawing similar to original components. After inserting of all components on

drawings we can determine the association of pairs original – shadow, previously declaring the components on plan views as shadows.

To simplify, we will call the original components just “components” in description. Shadows are excluded from the control of connection correctness. Removing the shadow will not disturb the installation structure for calculations, removing the original will cause an error.

! From shadows components no data for calculations are taken. Shadows take over the calculations results from assigned originals.

We assume in the example that analytical requirements of rooms for the heat are known.

2.4.2. Project creating stages

Main stages of creating the installation project are:

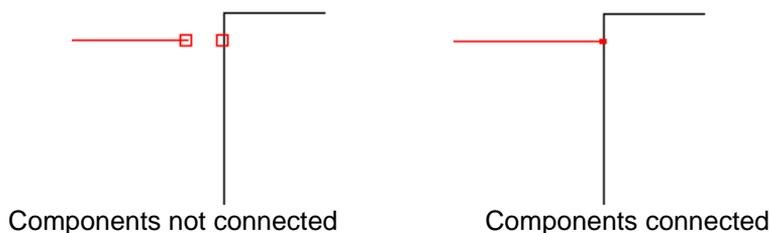
1. Creating a new project and configuring its general data, e.g. catalogues (see chapter 1.1)
2. Creating an adequate number of sheets with inserted building plan views (see chapter 6.1.1)
3. Inserting terminals and the plan of distribution network on the building plan views (see chapter 2.4.3 p. “Inserting radiators and plan of distribution network”) and declaring inserted components as shadows.
4. Creating a schematic view sheet and drawing the installation schematic view (see chapter 6.5.1).
5. Association of terminal shadows and pipe-runs with schematic view components (see chapter 6.5.2).
6. Completion of data and determining the types of components and devices from catalogues.
7. Possible completion of drawings with additional labels (e.g. names of groups – risers, drawing table etc.)
8. Saving the file
9. Settlement of calculation options, diagnostics and calculation (see chapter 4).
10. Review results in tables and/or on drawing (see chapter 4.4).
11. If required – correcting of data or drawing (e.g. when labels are overlapping) and repeated calculations
12. Making of required printouts (see chapter 4.6.1)
13. Saving the file

2.4.3. General rules for editing installation diagram

The order in which components are drawn is not important. However, bear in mind that:

- pipe-runs must be connected to other components (sources, terminal units, manifolds), not vice versa; it is therefore better to draw pipe-runs at the end, when all other components are arranged
- fitting components are always placed on basic components, usually on pipe-runs (they cannot stand alone, the only exception are three- and four-way valves)

- connection is formed immediately after a pipe-run is drawn or modified – this is indicated by filling in with colour the small square at the end of the pipe-run (similar squares at terminal units and sources are the points where connections are made with pipe-runs). It is good to check visually connections while they are made.



A layout can be formed of:

- single components available on the toolbar tabs, such as: terminal units, pipe-runs, etc.
- modules available in the program
- expanding groups available in the program
- fragments copied to clipboard and pasted elsewhere in the drawing
- user-specified modules and expanding groups.

All components available in the graphical editor are described in the section 7 of the manual.

! Some components located on schematic view have other appearance than the same located on the plan.

Inserting a pipe-run consists in:

- clicking on the pipe-run button in appropriate place of toolbar from the edition scope concerning installation
- clicking on the point within the drawing area where the pipe-run is to have its starting point
- moving the mouse pointer to the point where the pipe-run is to terminate. If at that point there is no connection point, for instance, to a terminal unit (the pipe-run is to have a free end), press the left mouse button and then the right mouse button. Otherwise just press the left mouse button – the pipe-run will be connected.

Pipe-run turns (points of direction change) are made during drawing by clicking the left mouse button. Pipe-runs are numbered automatically: numbers of supply and return pipe-runs as well as hot and cold water are identical. The system is numbered from the source to terminal units. When a pipe-run consists of several segments, then all fragments have the same number followed by subsequent letters: _a, _b, _c, etc.

Inserting a component other than a pipe-run consists in clicking on the button representing the component and then clicking at the point where we want to place the component. This also applies to modules and expanding groups. Some components (manifold with main, boiler, preheater floor elevation label, all groups and expanding groups) can be expanded (spread) or contracted in one or two dimensions.

