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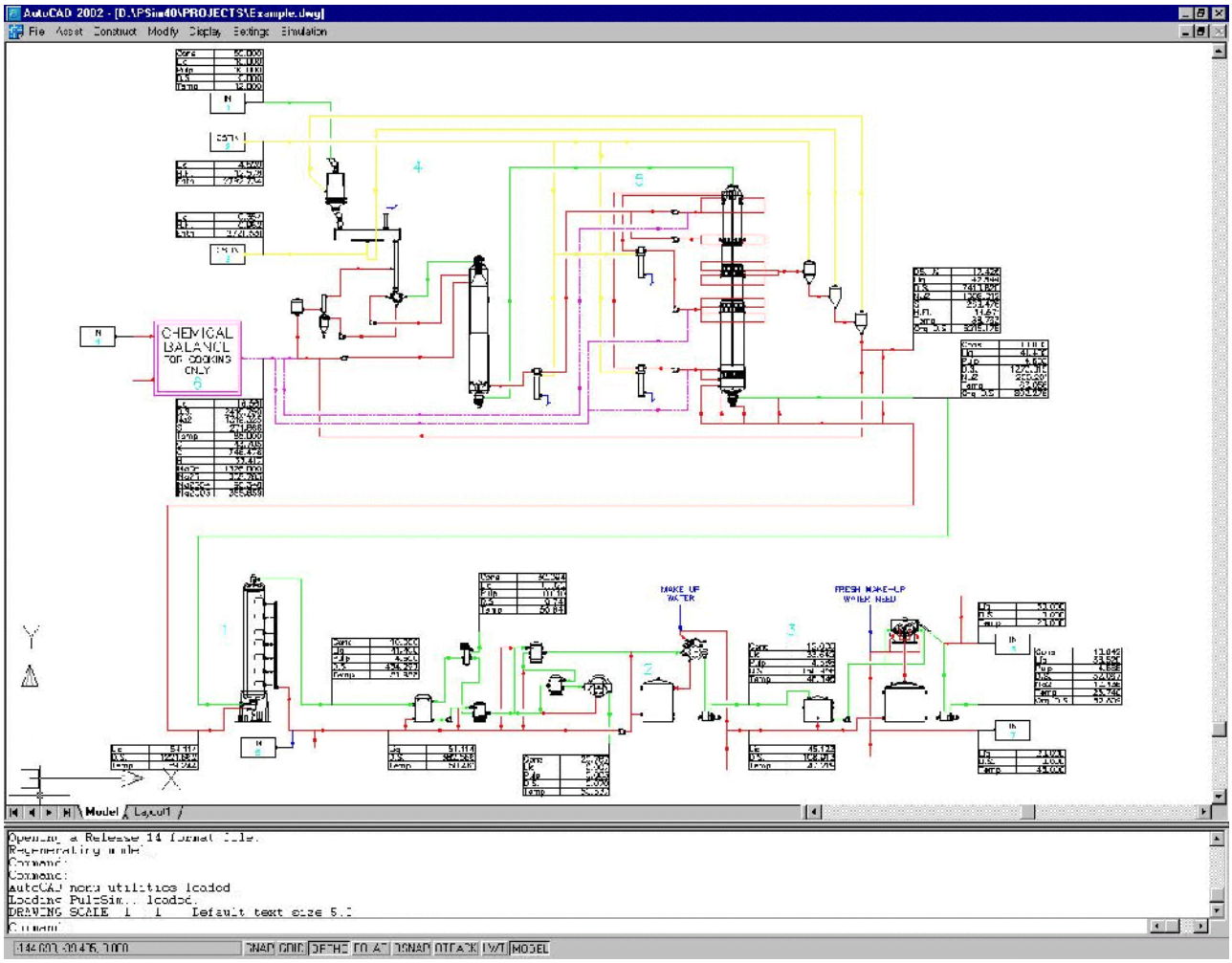

PulpSim 4.x Manual

for AutoCad 14.01, 2000, 2000i and 2002

25 November 2004

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The PulpSim design package is a specified purpose Computer-Aided Design/Drafting /Calculation application for Pentium system computers running Win95, Win98, Windows NT4.0, Windows 2000 or Windows XP with AutoCAD® release 14.01, 2000, 2000i or 2002. It is aimed to calculate pulp mill mass and heat flow balances and draw corresponding flow sheets with help of the AutoCAD interface. PulpSim provides a set of equipment (*module's=block* combinations with corresponding layout figures and single *blocks*) for constructing a pulp mill. *Modules* are simply a set of *blocks* tied to a layout drawing. *Blocks* perform unit operations, like splitting one flow to two flows, with specified parameters. PulpSim also gives the freedom of making our own *set of blocks*, which makes easy to build and examine new processes that don't exist in the program. Making a new module needs many new files to PulpSim, so our policy is that we produce the module you need on the bases of your information. The information needed deals with processes and the real outlooks of the equipment used in the module.

Equipment, which are modules or single blocks, have so-called connection points. These points are marked on the display as small circles with a cross. All materials, in or out, to and from equipment, flow via these connection points. No equipment must be left without connection to an inflow connection point, otherwise the calculation cannot be completed, because of the missing information.

For accurate heat recovery calculations, PulpSim has an optional so-called POWER MODE. The Power mode is a separate program called PROSIM using the same interface. PulpSim produces input information direct to PROSIM via some information files. More about it in it's separate manual.

The expanded version of the PulpSim simulator is PulpSim 4.x. It facilitates estimation of pH values and transition metal concentrations based on Donnan equilibria in freely selected process steps. The basic system has been expanded with several new blocks and modules.

All recovery boiler and connected modules have been reconfigured to allow elegant calculation of sodium, potassium, chloride, sulfur dioxide and hydrochloric acid distributions around the boiler. New modules for chloride and potassium separation as well as an offgas scrubber module have been constructed. Dissolving tank and electrostatic precipitator modules have been renewed.

All new modules have been tested and verified.

Calculations of pH and metal concentrations are based on a system developed by the forest products chemistry laboratory of Helsinki University of Technology. Analytical data are combined into the PulpSim environment. The product development work was financed by TEKES (Technology development centre of Finland) and Arhippainen, Gullichsen & Co. We have now the worlds first process simulator for the forest products industry which is capable to accurately estimate both process flow pH and metal concentrations.

The outlooks of PulpSim depends on the platform it is on (AutoCad’s version). So example display figures might be different in this manual than on your screen even the function is the same.

System requirements for PulpSim
- x86 compatible processor
- Color video display (1024 × 768 or higher recommended)
- CD-ROM drive for initial installation only
- Mouse or other pointing device
- Internet connection (optional)
- Email address for the PulpSim user (optional)

Software needed for PulpSim
- Installed AutoCAD release 14.01, 2000, 2000i or 2002
- PulpSim setup CD and the preprogrammed hardware lock.

Installing PulpSim

FIGURE 2: The LPT dongle (Hasp).

Before the PulpSim software installation turn off our computer and all connected devices and insert the hardware lock, delivered with the PulpSim package, to a LPT or USB port. There is no matter into which port it is connected, if there is more than one port. PulpSim hardware lock has no effect on the printer or other devices connected to the same parallel port. It has no effect on your other programs.

FIGURE 3: The USB token (Hasp).

Caution! : Don't connect the hardware lock to a serial port.

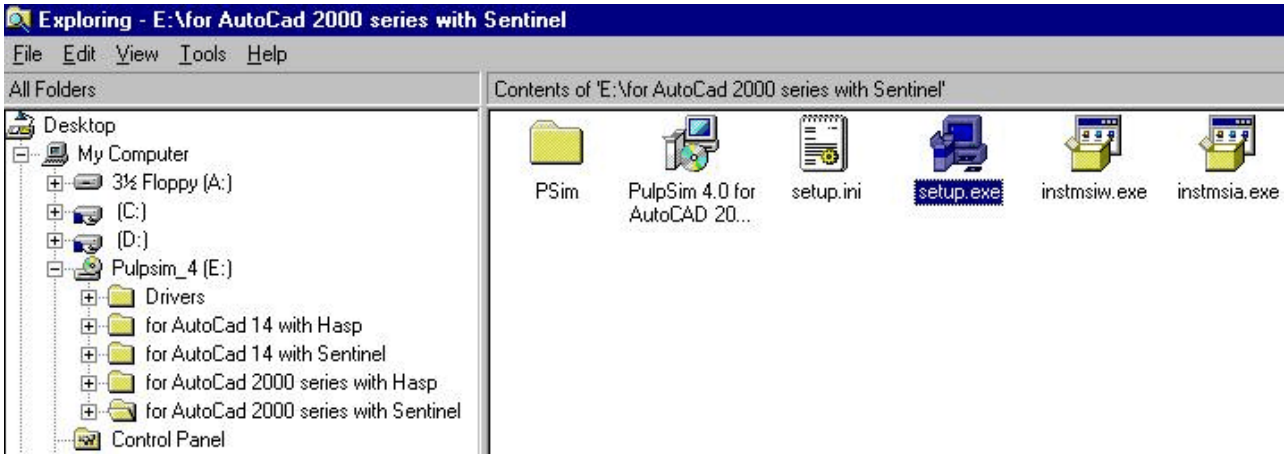


FIGURE 4: Selecting the directory and choosing the right setup.exe

The new Setup program called InstallShield, makes the installation easy. The CD may have several directories for different AutoCad versions. Close all your open applications and run [CD drive]**:\...\Setup.exe** from the CD disk. The setup program prepares a wizard where can be chosen which kind of PulpSim installation wanted. It also checks the type and version of the AutoCAD. The AutoCAD can be a network application, but choose the local drive for PulpSim. Proceed by following

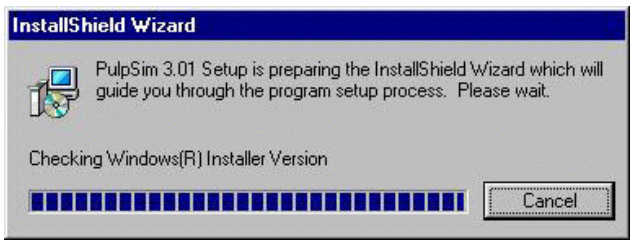


FIGURE 5: Running PulpSim Setup

the instructions. If the recommended Complete Setup is chosen, everything on CD will be installed. The Custom Setup has a better control on what and where to install. When the wizard is asking the folder's name of the install, choose the suggested [drive:]\PSIM or change the drive- or the directory name. If the setup has found a previous version of PulpSim the default is its. If you have several hard disks, Install PulpSim to the volume that has most space available. The requirements of disk space needed is shown before the installation.
When completed you should find a PulpSim icon on desktop and listed on Add/Remove Programs in Control Panel.

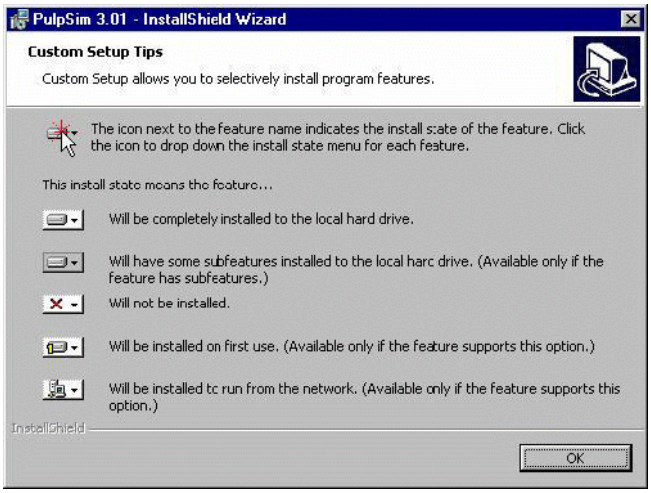


FIGURE 6: Custom Setup Tips

The installation can be Modified, Repaired or Removed by running Setup again and choosing from Program Maintenance in Custom Setup.

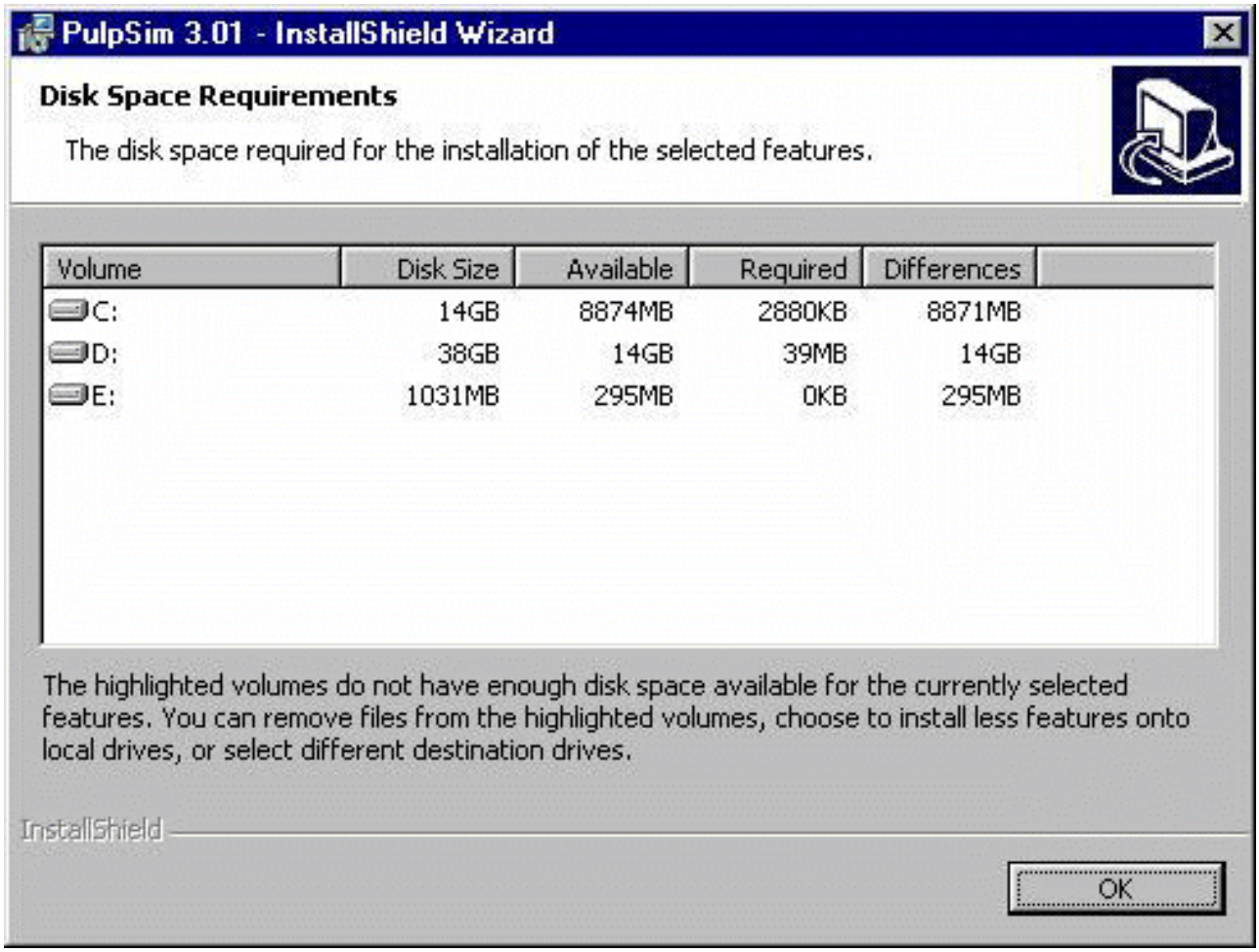
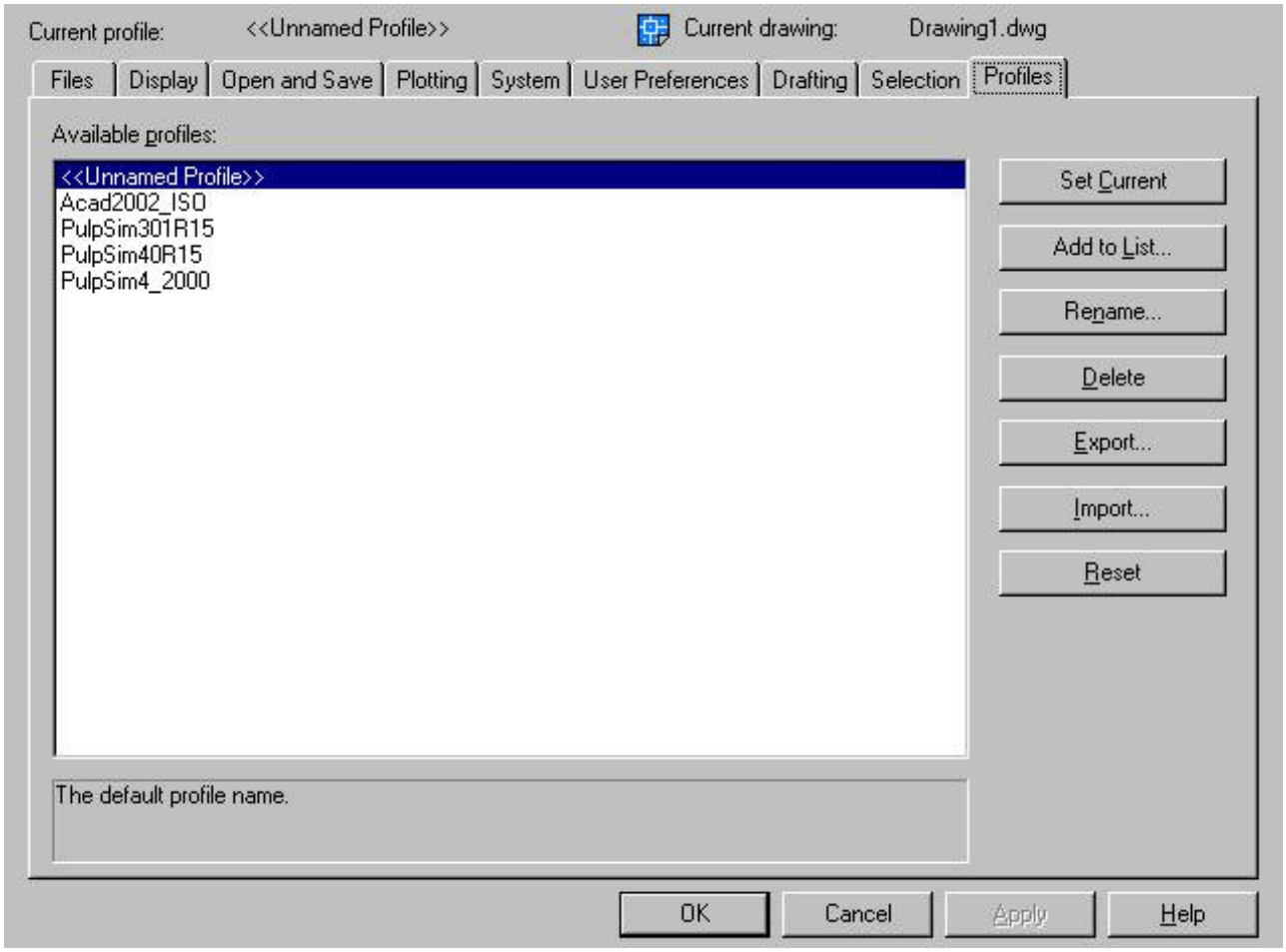


FIGURE 7: Disk space required

Important: If you have **earlier** made an **installation of PulpSim** in a different directory, **remove the Profile** via AutoCad's Tools Options before the new installation. This is true even the PulSim program has been removed because the removal of the program does not change the registers produced by the first PulpSim installation. You can, **even we advise not to** have both PulpSim versions in the same PC if you install the later version to another directory. The different PulpSim versions have

different profile file names as seen in the figure. R15 in the profile name points to AutoCad versions 2000, 2000i and 2002. You may want to add the normal AutoCad profile to AutoCad's shortcut to avoid PulpSim options to be loaded. Check that the target field of AutoCad's shortcut is:
"C:\program files\AutoCAD 2002\acad.exe" /P "<<Unnamed Profile>>"
that prevents the last used PulpSim menu to be loaded when normal AutoCad is to be used.



Besides the Setup the installation CD also contains some example simulation drawings, this manual and Block Help in Adobe Acrobat (PDF) format and the driver files for the dongles (Sentinel and Hasp).

When the installation is ready there is a PulpSim program group and an icon on the desktop. Start PulpSim and open one of the example drawings found in the default PSIM\PROJECTS directory. Calculate it to make sure that the hardware lock is working. The hardware lock prevents only the calculations made with PulpSim not the construction of the simulation.

FIGURE 9: The Pulpsim Icon

A block is the place where the unit operation happens. The type of the block determines which kind of calculations are made. The block type also specifies how many flows are incoming and how many are outgoing. The maximum of outgoing flows from a block is two. That is why **the addresses in a simulation are defined by flow numbers, that are outgoing flows from a block**. If there is only one outgoing flow its address is the same that the block number has. If there are two outgoing flows the other flow number is the block number with a minus sign ahead.

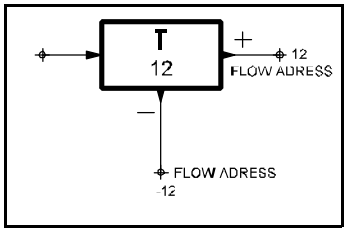


FIGURE 10: Thickener block

The numeric IN file has the information how the blocks are tied to each others and which are the parameters in each block.

The block type that defines the operation in that place in simulation is shown by a letter code in the upper center of a small box. In a calculated simulation also the block number appears into the lower center of the block box. The numbering of blocks is automatic, so you do not have to worry about it. All the block types and their properties are presented in PulpSim.

All incoming and outgoing flows have a so called connection points, that are points in the end of lines. All the incoming flows must have a numeric value, which happens when it is connected to an other block directly or with help of a process line.

The knowledge how the different block types work, is the basis of building a simulation. A brief declaration of a block type can be seen, when pressing Help button while inserting a block. It opens the \PULPSIM\BLOCK.HLP file from that specific area concerning the block type in question. There you can read the function of the block, which kind of block types or flows must be connected, the configuration and the parameter data needed.

Module

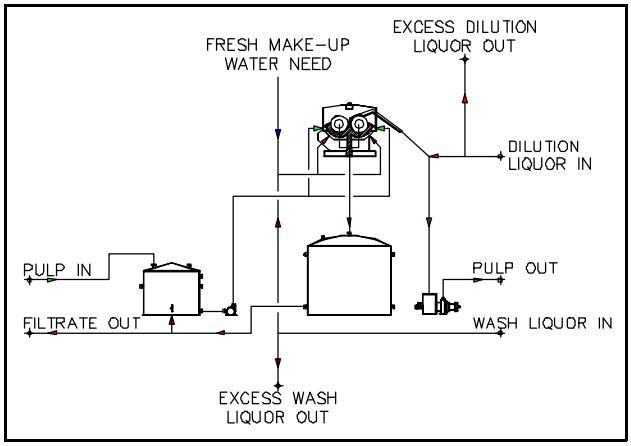


FIGURE 11: Equipment picture of the press wash module

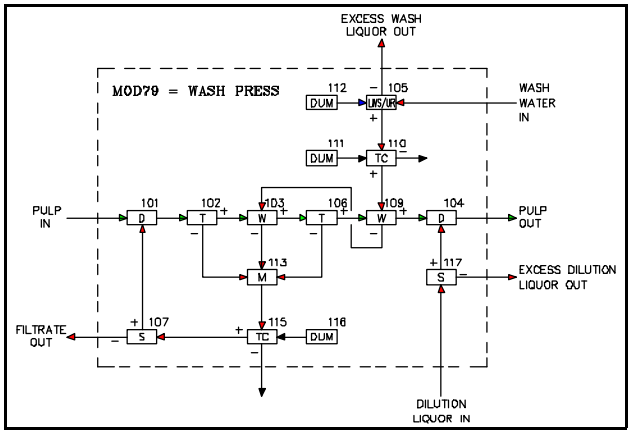


FIGURE 12: Matrix picture of the same module

A module is a predefined block combination. Its outlook is normally so descriptive that the user know its function. The numbering of flows inside a module is similar to blocks. The only exaction is the range, which is greater than thousand. In single blocks the range is from 1 to 999. Modules are also numbered and their appearance is shown with twice as large typefaces than blocks. This module order number defines the first digit(s) of flow numbers inside the module. The internal numbering and connections of blocks can be studied in

PulpSim from so called matrix of a module.

Building a new module requires some new files and editing some of the old ones. The user can build modules of his own with help of instructions later on in this manual. When building a new module the degree of changeable parameters is decided and locked. Because constructing new modules is not that easy we can provide special modules for your use with a separate agreement. If you want to build modules of your own you should contact us, that we can agree which area (module type numbers) are reserved for you. This way we can be sure that updates of the module libraries do not ruin your work and the simulations made by different users are interchangeable.

Using existing modules is far more easier than building the process from individual blocks. PulpSim has a quit large module library and we are building more all the time.