Fitting components are inserted in similar manner, and the second click indicates the pipe-run or terminal onto which the fitting is placed. Most of the fitting components can only be placed on pipe-runs, some can only be placed on terminals, some (e.g. bleeders) can be placed on a wider range of basic components. To place the same fitting component, e.g. a valve, on a number of pipe-runs, mark all these pipe-runs (e.g. by holding the Shift key and clicking on each pipe-run or by using the “Select all components of type...” function) and then double click the valve symbol in the “Fittings” tab – the valves will be inserted at the point of each pipe-run selected by the program. Some points may require some modification, however, it still is faster than placing a component on each individual pipe-run.

To repeat insertion of the same component press the **F3** function key.

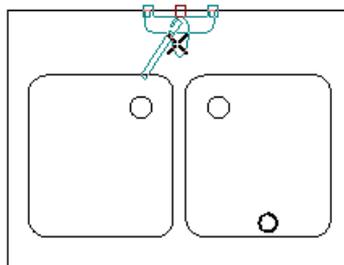
2.4.4. *Editing the installation*

To enable inserting receptors in the storey plan created beforehand go to the “San” editing scope. Placing receptors alongside walls is facilitated by the AUTO mode – the receptor is automatically placed near the wall and parallel to it.

Then you can start arranging components from the toolbar in the “Flow-through and other components” tab. The toolbar provides components that can be placed directly in the drawing board: pipe-runs, manifolds, water outlet points, sources. They make up the basic diagram of the installation. Components from the “Fittings” tab can only be placed on the components mentioned above – in practice on pipe-runs only.

The “Receptors” tab includes many drainage system components, which in the present release of the program are only used to make the drawing complete, but are not taken into account in the calculations. The manner of arranging these components in the plan views is similar to that of arranging other components from the “Receptors” tab.

Editing the plan view is easier when component pairs are created: drainage system component + water receptor. Creating such pairs is easy with the AUTO mode is enabled. Just place the drainage system component in the worksheet followed by the water receptor. If AUTO is on, the point of inserting the receptor is automatically indicated by a cross. Just left-click the mouse and the receptor is inserted at the proper place.



Diagnostics is not carried out for shadow-type components. Therefore the fragment (or fragments) of distribution network drawn in the plan views with the use of shadow components should remain unconnected to the remaining part of the

installation (which in fact may be shown incomplete in these plan views), as these components are provided as information for the plumbers only.

Assuming that originals of the components are included in the schematic views, mark all components placed in the view plans and select “Mark as shadows” from the “Component data” menu. These components will now be drawn with a broken line. Later the shadows will be associated with the originals.

! The lengths of pipe-runs which form connection lines in the plan views are extended to connect to the receptors and heaters.

2.4.5. Opening and editing a schematic view sheet of the system

To create a schematic view sheet select “Worksheets” in the “File” menu and click on the “New” button, select sheet type (“Schematic view” in this case) and click “OK” and then “Close”. The new sheet becomes the current sheet. This sheet should also include the base plan for schematic view. For a flat schematic view, such base plan will be the cross-section through the building ceilings. Select the “Construction” tab in the lower set of project edition scopes tabs – project layers. To create a cross section of

the floors select “Floor elevation label”  from the upper toolbar in the “Components” tab, move to the drawing area and insert the object against the background of which the schematic view will be drawn. To modify this object, for instance, make it longer, click on the floor arrangement area – an olive green frame appears. Move the mouse pointer above the right-hand edge of the frame where there is a small square of the same colour as the frame – the mouse pointer takes on the shape of an arrow. Press and hold the left mouse button and drag the frame to the right and, if necessary, up. Upon releasing the mouse button the floor arrangement is extended. In similar way you can extend this component in upper direction, increasing the number of visible floors.

To add another cross section of the floors in another arrangement (shifted by 1/2 of a storey height – in case of mezzanine radiators), select the “Floor elevation label” again and place it beside an existing component, then in the data table of that component enter elevation of the first storey other than in the neighbouring floor arrangement.

Go to the Installation edition scope and plan the relative arrangement of risers and the main supply point – the source.