Important module notes

When inserting a module the Info button shows the names of ingoing and outgoing flow names. It also gives information if the module is suitable for the purpose. Some modules need certain other modules to be combined in a simulation. For example different types of continuous cooking are divided to two parts. First part having chip bin, 2 or 3 flashes and a possible pre-impregnation tower and the second part having different types of cooking towers. These modules are designed so that all necessary connection points hit each other so do not use process lines between continuous cooking modules.

White liquor to cooking must be imported through a special type of module. They can be found under the group named Chemical Recovery. These white liquor supplier and balance modules get some of their input parameter information directly from connection and that is why a normal input is not valid feeding white liquor to cooking or to oxygen delignification.

When using a recovery boiler in a simulation you must add the components found in file CHEMICAL.USC otherwise electrostatic precipitator does not work. By default there are only sixteen different components when you start a simulation, but reading the file CHEMICAL.USC adds the necessary components to the simulation.

In washer modules there are inside a so called internal conditional (dum) input, which is used when the wash amount alternate parameter is not zero and parameters are given as Dilution Factor, Weight Ratio or absolute Flow. This internal flow is so called MAKE-UP WATER shown in results of a module. The value of a make-up water depends on the incoming wash liquor and the liquor needed to satisfy the criteria set to displacement. Give notice, that make-up water is pure water, because temperature is the only component that can given. If the incoming wash liquor is greater than needed in displacement, the extra wash liquor is a so called EXCESS WASH LIQUOR, also found in results of a module.

1. Start PulpSim by double clicking its icon.

   This command does the necessary commands and sets the variables for proper use of PulpSim. PulpSim loads and the graphics screen appears. You can begin work right away after loading is completed (command line appears) and start to construct your pulp mill. To edit an existing drawing, you can use the **open** command with keyboard or select ***Open*** from the ***File*** pull-down menu. The **File** menu contains several other file management options as well.

2. Move the cursor to the left top of the screen. Select the **File** menu, then select the **Open** item.

   The **Select File** dialogue box appears.

3. From the ***Projects*** folder (directory) choose a drawing.

   In a moment, it appears on the screen.

4. Go to the File menu and select the **Save As...** item.

   The **Save Drawing As** dialogue box appears. Type a different name if you want to keep the original drawing untouched. PulpSim creates a copy of the *original.**DWG*** with the name you entered, and makes this copy the current drawing. The *original.**DWG*** is retained in the ***Projects*** folder.

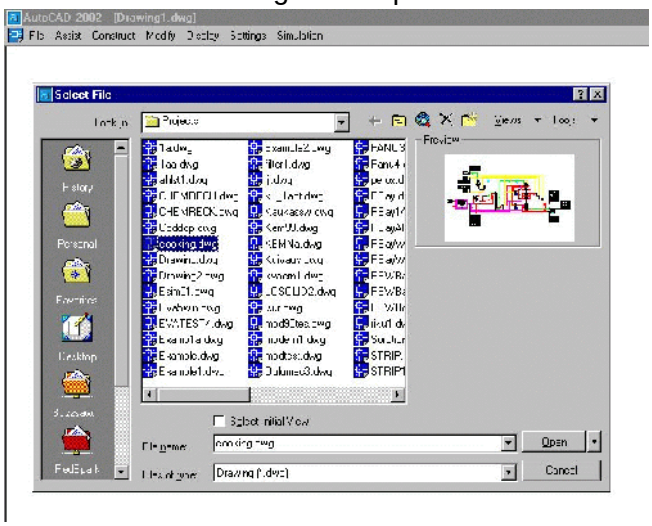


FIGURE 13: File Selecting

Important: Do not name any PulpSim drawing name or directory name longer than 8 marks to make sure to find the result files after calculation.

Command Line

Even you normally do not give PulpSim commands from keyboard through the Command line, it is always available. All standard AutoCAD commands can be executed through the Command line. The command line is a text area at the bottom of the screen. The text area can be sized by dragging it with the mouse.

Many commands present a default value, which is the last setting entered for that command, as shown in this example:

Command: **snap**
Specify snap spacing or [ON/OFF/Aspect/Rotate/Style/Type] <4.00>: Press **5**

Here, the last snap setting was 4.00, which is the PulpSim's default. The equipment drawings are designed suitable for this snap value. Do not change it in the PulpSim.

Some commands display dialogue boxes. For example, the dialogue box version of the LAYER

command is the DDLMODES command. Most of the time, the dialogue box version performs the same functions as its command line equivalent, though sometimes there are differences. A dialogue box command may have additional features, that command line equivalent do not have.

Usually, you can invoke a command while you are using another command. The command you invoke is called a *transparent* command. Suppose you are drawing a line, and you want to draw its endpoint outside the present display you can invoke the PAN command transparently. After you complete the transparent command, the original resumes and you can give the endpoint to your LINE command.

At the command prompt you can press the space bar or **5** to repeat the previous command. (You can also use your pointing device, depending on how many buttons there are in your pointing device). For example with a Microsoft mouse having two buttons, you could give **5** by pressing the right button.
The command line also displays prompts and important messages. If your computer uses a single-screen configuration, some commands replace the entire graphics area with a text window.

Pull-down Menus and Dialogue Boxes

At the top of the screen is the menu bar. It contains a row of menu titles. If a menu title has an arrow to right, it has a cascading submenu. Also, often the pull-down menu items display dialogue boxes instead of command line prompts. **The most efficient way to work with PulpSim is through pull-down menus. Most of the commands there are produced by AutoLISP language and have dialogue boxes. These PulpSim special commands made with AutoLISP cannot be executed from the keyboard like normal commands.**

Do the following:

1. Move the pointer to the **Construct** menu and press the pick button.

2. The Construct menu appears.

3. Select the **Insert Equipment** command and you get the **Equipment Selection** dialogue box.

4. Pick one **Equipment Group** and **Select Equipment** from the list and you'll see the corresponding layout drawing in the dialogue window.

5. When satisfied pick OK.

6. After insertion the **Edit Parameters** dialogue box will open. If you wish to change any of the default parameter values, move the cursor to the edit box and rewrite it. Note that **the decimal separator in PulpSim is always the point**, not the comma. PulpSim does not tolerate empty spaces in parameters.

When you are familiar with the different parts of the screen and menus, go to the **File** menu and choose **End**.

A dialogue box lets you know that the current drawing has been modified, and asks if you want to save your changes before leaving. Pick discard changes.

You'll exit from your copy of *Simu1.DWG* without any changes, and return to the operating system level.

When PulpSim started the empty drawing file has the default name of PSIM\PROJECTS\DRAWING1.DWG. The basis of this empty drawing is Pulpsim.dwt, that must not be modified or renamed. Opening from the pull-down menu ***File*** and choosing ***New***, will prompt asking the template filename. **Use the default template** drawing. It determines some properties necessary for PulpSim.

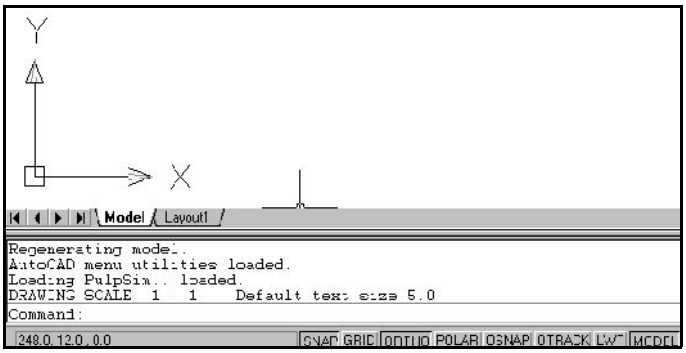


FIGURE 14: Empty PulpSim drawing loaded.

You can create several subdirectories for simulation drawings. Do not name these subdirectories with more than 8 marks to make sure all result files are found after calculation.

Equipment

Open the pull-down menu ***Construct*** and select ***Equipment***. The dialogue box, where are the equipment groups, appears on the screen. Select the group that contains the equipment you want and pick one from the list. Equipment can be a block or a module. A small box or a process line branch is

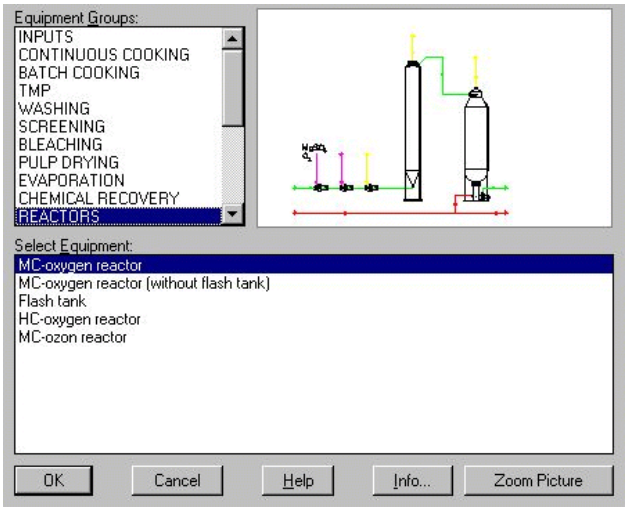


FIGURE 15: Insert Equipment dialogue box

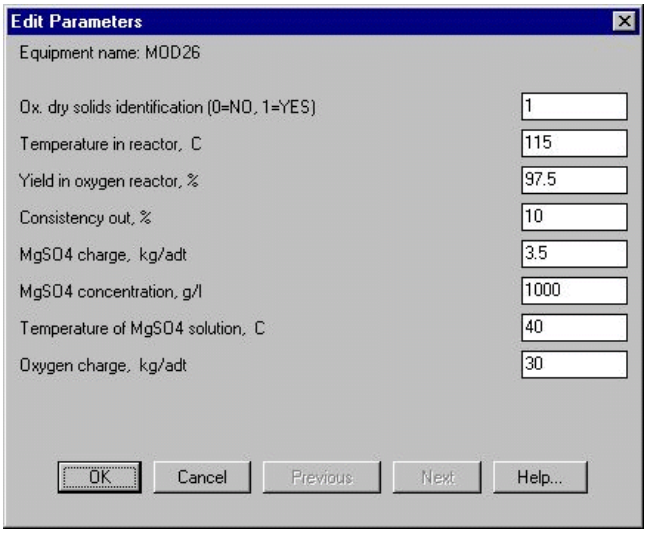


FIGURE 16: Edit Parameters dialogue box

a block and a equipment figure or a big box is a module. All equipment in INPUTS and Unit operations: are blocks. After numbering the small numbers represent block numbers and the big ones are module ordinary numbers. The *Help* button guides in this point if you don't know what to do. *Zoom picture* button shows a picture witch is bigger and there might be added more information about the equipment. More information of the equipment is presented by pressing the *Info* button. The block matrix picture can be seen if a module is the selected equipment.

Next the program will ask (in command line) the insertion point of the equipment. You can give it with the pointing device or from the keyboard. If the insertion point is given from the keyboard, it must be in the format x,y. The z-coordinate is omitted, because the drawings made by PulpSim are two-dimensional. The insertion point is mostly the ingoing main flow (pulp flow in fiber line). When the equipment is inserted in the drawing, the ***Edit parameters*** dialogue box, where the questions about the current equipment are, appears on the screen. The user can give new values for the variables in the

box. In the dialogue box there are the default values, which will be used in calculation, if the user does not change them.
Note, that the decimal separator is point not comma.
The equipment can be connected in two ways. It can be inserted so that its incoming connection flow point hits another connection outgoing flow point from another or same equipment. It is here it gets its inflow data. If the connection points of the two equipment do not meet each other, you must use a ***Process line*** between the points. The program checks the connection points when the equipment is inserted into the picture.
A piece of advice for beginners: connect only Equipment inputs, other equipment or other modules as an input to a module. These can be found without scrolling the Module Groups.
The usage of other single blocks is for more advanced users, who have studied the Block Help manual carefully. This Block Help is also available in PulpSim under Help button, when a block is selected. The printable version of it has the filename PSim\Manual\Blockhelp.pdf.

Process line

Open the pull-down menu ***Construct*** and select ***Process line***. The program will ask the starting point of the line. Pick one connection point and draw the process line segments simply by giving the points and finally pick the other connection point and complete the command with **5**. The program will check the success of process line connection. Picking order of endpoints of the process line, makes no difference. The outgoing line can be connected **only** into the ingoing line (into the same or into a different equipment). The lines, which are connected must be of **matching type**. That is why, the color of process line varies, depending the kind of flow in question. Process line for pulp is green. Steam line is yellow, liquor is red and chemicals are drawn with magenta.
For example the pulp line cannot be connected in a point where steam is needed. The program will check the correct connections of the process lines. When the whole flow sheet is drawn, the next step is calculation.

User sets

The pull-down command ***User sets***, gives you the possibility to save, delete and insert your own sets of blocks or modules. When you have selected the equipment that goes to a set, save it. Select a group or create a new, and name the set so it can be found later on. A brief description out of the set can typed. These saved sets go to \PSIM\PULPSIM\USRDAT directory and have the USC extension.

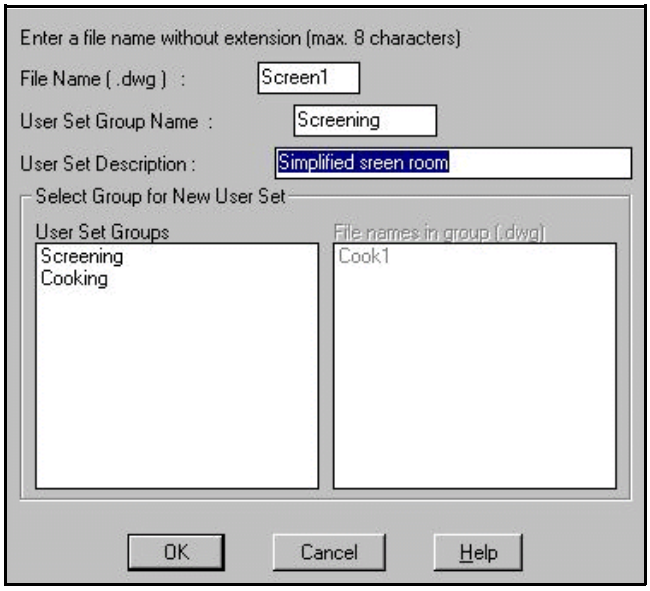


FIGURE 17: Saving a user set

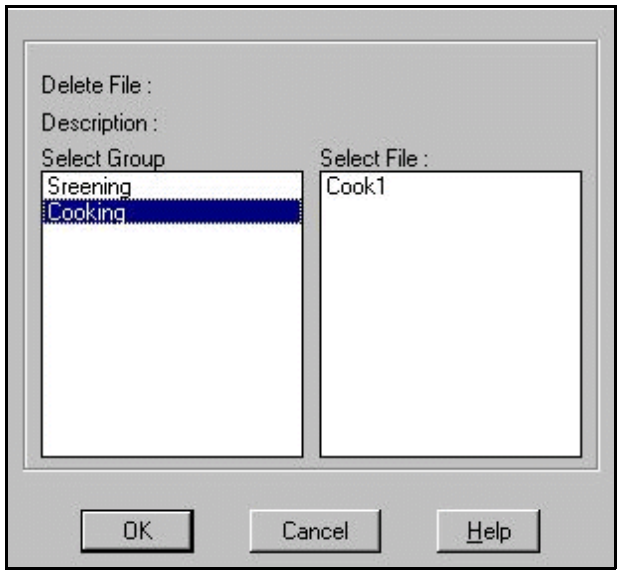


FIGURE 18: Deleting a user set

If you intend to use this saved set later leave the inputs out of the selection. This way you can insert

your set in the middle of a new flowsheet.

Note that the ***User set*** is not a real module even it has many of it's features.

To be able to make your own User sets out of individual blocks you must be familiar with the blocks. Information of single blocks, can be found picking the *Help* button in the Select module dialogue box, when one of the group Unit operations is selected. It opens you a ASCII file named \PSIM\PULPSIM\BLOCK.HLP that contains all block data information. This information can be printed out from the ..PSIM\Manual\Blockhelp.pdf file.

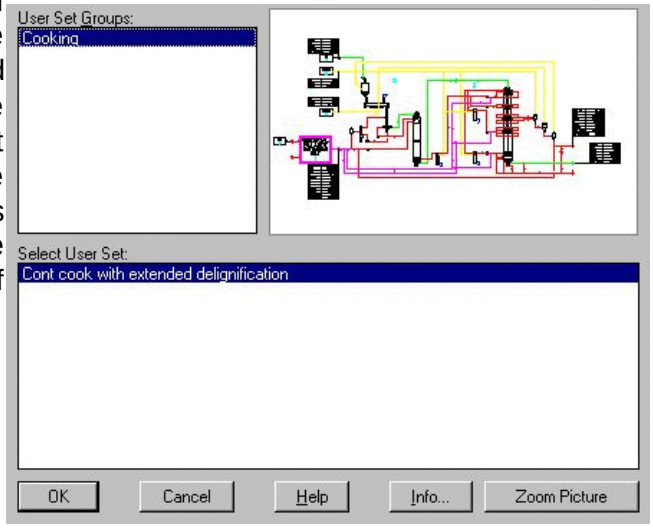


FIGURE 19: Selecting a User Set

A list of different block types in PulpSim. **(Bolded only in PulpSim 4.0 version** *and italic when different than in PulpSim 3.01*)

Unconditional input (IN - 101), more componets in PulpSim 4.0
Unconditional steam input (STIN - 102)
Mixer (M - 201)
Mix steam flows (MST - 202)
Splitter (S - 301)
Apparent splitter (AS - 302)
Soap removal (SOAP - 306)
Thickener (T - 401)
Lime mud thickener (TS - 402), earlier dry solids thickener (DST - 402)
New thickener (NTHICK - 403)
Diluter (D - 501)
Lime diluter (DS - 502), earlier dry solids diluter (DS - 502)
White liquor oxidizing (OXIDI - 503)
Washer model, old type (WOLD - 601)
Sorption and diffusion wash model (W - 602)
Hiheat washer (HIHE - 603)
Norden wash model (NORDW - 604)
Pulp reactor (PR - 701)
Recovery boiler (REC - 702)
Electrostatic precipitator (EP - 703)
Special pulp reactor (SPR - 705)
New recovery boiler (NREC - 706)
Smelt dissolving tank (SDT - 707)
New electrostatic precipitator (NEP - 708)
Chloride removal process (CRP - 709)
Flue gas scrubber (SCR - 710)
Acid reactor (AR - 711)
Direct heating with live steam (DSL - 801)
Direct heating with process/live steam (DSP - 802)
Condensate process steam with process flow (DCP/P - 803)
Condensate process steam with fresh water (DCF - 804)
Condensate process steam with process/fresh water (DCP - 805)
Cooking liquor preparation (CLPR - 806)
Indirect heating with live steam (ISL - 901)
Indirect heating with process/live steam (ISP - 902)
Condensate process steam with process flow ind (ICP/P - 903)
Condensate process steam with fresh water ind (ICF - 904)
Condensate process steam with process/fresh water ind (ICP - 905)
Heat or cool process flow with fresh water (IHEP - 906)
Heat or cool process flow with process/fresh water (IHEP - 907)
Chemical balance (CHEMBAL - 909)
Tall oil plant (TALL - 910)
Heat or cool process flow with process liquor (IHEP/P - 1001)
General temperature control and heat input/loss (TC - 1101)
Density control (DEN - 1105)
Causticization (CAUS - 1201)
Lime kiln (LIME - 1202)
Flash of process flow (F - 1301)
Evaporation unit, simple type (EVAP - 1404)

Component and compound splitter (CS - 1405)
Split a defined steam flow from a liquid process flow (SST/L - 1406)
Steam splitter (SST - 1407)
Supply unrestricted amount of steam to consumer (SS/UR-1501)
Supply unrestricted amount of liquor to consumer (LS/UR-1502)
Supply unrestricted amount of wash liq. to washer (LSW/UR-1503)
Supply restricted amount of wash liq. to washer (LSW/R-1504)
Input of sulphite cooking chemicals (SICH - 1603)
Input of craft cooking chemicals (KRCH - 1604)
Input of bleach chemicals (BLCH - 1605)
Dummy input (DUM - 1701)
Conditional steam input (CSTIN - 1702)
Control parameter in another block (CONT - 1803)
Heat generated in refiner (REFR - 1807)
Check of chemical demand (PSPC - 1808)
Black liquor properties (CBHV - 1809), hardwood parameter choice added in PulpSim 4.0
Bark properties (BARK - 1810)
Calculate pH of the stream (PH - 1811)

When using other blocks than given in INPUTS or Other equipment, make sure that the block type is suitable for the purpose. Some block types are suitable only for a restricted purpose and have predefined layout combinations. These predefined layouts can be checked out from Help when inserting the block.

Continuous Cooking Group I
Chipsteaming with 3 flash + impregnation
Chipsteaming with 3 flash + CC wash in impreg.
Chipsteaming with 2 flash + impregnation
Chipsteaming with 3 flash
Chipsteaming with 2 flash

Continuous Cooking Group II
Hydraulic digester with hiheat wash
Hydraulic digester with extended delign. and hiheat
Steam phase digester with hiheat wash
Steam phase digester with hiheat wash, no wash circ.
Steam phase digester with extended delign. and hiheat

Batch Cooking Group
Saw Dust Digester (Bauer) without wash
Batch Cooking without wash
Batch Digester with heat recovery
Super Batch Cooking with chip preheating
Super Batch Digester with soap removal

Washing Group
Press diffuser
One stage diffuser
Two stage diffuser
One stage filter, two wash waters
Drum displacer
Wash press
Belt wash
Two stage DD-washer
Sequential filter, two wash waters
Displacement mat washing, 3 wash waters
Norden wash

Screening Group
Screening unbleached, rejects out
Screening unbleached with refiner
Dilution tank
Knot washer
Screen
Rejects refiner

Bleaching Group
D/C-stage diffuser bleaching tower
E-stage diffuser bleaching tower
E-stage diffuser bleaching tower
Eo-stage diffuser bleaching tower
D-stage diffuser bleaching tower
Eop-stage diffuser bleaching tower
D/C-E-D-E-D stage filter bleaching
DC-Bleaching reactor (up flow)
DC-Bleaching reactor (down flow)
Bleaching stage with 2-stage diffuser

Evaporators Group
Evaporation 1
Evaporation 2
Evaporation 3
Evaporation 4
Evaporation plant
Stripper

Chemical Recovery Group
White liquor supplier for cooking only
White liquor supplier for oxygen stage only
White liquor chemical balance, for cooking only
White liq. chem. balance, for cooking and oxygen stage(s)
Recovery boiler
New recovery boiler (only PulpSim 4.0)
Smelt dissolving tank (PulpSim 4.0)
New electrostatic precipitator (PulpSim 4.0)
Chloride removal process (PulpSim 4.0)
Flue gas scrubber (only PulpSim 4.0)
Causticization
Green and white liquor clarifier
Grits out, Causticization
Dregs filter
Lime mud filter
Lime kiln
Tall oil plant with soap removal

Reactors Group
MC-oxygen reactor
MC-oxygen reactor (without flash tank)
Flash tank
HC-oxygen reactor
MC-ozon reactor

Tanks and Storages Group
Storage tower (LC-discharge)
Storage tower (MC-discharge)
Filtrate mixing tank
Splitter tank

Heat Exchangers Group
Liquid/liquid heat exchanger for process flows
Fresh steam/liquid heat exchanger for process flows
Process steam/liquid heat exchanger for process flows

The pull-down ***Simulation*** contains the tools, which are needed after the drawing is constructed. Before the input file for calculation can be constructed, must all equipment (modules and blocks) have a number. It will be done by selecting the ***Calculate*** button in the Calculation dialogue box. Be sure to have the *Regenerate numbering*, and *Make new infile* marked. The third option is *Use Sorption*. If it is marked, the default sorption constants are used. More about sorption later.
Regenerate numbering and ***Make infile*** commands without immediate calculation are also possible in this dialogue box.
The input and the output filename can be changed by the ***Change*** command in the same dialogue box. When new infile is made, it has actual parameters. The program will ask the names of input and output files. Usually the best choice is to use the option: ***Use drawing name as in/out file name***.
After picking ***Calculate*** in this dialogue box the program executes the connection checks and the actual calculations with a necessary amount of iterations and writes the output file. After this operation you have the simulation results.

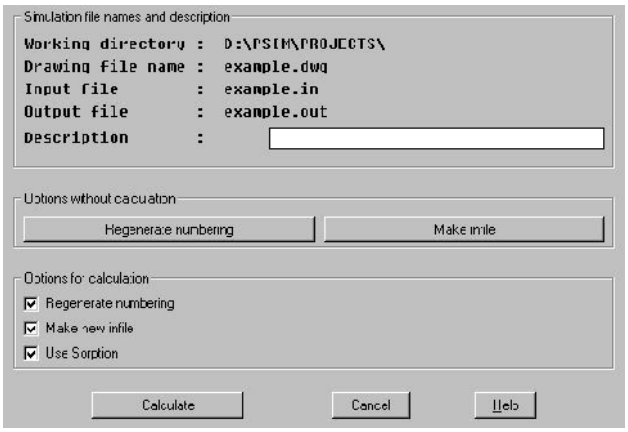


FIGURE 20: Calculation dialogue box

Results

From the Simulation results dialogue box you can choose which kind of information you need when calculation executed.