In practice it is best to create and copy typical risers, taking advantage of their repeatability and then to insert the source and connect it to the risers by means of a distribution network. There is a button in the toolbar that enables drawing a pair of pipe-runs simultaneously, which facilitates creation of a schematic view of a distribution network. Then radiators placed in unusual points, connected directly to the distribution network, for instance, can be inserted. The ORTO mode (activated by clicking ORTO in the lower right corner of the screen) facilitates creation of a 2D schematic view in most cases.

Switching the AUTO mode facilitates connecting the components. The ORTO mode can be temporarily switched on by pressing the **Ctrl** key and the AUTO mode pressing the Shift key.

After having drawn the entire schematic view it is a good idea to make a fast check of connections by pressing the **Shift+F2** key combination. If erroneous or

missing connections occur then a list of unconnected components, components forming a loop and components with undefined direction of flow is displayed.

The principal receptors are water supply valves and faucets. As there are many types of valves and faucets available, the placing and specification of a receptor is done in principle in three steps:

- selecting a symbol in the “Receptors” tab and placing it on the drawing
- specifying the drawing type of the valve or faucet in the data table by selecting it from a list; this selection does not affect calculation parameters
- specifying calculation parameters of the receptor by selecting appropriate item from the list in the data table, under the item “Water outlet point”

It is also useful to create and use system component + water receptor typical pairs in the schematic view as described in section 2.4.4.

! Always check that the default type of water outlet point corresponds to the planned use of that point.

Receptors are connected to sources by means of pipe-runs. Symbols are available that enable placing two parallel pipe-runs simultaneously. This is of advantage, when the receptor is a hot and cold water faucet. There is a separate pipe-run symbol for circulation pipe-runs. These pipe-runs are connected to the appropriate outlet in the source or heater on one end, and to appropriate point of hot water pipe-runs on the opposite end. Thus points are created that define the circulation of utility hot water. It is also possible to arrange three parallel pipe-runs simultaneously (cold water, hot water and circulation). This is of advantage when drawing riser systems and connection lines with circulation.

The source is the main point of supply in the system. If cold water is supplied to the building not in the same place as hot water, you can use two sources. However, each of them should be configured in a different way. Water heater forms a transition between cold water system and hot water system. It can also be connected to a circulation system. However, the heater cannot form a cold water source.

2.4.6. Associating terminals and pipe-runs in plan views – as shadows – with the schematic view

To associate shadows with originals, select “Associate original-shadow pairs” in the “Component data” menu. Two windows for editing are opened in which separate sheets may be selected for further operations. By default the current sheet is opened in the left window.

Open the schematic view sheet in one of the windows and the plan view with the shadows in the other window. Not assigned components shadows are marked with grey colour and drawn with broken line.

Now mark a component “shadow” in one window by clicking on it and mark the corresponding component “original” in the second window in the same manner and click on the “Link” button to effect an association. After performed calculations, results will be assigned to appropriate component “shadow” from its original.

! While associating the original-shadow pairs in the program, data from component “shadow” are not transferred to the component “original”, but the original calculations results are transferred to their shadows.

Navigation capabilities of the windows used for indicating components are similar to those of the main editing window: zooming in and out, grabber hand for moving the view.

Revoking an association is done by clicking on the shadow component and selecting from the main menu “Components data” / “Unmark as shadow”. This way the association of components (pairs original – shadow) is cancelled and the selected components is not a shadow anymore. To turn the component into shadow again, select it and select from menu “Components data” – “Deselect selected as shadows”. This also can be done in original – shadow pairs linking window.

2.4.7. Appending component data and specifying component types

After creating the diagram of the system and placing fittings on the pipe-runs you have to provide the information which the program cannot read from the drawing. Such information includes:

- pipe-run lengths (only lengths of vertical pipe-runs are read from the drawing – this can be changed in the “Options” – “Project options/General data” – “Edit” item)
- pipe types for pipe-runs if other than “default type” specified in the general data
- for pipe systems with various pipe fitting sets the appropriateness of the default system must be checked (“Cat. and connection type” field)
- insulation type for pipe-runs to be insulated
- types of valves on pipe-runs or data for calculating flow resistance across these valves
- type of water outlet point for faucets and taps (default values are adapted, these however may be inappropriate)
- receptor connection system selected from a list which depends on the pipe catalogue used.

Appending data is not necessary in many cases as long as the default values have been specified and as long as these values are appropriate.

Component data are described in detail in section 6.5.

! Many data and values are derived automatically from the drawing or determined from other data. Such values are placed in brackets. You can overwrite these values. To revert to the default value (determined automatically) enter a question mark (?) in the appropriate field and press “Enter”.

Component data are appended in a table displayed on the right side of the screen. The contents of the table change depend on the type of component marked. Marking the component is done by clicking it in the drawing. The marked component is drawn with thicker lines (receptor is filled with colour) and a message indicating the type and number of components marked is displayed. Similar information is displayed in the data table header.

! Data can only be appended for original components

! Fitting component data form part of principal component (pipe-run) data table

The data is entered directly in the form of numerical values or text strings or is selected from lists. In some fields the entered value is specified after opening an auxiliary window with additional auxiliary edit fields or lists. Detailed description of field types is given in further sections of this manual.

To speed up working with the project it is advantageous to enter data for many components of the same type at the same time. There are several methods of marking multiple components:

- marking subsequent components by clicking on them while holding the **Shift** key
- selecting the “Select all components of type ...” function in the “Edit” menu and specifying the required components
- selecting the “Select in rectangle components of type ...” function in the “Edit” menu and specifying the required components and then marking a rectangular area in the drawing.

Search criteria may be defined by the user.

2.5. Diagnostics and calculations

2.5.1. Launching diagnostics and calculations

Calculations are launched by pressing the **F10** function key or by clicking on the calculator button. First a diagnostic run is done in which possible errors that make calculations impossible can be detected or after which a list of warnings and hints is displayed. If the messages displayed do not indicate the occurrence of any errors in data, calculations may be continued. Click on the calculator and “Next” button in the message list window. Now the calculation options should be specified.

If errors occur, or if you want to eliminate the causes of warnings, you have to go back to editing by clicking on the “Back” button. After reverting to the editor the list of errors and warnings is displayed in a separate window. This window can be displayed by pressing F8 function key. After clicking on a component in the list the object to which the message applies is marked in the drawing, which facilitates finding and correcting the right data. Some error types, e.g. those that apply to the interpretation of connections, cannot be assigned to the component that caused the error (as such component cannot be indicated explicitly) and can, for instance, be assigned to a source in the area where the error has occurred.

In case of messages that occur many times (for many similar components) the correcting of the data usually consists in entering (or changing) the same data for all these components. In such case it is best to click the right mouse button on any of the recurrent messages and selecting “Mark all components where this error occurred” from the pop-up menu. Then you will be able to enter into the data table the value, which will be entered or modified for all components with the given error.

2.5.2. Calculation options

If no messages are displayed after the diagnostic run, then after pressing the **F10** key the tabs with the list of calculation options and results are displayed. On the left-hand side of the screen is a list of grouped calculation options.

These options are assigned to individual pipe catalogues used in the program and include – for various types and locations of pipe-runs in the project – the values of:

- minimum inner diameter of pipe for diameter sizing,
- maximum water velocity, which is the main criterion for sizing diameters of cold and hot water pipe-runs. If the catalogue specifies different velocities for the various diameters (steel pipes, copper pipes), then an average value is given,
- maximum friction (for circulation pipe-runs only),
- minimum water velocity in pipe-runs.

If the project was calculated before and there is a need to size pipe diameters again, e.g. after changing calculation options, check the “Resize diameters” box.

If user-specified diameters are to be retained during resizing, check the “Retain user specified diameters” box. The pipe diameters specified in the editor will be retained during resizing.

Checking the “Adjust hot/cold diameters” box will cause the program to increase (when possible) the diameters of pipe-runs to lower pressure losses in the installation and adjust the pressure in the installation to the available pressure specified by the user.

Checking the “Skip to pipe successors” box enables selecting other type of pipes than the one originally indicated, should sizing of the latter prove impracticable.

Checking the “Skip to pipe fitting successors” box enables selecting other type of pipe fittings than the one originally indicated, should sizing of the latter prove impracticable.

The next item of the list includes options that constitute data for flow calculations and data for determining circulation flows in the system (for heat calculations).

The last item in the list includes result-editing options. They are used to open or close some types of result tables and to enable or disable generating bills of materials.