Write result box asks for the flow point and writes the results on the drawing in a box. The flow values to be written can be selected in the dialogue box. Scaling and rotation of the boxes can be also chosen from the same dialogue. Note, that you must ***Update result boxes*** after every calculation, in order to get right numbers in result boxes.

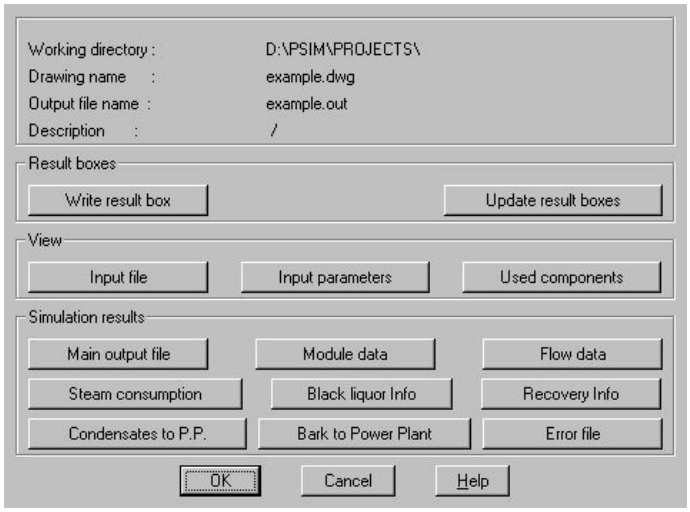


FIGURE 21: Results dialogue box.

Input file shows the input file. Editing of the file is not possible. Calculation can be done after the input file is constructed. Viewing the input file is a big help in error finding if your calculation has stopped because of lacking infile information. Usually there is a missing inflow somewhere in your flow sheet. This lacking flow is marked in the infile by #, which is non-valid character and results in calculation failure.

Main output file is an option where you can closely study all flows in ASCII format, but remember that flow units in this file are not always the same as seen on display.

Through the ***Input parameters*** you can study and edit the parameter values.

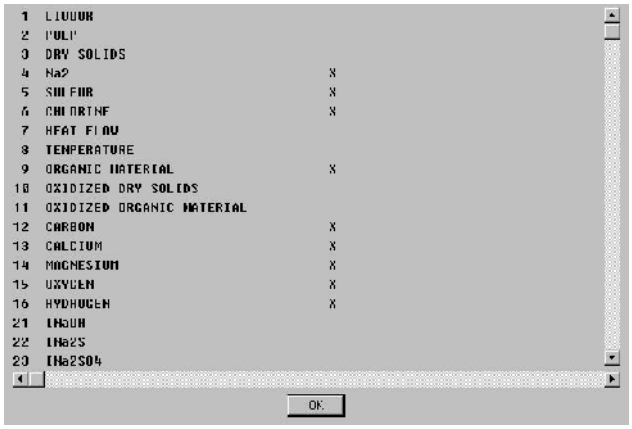


FIGURE 22: Used components.

Used components is a button where you can check the components used in present simulation. To add or remove components used, see ***User components*** in ***Settings***.

The ***Error file*** button gives you information about every component, if the total balance or balance around a single block does not satisfy the maximum error criteria.

Flow data is a command that shows a flow data only in a connection point. The command is the same as write results, with the exception, that it does not write the flow information on the drawing.

With the help of ***Module data*** you get essential information on modules. Notepad opens the specified

WASH PRESS
MODULE NUMBER: 6

EK-VALUE IN DISPLACEMENT ZONE	1.00
SORPTION CONSTANT ALTERNATE	1.00
PULP CONSISTENCY TO WASH PRESS	12.00 %
PULP CONSISTENCY AFTER DILUTION	4.00 %
PULP CONSISTENCY IN DISPLACEMENT ZONE	10.00 %
PULP CONSISTENCY IN PRESS	35.00 %
PULP CONSISTENCY FROM WASH PRESS	10.64 %
SODIUM LOSS (AS Na2SO4) FROM PRESS	6.32 kg/adt
DILUTION FACTOR	2.25 t/adt

*

	LIQUOR t/h	PULP bdt/h	DRY SOL. kg/h	Na kg/h	S kg/h	Cl kg/h	HEAT FLOW GJ/h	TEMP. øC
PULP FLOW TO WASH PRESS	33.64	4.59	160.95	32.26	7.46	.00	7.12	48.33
PULP FLOW FROM WASH PRESS	38.52	4.59	52.07	10.44	2.41	.00	4.49	26.74
WASH LIQUOR TO IN TO WASH PRESS	20.00	.00	.00	.00	.00	.00	3.77	45.00
WASH LIQUOR TO DISPLACEMENT	20.00	.00	.00	.00	.00	.00	3.77	45.00
EXCESS WASH LIQUOR OUT	.00	.00	.00	.00	.00	.00	.00	.00
MAKE-UP WATER NEED IN WASH PRESS	.00	.00	.00	.00	.00	.00	.00	.00
DILUTION LIQUOR IN TO WASH PRESS	30.00	.00	.00	.00	.00	.00	2.51	20.00
DILUTION LIQUOR NEEDED BEFORE MC-PUMP	30.00	.00	.00	.00	.00	.00	2.51	20.00
EXCESS DILUTION LIQUOR OUT	.00	.00	.00	.00	.00	.00	.00	20.00
FILTRATE FROM WASH PRESS	45.12	.00	108.90	21.83	5.05	.00	8.91	47.21

	T.ORG.DS kg/h	OX.DS kg/h	OX.ORG.DS kg/h	C kg/h	Ca kg/h	Mg kg/h	O kg/h	H kg/h
PULP FLOW TO WASH PRESS	101.42	.00	.00	1.20	.00	.00	17.86	.75
PULP FLOW FROM WASH PRESS	32.81	.00	.00	.39	.00	.00	5.78	.24
WASH LIQUOR TO IN TO WASH PRESS	.00	.00	.00	.00	.00	.00	.00	.00
WASH LIQUOR TO DISPLACEMENT	.00	.00	.00	.00	.00	.00	.00	.00
EXCESS WASH LIQUOR OUT	.00	.00	.00	.00	.00	.00	.00	.00
MAKE-UP WATER NEED IN WASH PRESS	.00	.00	.00	.00	.00	.00	.00	.00
DILUTION LIQUOR IN TO WASH PRESS	.00	.00	.00	.00	.00	.00	.00	.00
DILUTION LIQUOR NEEDED BEFORE MC-PUMP	.00	.00	.00	.00	.00	.00	.00	.00
EXCESS DILUTION LIQUOR OUT	.00	.00	.00	.00	.00	.00	.00	.00
FILTRATE FROM WASH PRESS	68.62	.00	.00	.81	.00	.00	12.08	.51

	INaOH kg/h	INa2S kg/h	INa2SO4 kg/h	INa2CO3 kg/h	ICaO kg/h	ICaCO3 kg/h	My Compon kg/h
PULP FLOW TO WASH PRESS	29.68	16.71	2.64	10.59	.00	.00	1.43
PULP FLOW FROM WASH PRESS	9.60	5.41	.86	3.42	.00	.00	.46

FIGURE 23: Example of Module data.

ASCII-text file, that is named <filename>.ext where ext is the module's ordinal number in the simulation. These files can also be printed out. For example if the simultion drawing has the name Mill3.dwg the mo

The module number is the big number found inside or nearby the corresponding equipment in the drawing.

The ***Steam consumption*** button opens a ASCII-file where all steam needed in simulation is collected

and summed up in different pressure/condensation temperature categories.

Bark to Power Plant, **Black liquor Info, Condensates to P.P.** and **Recovery Info** are information in separate ASCII formatted files, mainly for Prosim.

CHAPTER 6
Modifying and recalculating

Erase

Editing a drawing can be done same way as the constructing. The equipment can be erased using the PulpSim command ***Erase*** under pull-down ***Modify***.
If you want to add new equipment into the middle of a drawing move, erase or stretch existing equipment so that the new equipment have space enough. Then new equipment can be inserted into the drawing and the connections will be rebuilt.
Note that if you erase a module or a block you must also erase result boxes, their pointer lines and ***Process lines*** connected to those erased equipment.

Edit parameters

The parameters can be changed by the command ***Edit parameters*** which asks to select the object. After pointing an object in a block or in a module, it's parameters are shown in a dialogue box, where they can be edited. Note that the decimal separator is point not comma. If any changes in parameters have been made, the present results are no more valid before a new calculation.

Move

You can move all other objects except process lines. If there are process lines in selection when you move they will be erased and you have to draw them again.

Rotate and Mirror

These commands are mainly for turning blocks for better direction. Do not use the command with modules.

Stretch Process Line

Clicking here will produce a selection of commands that are not safe in PulpSim, but can be used to edit the drawing's outlook. Clicking again gives the original command selections.
Stretch command is helpful command if you have a process line between two pieces of equipment. By this command you can make more room between. After erasing the process lines connecting this equipment you can insert others.
Stretch does not erase the process lines and that is why it is more convenient than move.

Remove all Result Boxes

This command will erase all result boxes, their information and pointers.

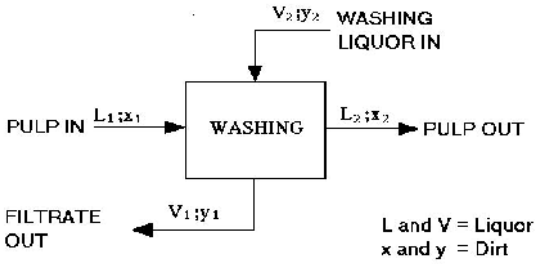


FIGURE 24: Washing components

The general value for washing efficiency can be put in formula on right:

The washing efficiency value in 10% output consistency has the previous formula:

where follows that:

PulpSim uses so-called Norden E-value (E_k=E when W=1).

It is an efficiency value for the washing zone only. The effect of dilution gives 0.3 - 0.8 higher values for washing efficiency. The relationships between these concepts are the following:

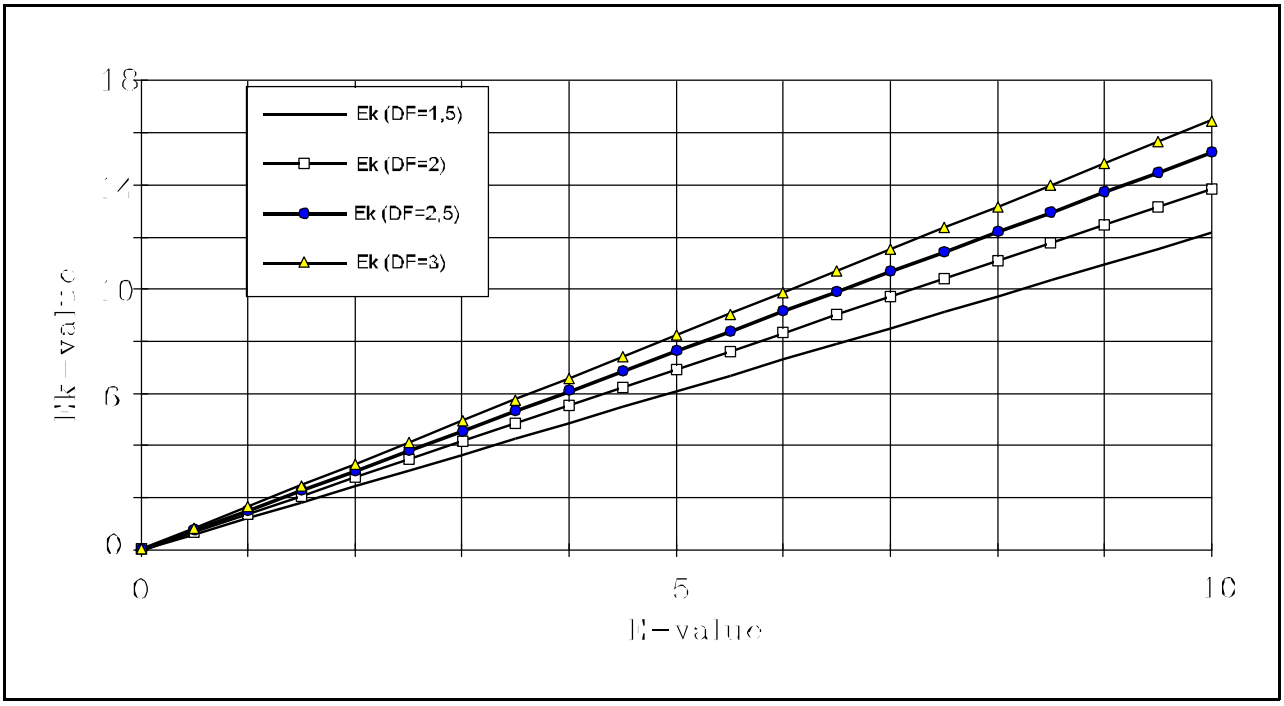


FIGURE 25: E_k-value vs. E-value

Washer Type	Consistency		E-value	E_{10}-Value	E_k *)
	In	Out			
Hi-heat 2-4 h	10	10	6,0-9,0	6,0-9,0	6,5-10,5
Pressure Diffuser	10	10	3,6-4,5	3,6-4,5	4,5
Diffuser 1-stage	10	10	3,4-4,0	3,4-4,0	4,5
Diffuser 2-stage	10	10	6,5-7,5	6,5-7,5	4,5+4,5
Wash Press	3-6	28-35	0,9-1,2	3,0-3,8	1,0-1,1
Pro Feed	3-4	12-14	3,0-3,5	3,5-4,5	
GF-Filter	1-3	12-16	2,0-3,0	2,5-3,5	2,0-2,5
Belt Washer, 3-stages					6,0
Belt Washer, 4-stages					8.0
LC-DD 4-stage, non fractional	3-5	12-16	10-13	12-15	11-14
LC-DD 3-stage, non fractional	3-5	12-16	8,0-10	9,0-11	8,5-10
MC-DD 2-stage, non fractional	8-10	12-16	6,0-8,0	7,0-9,0	7,0-8,0
MC-DD 1.5-stage, non fractional	8-10	12-16		5,0-6,0	
MC-DD 1-stage, non fractional	8-10	12-16		3,5-4,5	

*) E_k = Input parameter in PulpSim washer blocks = Corrected E-value for washing zone only when washing weight ratio (W =1).

Sorption constants

The sorption equilibrium used in PulpSim bases to Langmuir formula:

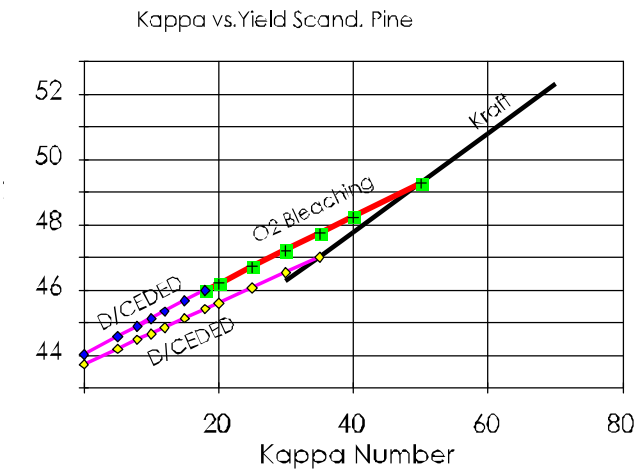
Where:
A = amount of dissolved substance that maximally can be sorbed to a fibre.
B = equilibrium constant between liquid and solid phase.
C = concentration in liquid.

By default the sorption constants are present. You can also eliminate the effects of sorption and diffusion by unmarking them in the Calculate dialogue box. But if you do so all the washing losses are lower, because sorption and diffusion phenomena are ignored.
The default sorption constant values for dry solids are A = 8 kg ds./bdt and B = 25 t liq./kg ds.
If you are not happy with the default sorption constants used in current simulation, you can edit with an ASCII text editor, the \..*PULPSIM\DAT\DEFAULTS.DAT* file. The line where the sorption information lies, is the last row. But if you edit the DEFAULTS.DAT file which is a help file for producing the <drawingname>.IN file it will change the sorption constants permanently.
Your <drawingname>.IN input file might look like this where the sorption row is bolded.

Row nr.	File contents	Comments
1	/	Heading row (0 - 40 characters)
2	0 0 / /	Run type = always 0 0
3	0 /	End of specific data = always 0
4	2000 5 / /	Nr. of iter. Iter. before heat calc.
5	7.0 0.35 1.00 0.45 0.0 / /	Boiling point rise Spec. heat of pulp etc.
6	1 101 /	Start of configuration (Block nr. 1, type 101 = IN)
7	.... /	
7	77 201 76 2111 /	Last block in configuration (Block nr. 77, type 201 = M)
-1	18 2 -2103 3.0 2.77 .. /	Module row in configuration (Module nr. 1, type 18)
...	.../	
...	0 /	End of configuration + miscellaneous data
...	1 10 50 /	Start of parameters data (Block nr.1, Par1, Par2)
...	.../	
n-4	0 /	End of parameter data
n-3	**-1 8 25 /**	Sorption row nr. = 1 A for D.S. B for D.S.
n-2	0 /	File
n-1	0 /	end
n	0 /	marks = 3 zeros

Note that a row in infile must ended by the divide mark (/).

Yield



Yield is asked in reactor blocks and its value is given by the user. The program has no relationship between kappa number and yield so the user better know them.
On the left there is an example diagram how to adjust yield parameters related to kappa number achieved in kraft cooking, oxygen delignification and in D/CEDED-sequence bleaching (Scandinavian Pine).
Note that in cooking modules there are several places where yield losses are taken. That is why the sum of fractions concerning yield losses in cooking modules must be 100%.

FIGURE 26: Yield vs. Kappa

If you have configured a plotting device that can be a printer or a pen plotter, you can plot the flowsheet with your plotter, printer or to a file. You can have many plotters, because PulpSim can store 29 plotters into the *\pulpsim\cfg\pulpsim.cfg* file.
The ***Plot*** command found under ***File*** is the same as in the AutoCAD. You can also plot to a file. The plot file has *plt* extension and the drawing can afterwards be imported to text editors like WordPerfect or MSWord. Also PostScript formatted plot files can be exported from the display. These files have the *EPS* extension. This flowsheet example above and a zoom of it have been imported to this document in the PostScript format. The detailed information of plotting possibilities can be found in the AutoCAD reference manual.

Other than pull-down menu commands are not recommended while constructing the drawing. Yet PulpSim can use all AutoCAD commands by typing them to the Command line or choosing them from the screen menu. You can freely add your own comments to the drawing. Copy, Move, Trim, Stretch, Rotate etc. commands executed from keyboard are not recommended, because they can corrupt our drawing's calculation capability by destroying the connections. They may be used as modifying the picture for printing/plotting.

Assist

Help Menu gives guidance in special PulpSim pull-down commands and can be found under the pull-down menu ***Assist***.
With ***Matrix/Equipment viewer*** you can study module's inner structure.
The AutoCAD commands ***Cancel, Undo, Redo,*** are in the same pull-down menu.
Pulpsim Status gives information of drawing status, blocks and modules used etc.
Check Connection is an aid to examine which connection is false when calculation has halted and no results (output) file is produced.

Display

The useful commands ***Zoom, Redraw, Regen*** and ***Pan*** can be found under the pull-down menu ***Display***.
Zooming is often needed to get reasonable size displays of the area. It can also be done in the middle of some other command that requires a different zoom, which is useful when drawing a long process line.
The ***Pan*** command acts like a screen scroller and is useful when you want to move the place in the display without changing the zoom ratio.
Redraw and ***Regen*** commands are needed to update the screen. For example if you have many markings on screen and you want to remove them.
Further information of **Zoom** options see AutoCAD's manual.

Settings

Settings pull-down is the menu where default settings of the drawing can be changed. Normally you don't have change any of these, but for example if you do not want connection points to be shown click / ***Show points*** once. To see points click ***Show points*** again.
On the attribute layer are numbers of blocks and modules. If the layer is frozen the numbers will disappear from the display.
There are also some useful shortcut keys, which are designated to function keys. They work as toggle on and off. F1 = Graphics screen/text screen, F8 = Ortho mode On/Off, F9 = Snap On/Off.

Iteration values command opens a dialogue box, where you can change the *Maximum amount of iterations* and *Maximum error*. The number of iterations determines how many iterations will be done maximally. However if the maximum error criteria reaches a value less than set the calculation halts. The amount of iterations is always at least 300. The error is a ratio between ingoing flows divided by outgoing flows in a single block or in the total balance. The error is met in all individual blocks and concerning all components. If it exceeds the maximum value components and blocks doing it

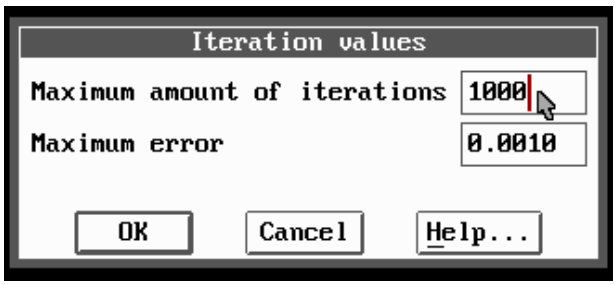


FIGURE 27: Iteration values dialogue box

will be written to the ***Error file*** found in ***Results***.

With the **User components** You can also define such components, which are not in PulpSim by default. When choosing ***User components*** a dialogue will open, where you can define the component you want to use. Or you can define from which file components can be read. **The suggested CHEMICAL.USC file adds eight more components needed in proper chemical recovery calculations**.

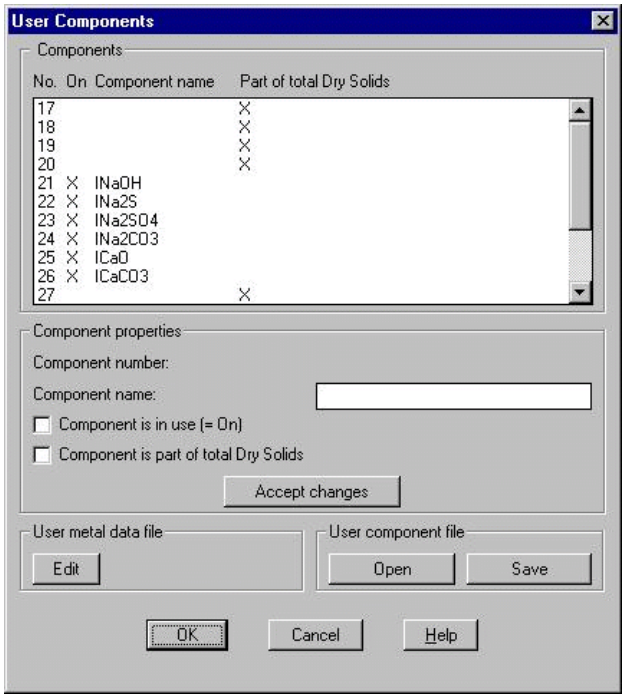


FIGURE 28: User component definition dialogue box.

If you want to save the component definition to a file for future use it is also possible by writing it. In the dialogue box there is a button where you can choose if component is counted in present simulation. You can also choose, which flow component is counted to total dry solids. When you have chosen the component number, filled the name in its edit box and chosen the desired options (In Use, Component is part of total Dry Solids), *Accept* it in this dialogue box.

At the moment the maximum number of components is set to 32.

Precision of Result Boxes defines number of decimals written to result boxes.

SI units or US units can also be chosen from the pull-down ***Settings***. To be able to see ***Module data*** results in US units pick the right option in ***Calculate***.
The default setting in PulpSim is set to SI units
Units used by PulpSim and their explanations and conversions are shown below:

Flow name	Contents	SI units	Conversion US units US6SI=/	SI6US=*
Liquor	Liquid + dry solids	t/h	gal/min	4,402869
Pulp	Fibre material	bdt/h	adst/h	1,224789
Dry solids	Organic+Inorganic material	kg/h	lb/h	2,204624
Na_2	Sodium	kg/h	lb/h	2,204624
S	Sulphur	kg/h	lb/h	2,204624
Cl	Chlorine	kg/h	lb/h	2,204624
Heat flow		GJ/h	Btu/s	263,2815
Temperature		ºC	ºF	ºC*1,8+32
			(ºF-32)/1,8	
Organic material		kg/h	lb/h	2,204624
Oxidized dry solids		kg/h	lb/h	2,204624
Oxidized organic material		kg/h	lb/h	2,204624
C	Carbon	kg/h	lb/h	2,204624
Ca	Calcium	kg/h	lb/h	2,204624
O	Oxygen	kg/h	lb/h	2,204624
H	Hydrogen	kg/h	lb/h	2,204624
Pressure		bar	psi	14,50377
Consistency	bd Pulp/(bd Pulp+Liquor)	%	%	1,0
Dilution factor		t/adt	t/adt	1,0
Density		t/m^3	lb/cu ft	62,42782
Concentration		g/l	g/l	1,0
Charge in cooking		% of bd wood	% of bd wood	1,0
Charge in bleaching		kg/adt	lb/adst	2,0

Units used:
Mass
adt = air dry metric ton (90 % dry pulp)
bdt = bound dry metric ton (100 % dry pulp)
t = metric ton = 1000 kg = 1,102311 st
kg = 2,204624 lb
st = short ton = 907,185 kg
adst = air dry short ton = 0,81647 bdt
lb = pound = 0,453592 kg
Pressure (absolute)
bar = 14,50377 psi
Energy and heat values
GJ = 947813,4 Btu
GJ = 238,846 Mcal
Mcal = 0,0041868 GJ
GJ/h = 263,2815 Btu/s
GJ/t = 429,92 Btu/lb

Density and volume
t/m3 = g/l = 0,0160185 lb/cu ft
gal = US gallon = 3,78541 liters
liter = dm3 = 0,26417 gal

CHAPTER 10
System Developing
Making Modules

This chapter tells about modules that are a group of individual blocks tied together in a specific way. The advantage of building modules is that they can be tied to a drawing that corresponds the outlooks of the equipment you try to simulate with the help of several blocks and you do not have to build the block combination every time all over.

In able to make a new module work in your PulpSim you need to build following files:

1) \PULPSIM\EQP\MODxx.DWG (is an AutoCAD drawing of the equipment having the connection points called nodes and parameter information as attributes that is changeable in the module).

2) \PULPSIM\EQP\MODxx.SLD (is a slide made by AutoCAD from MODxx.DWG when the ATTRIB and TEXT layers are frozen = switched off. This file is needed by Module selection dialogue box when choosing Equipment. The slide is shown in the upper right window of the Module selection dialogue box).

3) \PULPSIM\EQP\MODULxx.SLD (is a slide made by AutoCAD from MODxx.DWG when the ATTRIB layer is frozen and text information of connections added. This file is needed by the Zoom Picture button in the Module selection dialogue box).

4) \PULPSIM\MATRIX\MATRIxx.DWG (is an AutoCAD drawing where the blocks and their connections are presented as a picture).

5) \PULPSIM\MATRIX\MATRIxx.SLD (is an AutoCAD slide from MATRIxx.DWG and is activated by Info... button in the Module selection dialogue box).

6) \PULPSIM\DAT\MODxx.DAT (is an ASCII format file where the module configuration + miscellaneous data and the parameter data are presented in numeric format block by block).

7) \PULPSIM\EQP\MODxx.XDT (is an ASCII format file where the information of changeable parameters and connection nodes is).

To activate the new module type xx you need to have and edit following files:

1) \PULPSIM\DAT\MODULE.DAT (is an ASCII format file that defines how to put the missing information to the <filename>.IN file needed by PULPSIM.EXE calculation program, which is missing from the \PULPSIM\DAT\MODxx.DAT file).

2) \PULPSIM\DAT\MODULES.DEF (is an ASCII format file that defines how the Module selection dialogue box looks like).

3) \PULPSIM\DAT\MODTEX.DAT (is an ASCII format file which defines what the RESULT.EXE program calculates and what is presented under the Module data button in the Simulation results dialogue box.

4) \PULPSIM\DAT\MODFLOW.DAT (is an ASCII format file that defines the flows going out from the modules. The file is needed in able to see the Unconnected flows in a specified module under the Module data button in Simulation results.

MATRIxx.DWG

Let us make for example a new module called new wash press, which is a module type 79. When starting to a new module, draw the block configuration matrix drawing first, with AutoCAD and name it to \PULPSIM\MATRIX\MATRI79.DWG. The two number digit 79 in the filename defines the type number of the modules and must be the same in all files related to the same module. Be sure when making a new module that you name it with a number that is not already in use.

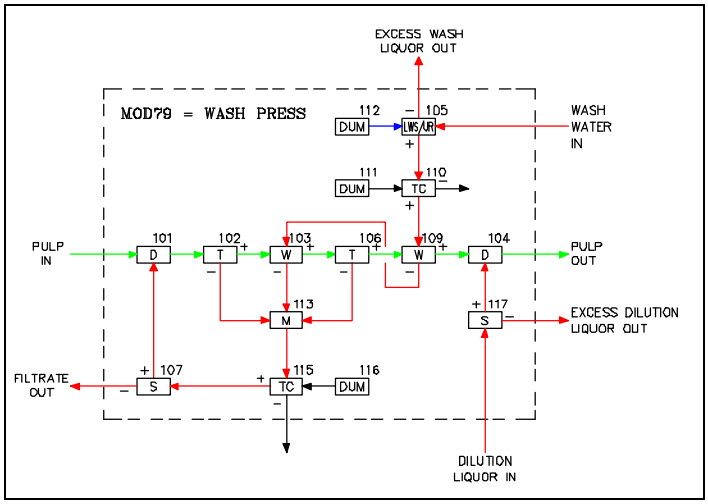


FIGURE 29: : Matrix of a module

As you can see from the example matrix drawing, a block is drawn as a box with a letter(s) in it. It stands for the block type and the number above the box stands for the block number. The flows and their directions are marked as arrows and have a plus or a minus sign. If only one flow is leaving the block it is always a plus flow. So all flows have a different address. In a module, block numbers must be three digit numbers and can have values between 101 and 999. One block in the module must have block number 101, but otherwise numbering is free.

To make the matrix picture nicer you can use green color for pulp flow, red for liquor, yellow color and hidden line type for the steam etc.

If you have little room in the disk, store these matrix drawings to diskettes, because the program does not need them.

MATRIxx.SLD

Then make a slide out of the matrix drawing with AutoCAD Command: MSLDE, and give the slide the same name. Slide file extension is SLD, but you have to give it. The slide file must be in the PULPSIM\MATRIX directory. This type of slide file is necessary to open the Info button in the Equipment dialogue box. It shows the user the equipment's structure divided into blocks tied to a module. If the slide file is missing PulpSim still works, but without the matrix presentation feature.

MODxx.DAT

The data below that is the exact format of the \PULPSIM\DAT\MOD79.DAT example file. First fifteen rows represent the configuration + miscellaneous data and the last fifteen rows the parameter data. Note that the block numbering in both parts must have the same order. Fields are separated by numbers followed by space (at least one) and a row ends with the slash mark (/). After the slash in the same row, marks have no effect, so you can add comments etc. The file is ended when all blocks configuration + miscellaneous data and corresponding parameter data are set. If you want to add additional information (for example file information needed for other files concerning the corresponding module you must separate them with an asterix (****...**) line.

Below the example file named PULPSIM\EQP\MOD79.DAT

```
101 501 0 107          / WASH PRESS, dilution: first water
102 401 101 0 103      / press displacement consistency
103 604 102 -109 0     / displacement takes place
```

```
104 501 109 117       / dilution takes place
105 1503 112 0        / takes care of dilution factor, weight ratio etc.
106 401 103 0         / press consistency
107 301 115           / splits filtrate to dilution
109 602 106 110 0 105 / dummy washer (washing does not take place)
110 1104 105 111      / heat loss block (option for future)
111 1701              / heat input
112 1701              / make-up water supplier
113 201 -102 -103 -106 / filtrate tank
115 1104 113 116      / heat loss block (option for future)
116 1701              / heat input
117 301 0             / splitter feeding end dilution
101 0                 / dilution consistency
102 0.12              / press displacement consistency initial estimate
103 0 0 0 0 0 0 0 0   / displacement takes place
104 0                 / leaving consistency
105 0                 / temperature of make-up water
106 0                 / press consistency
107 0                 / splits filtrate to dilution
109 0 0 0 0 0 0       / dilution factor etc. action
110 / 33.3            / heat loss block (option for future)
111                   / heat input
112                   / make-up water supplier
113                   / filtrate tank
115                   / heat loss block (option for future)
116                   / heat input
117 0 0               / splitter controls automatically par2
************************************************************
(add to ..\PULPSIM\DAT\MODULE.DAT)
 -79 1 15 15 606 1010 / WASH PRESS = MOD79
   1 3 3  / pulp in
   5 4 4  / wash water in
  15 3 5  / dilution water in
   2 4 6  / row number of sorption constant alternate
   3 5 6  /
   6 4 6  /
 101 1 7  / dilution consistency (%/100)   ( 4 %)
 103 1 8  / E-value                        (1.0)
 103 2 9  / displacement consistency (10 %)
 106 1 10 / press consistency    (%/100)   (35 %)
 104 1 11 / pulp consistency out,(%/100)  (10.0 %)
 109 5 12 / wash liq. alternate (0=All to wash|1=Flow, t/h|2=W|3=DF)
 109 6 13 / wash liq. flow which unit depends on alternate given
 105 1 14 / temperature of fresh make-up water (0=same as incoming)
 103 3 15 / component number for deviating E-value
 103 4 16 / E-value for deviating component
 0 /
************************************************************
*WASH PRESS  (add to ..\PULPSIM\DAT\MODTEX.DAT)
TYPE: 79
CON| 101 3      | PULP CONSISTENCY TO WASH PRESS        | %
CON| 101 0      | PULP CONSISTENCY AFTER DILUTION       | %
CON| 102 0      | PULP CONSISTENCY IN DISPLACEMENT ZONE | %
CON| 106 0      | PULP CONSISTENCY IN PRESS             | %
CON| 104 0      | PULP CONSISTENCY FROM WASH PRESS      | %
P  | 103 1      | EK-VALUE IN DISPLACEMENT ZONE         |
DF | 109 0      | DILUTION FACTOR                       | t/bdt
C  | 102 4      | SORPTION CONSTANT ALTERNATE           |
F  | 101 3      | PULP FLOW TO WASH PRESS               |
```

```
F   | 104 0       | PULP FLOW FROM WASH PRESS                |
F   | 105 3       | WASH LIQUOR IN TO WASH PRESS             |
F   | 110 0       | WASH LIQUOR TO DISPLACEMENT              |
F   |-105 0       | EXCESS WASH LIQUOR OUT                   |
F   | 112 0       | MAKE-UP WATER NEED IN WASH PRESS         |
F   | 117 3       | DILUTION LIQUOR IN TO WASH PRESS         |
F   | 117 0       | DILUTION LIQUOR NEEDED BEFORE MC-PUMP    |
F   |-117 0       | EXCESS DILUTION LIQUOR OUT               |
F   |-107 0       | FILTRATE FROM WASH PRESS                 |
END
************************************************************
*WASH PRESS  (add to ..\PULPSIM\DAT\MODFLOW.DAT)
TYPE: 79
F   | 104 0       | PULP FLOW FROM WASH PRESS                |
F   |-107 0       | FILTRATE FROM WASH PRESS                 |
F   |-105 0       | EXCESS LIQUOR OUT                        |
F   |-110 0       | HEAT LOSS IN WASH FLOW                   |
F   |-115 0       | HEAT LOSS IN FILTRATE FLOW               |
F   |-117 0       | EXCESS DILUTION LIQUOR OUT               |
END
************************************************************
```

The corresponding data is presented below in a table format, where fields in boxes show the meaning of the figures in this specific file. The upper half of the file is so called configuration + miscellaneous data and the lower half is a so called parameter data. They are separated with a bold line. Each field must have a numeric value, even zero, followed by space. Every row must have an end-of-row mark (/) after last significant data. These slash fields are not presented here, because lack of space. Comments can be added after the slash mark. If the last data given is zero it can be omitted and the slash mark can be added. No other codes, but numbers, spaces and slashes are allowed in reading area of MODxx.DAT files. The decimal separator is the full stop (.) mark.
The missing data fields of the example file ..\PULPSIM\DAT\MOD79.DAT are represented with shadowed fillings (dotted areas).