! In the case of very large files (with more than 2000 pipe-runs) disabling the generation of a list of components on a pipe-run speeds up calculations. This option can be enabled before final calculations if the list is required for detailed analysis of results.

After selecting the “Results” tab the calculations are completed and results are displayed in tables.

A detailed description of calculations is given in section 7.4.

It is also possible to carry out “fast” calculations by pressing the “calculations (fast)” button (calculator and lightning symbol on the “Program” tab) (Shift+F10 keys). The calculations are then carried out without pausing on result tables. “Fast” calculations are recommended when when a full calculation (F10 key) of the project was done before. This feature may be used when you make some alterations to a calculated project and want to see the effects of these alterations on calculation results.

The following hierarchy of messages has been adopted:

Errors – displayed in capital letters. Indicate deficiencies or incorrectness of data that have to be rectified before making calculations. If any error has occurred, calculations cannot be continued – you have to go back to editing and correct the error.

Warnings – issued if a presumable incorrectness is encountered. Warnings do not exclude making calculations. Nevertheless it is advisable to check them and ensure that there is no incorrectness.

Hints – messages of the least significance. They draw your attention to some data, which, however, may be correct (as intended by the user).

Connections – these are warning type messages that can be displayed after calculations. They apply to automatic sizing of component connections in the installation and occur when a connection or node has not been sized.

After having analysed diagnostics results, you can go back to the editor to amend data or proceed further with calculations if there are no errors.

A detailed description of diagnostics is given in section 7.3, and description of diagnostic messages in Annex B.

2.5.3. Analysis of complete results and project printout

All calculation results are given in tables: “General results”, “Pipe-runs”, “Rooms”, “Terminal units”, “Routes, circuits” and, depending on the selected result options, also in tables “Bills of materials” and “Component list”.

The table of pipe-runs also provides information on valves and pumps and manifolds assigned to pipe-runs.

The bill of materials is split into several parts. The contents of the tables may be specified (you may hide some columns). You can also look for components that meet defined conditions, e.g. pipe-runs of specified number, with medium velocity exceeding a set value, with water temperature drop higher than set, etc. Detailed description of tables of results and associated functions is given in further sections of this manual.

After clicking on the “Print” button, print preview is displayed with a window enabling convenient configuration of the scope and style of printout. To switch the print preview to another table of results, select the “Layout” tab in the control window and select the required layout. You can create your own layout.

Upon completing the printout go back to the results by clicking on the “End” button.

To go back to the graphical editor click on the “Editor” button in the upper part of the screen. In the graphical editor the results are:

- automatically displayed in the drawing, e.g. radiator and valve sizes (within the scope defined in appearance configuration),
- displayed in the drawing after adding additional graphical components (e.g. pipe-run diameters, flow rates in pipe-runs and some other results for pipe-runs after placing “Pipe-run label” component).

To display sized diameters of pipes in the drawing you have to place “Pipe-run label” components from the “Graphics” tab on the pipe-runs. This component can be configured to display various results, e.g. pipe-run diameter, flow rate, insulation

thickness. A configured pipe-run label can be saved to the user toolbar (see “Append to toolbar” function) for further use.

Other graphical components can be added to the drawing, e.g. a project chart. Such a chart can be configured in a broad range, and it can also be copied to the toolbar for further use.

Checking partial results of individual components of the system is possible with “bubbles”. When you position the mouse pointer over a component, a bubble appears with results of that component. When you position the mouse pointer over a junction (connection point of pipe-runs) the bubble displays information on the manner of implementing that junction using components available in catalogues.

Instead of printing on a printer or a plotter, you can export drawings into graphical files, including CAD type files. To do this use the “File / Export drawing...” command and select one of the available formats.

In the graphical editor you can also view the results in tabular form. To do this press the **F11** function key or click on the “Calculation results” button in the “Program” toolbar.

To print tables select the appropriate item in the pop-up menu after clicking the right mouse button within the table.

Some tables include a  (torch) icon. Clicking on this icon results in the indication in the drawing of the component to which the row in the table with the icon applies. Finding a component the other way round (in the table) is available by selecting appropriate command from the pop-up menu that appears upon right clicking the component in the drawing. If the table currently displayed does not include results of the component indicated in the drawing, the appropriate table is displayed.

Drawing printouts are configured in the “Printout” tab selected from among the tabs in the lower right part of the screen.