IPLA (I,1) Block number (101)	**IPLA (I,2)** Block type number (D = 501)	**IPLA (I,3)** Inflow to be diluted (not yet known = 0)	**IPLA (I,4)** Diluting inflow (107)			
IPLA (I,1) Block number (102)	**IPLA (I,2)** Block type number (T = 401)	**IPLA (I,3)** Inflow containing pulp (101)	**IPLA (I,4)** PSPEC-location (not yet known = 0)	**IPLA (I,5)** Refer to flow IREF (103)		
IPLA (I,1) Block number (103)	**IPLA (I,2)** Block type number (NORDW = 604)	**IPLA (I,3)** Pulpflow to block (102)	**IPLA (I,4)** Wash liquor to block (109)	**IPLA (I,5)** PSPEC-location (not yet known = 0)	**IPLA (I,6)** Block number of wash liquor supplier (no supplier = 0)	
IPLA (I,1) Block number (104)	**IPLA (I,2)** Block type number (T = 501)	**IPLA (I,3)** Inflow containing pulp (109)	**IPLA (I,4)** Diluting flow (117)			
IPLA (I,1) Block number (105)	IPLA (I,2) Block type number (LSW/UR = 1503)	**IPLA (I,3)** Fresh water to block (112)	**IPLA (I,4)** Process water to block (not yet known = 0)			
IPLA (I,1) Block number (106)	**IPLA (I,2)** Block type number (T = 401)	**IPLA (I,3)** Inflow containing pulp (103)	**IPLA (I,4)** PSPEC-location (not yet known = 0)			
IPLA (I,1) Block number (107)	**IPLA (I,2)** Block type number (S = 301)	**IPLA (I,3)** Incoming flow (115)				
IPLA (I,1) Block number (109)	**IPLA (I,2)** Block type number (W = 602)	**IPLA (I,3)** Pulpflow to block (106)	**IPLA (I,4)** Wash liquor to block (110)	**IPLA (I,5)** PSPEC-location (no value = 0)	**IPLA (I,6)** Block number of wash liquor supplier (105)	
IPLA (I,1) Block number (110)	**IPLA (I,2)** Block type number (TC = 1104)	**IPLA (I,3)** Liquor flow to block (105)	**IPLA (I,4)** Heat flow to block (111)			

IPLA (I,1) Block number (111)	**IPLA (I,2)** Block type number (DUM = 1701)					
IPLA (I,1) Block number (112)	**IPLA (I,2)** Block type number (DUM = 1701)					
IPLA (I,1) Block number (113)	**IPLA (I,2)** Block type number (M = 201)	**IPLA (I,3)** Inflow A to block (-102)	**IPLA (I,4)** Inflow B to block (-103)	**IPLA (I,5)** Inflow C to block (-106)		
IPLA (I,1) Block number (115)	**IPLA (I,2)** Block type number (1104)	**IPLA (I,3)** Liquor flow to block (113)	**IPLA (I,4)** Heat flow to block (116)			
IPLA (I,1) Block number (116)	**IPLA (I,2)** Block type number (1701)					
IPLA (I,1) Block number (117)	**IPLA (I,2)** Block type number (S = 301)	**IPLA (I,3)** Dilution flow in (not yet known = 0)				
Block number (101)	**PAR(I,1)** Pulp consistency of outflow, %/100 (not yet known = 0)					
Block number (102)	**PAR(I,1)** Pulp consistency of outflow, %/100 (set to 0.12)					
Block number (103)	**PAR(I,1)** E-value (not yet known = 0)	**PAR(I,2)** Discharge consistency, % (not yet known =0)	**PAR(I,3)** Component number of deviating E-value (not yet known = 0)	**PAR(I,4)** E-factor for deviating component (not yet known = 0)	**PAR(I,5)** Wash liquor definition (not defined = 0)	**PAR(I,6)** Total wash liquor flow, unit depends on previous parameter (not defined = 0)
Block number (104)	**PAR(I,1)** Pulp consistency of outflow, %/100 (not yet known = 0)					
Block number (105)	**PAR(I,1)** Temp. of fresh make-up water, C (0)					
Block number (106)	**PAR(I,1)** Press consistency, %/100 (not yet known = 0)					
Block number (107)	**PAR(I,1)** (this type needs no parameters)					
Block number (109)	**PAR(I,1)** E-value (not given = 0)	**PAR(I,2)** (not given = 0)	**PAR(I,3)** (not given = 0)	**PAR(I,4)** (not given = 0)	PAR(I,5) Wash liquor definition (not yet known = 0)	**PAR(I,6)** Total wash liquor flow, unit depends on previous parameter (not yet known = 0)
Block number (110)	**PAR(I,1)** (no parameters are given)					
Block number (111)	**PAR(I,1)** (this type needs no parameters)					
Block number (112)	**PAR(I,1)** (this type needs no parameters)					
Block number (113)	**PAR(I,1)** (this type needs no parameters)					
Block number (114)	**PAR(I,1)** (this type needs no parameters)					
Block number (115)	**PAR(I,1)** (no parameters are given)					
Block number (116)	**PAR(I,1)** (this type needs no parameters)					
Block number (117)	PAR(I,1) (set to 0)	**PAR(I,2)** (set to 0)				

MODxx.DWG

The next step in the module constructor is to draw an AutoCAD drawing of the actual outlooks of the equipment. This file must be named \PULPSIM\EQP\MODxx.DWG, where xx = module type number with digits. The example module=equipment is a wash press (Sunds), type = 79, shown in the figure.

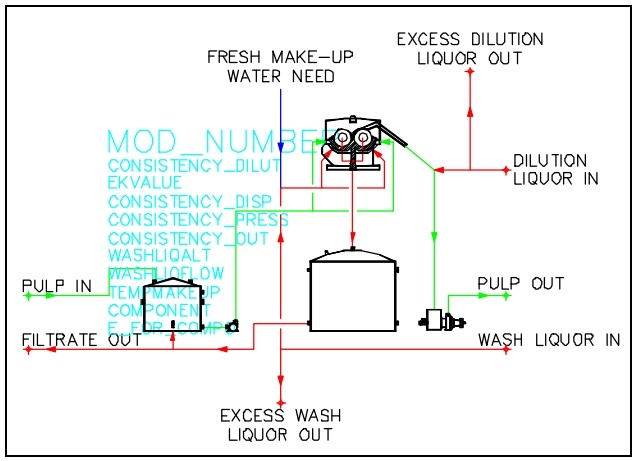


FIGURE 30: : MOD79.DWG module drawing

To make it easy to insert the module into the flowsheet drawing choose the module's base point so that it is the same than the connection point of the main flow in has. It is best to define this the coordinates of this point to x=0, y=0, z=0. And remember, that all connection points = nodes, have coordinates, that satisfy the snap on = 4 criteria. All other objects, can have whatever coordinates. Thus the z coordinate is defined, use only 0 value, because the flowsheet drawings are two-dimensional.

All objects except flows, attributes, points and hidden texts are drawn to 0 layer. Attributes must be on ATTRIB-layer and flow lines = pipelines and the connection points have a layer depending on their material. Materials are pulp, liquor, steam and chemicals. Flow lines that go in or out from the module must have a point in the end. The point is a so-called connection point where an incoming flow must be added. An outgoing flow from a module does not necessarily have to be connected.

The best way to insert and edit attributes is to use the dialogue boxes in ATTDEF and DDMODIFY commands. In figure below is presented editing the second attribute (CONSISTENCY_DILUT) in a dialogue box.

The layer must be set to attrib. The attribute tag string must match exactly the corresponding parameter string in XDT-file. In prompt area you define the text you want to appear in the Edit

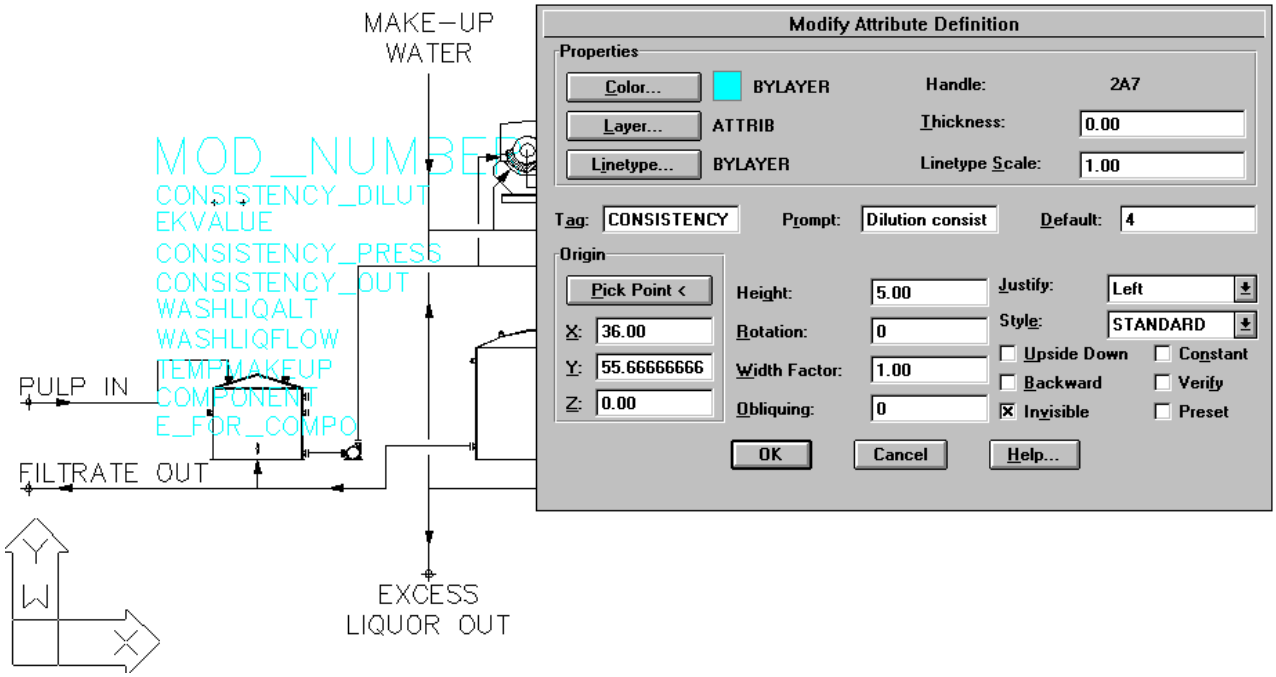


FIGURE 31: : Attribute edition in module drawing

parameters dialogue box when inserting the module. To default area you set the initial value of the parameter you want to be seen in the Edit parameters dialogue box. The default area can be also left empty = no default is given. With the pick point button the coordinates of a parameter can be changed. Note that the attribute with the tag MOD NUMBER must be the first one (the highest of the tag list). The order of inserting attributes must follow the exact order of parameters in XDT-file. All other attributes,

except the first one, must be invisible. Attribute with the tag MOD NUMBER must be visible and use text height 10 in modules and 5 in block attributes. Then you can see, in a flowsheet drawing, which equipment is modules and, which are blocks. The numbers in modules have twice the side of blocks.

MODxx.SLD

Make a slide out of the corresponding MODxx.DWG when ATTRIB and INFOTXT layers are frozen with the MSLIDE command. Slides must be located to the \PULPSIM\EQP directory. Slides are necessary for the Equipment dialogue box to preview the outlooks of equipment.

MODULxx.SLD

Make a slide out of the corresponding MODxx.DWG, when the ATTRIB layer is frozen, with the MSLIDE command and name MODULxx.SLD (xx = corresponding two digit number). On the TEXT layer there is text information of in and outflows of the module. These type of slides must be also located in the \PULPSIM\EQP directory. Slides are necessary for the Zoom button in the Equipment dialogue box to preview the outlooks of the equipment.

MODxx.XDT

The example module needs a \EQP\MOD79.XDT ASCII-file where the attributes, connection nodes, materials etc. have been defined. The best way to understand how to build a *.XDT file is to study the structure of it, presented below. The structure of *.XDT file for a block differs little from the one for a module. Parameters here have a different meaning than in the input file. Here parameters are configuration and parameter data. So also the missing configuration data is defined here as parameters. The program then inserts the values for missing configuration. These parameters must be defined exactly in the same order than attributes in the corresponding MOD79.DWG file. The insertions of real parameter values take place in Edit parameter dialogue boxes when inserting the MODxx.DWG as a block (in AutoCAD sense) to the flowsheet drawing.

```
-------------------------------------------------------------------------
                Data structure for pulpsim
-------------------------------------------------------------------------
                MODULE

"DECADI_PULPSIM"            ..Name for application
(1002 . "{")
(1000 . "MODULE")           ..Object type
(1000 . "Moduletype")         ..Module type number
(1000 . "#")                  ..Reserved for future needs
(1000 . "#")                  ..Reserved for future needs
(1000 . "#")                  ..Reserved for future needs

(1000 . "ROW")              ..Module parameter row
(1000 . "Par1")               ..1st parameter name
(1000 . "Par2")               ..2nd parameter name
                                (Parameters are written to input file
                                in this order)
(1000 . "CALCULATE")        ..Mark for calculation data
(1000 . "Formula")            ..Formula
.
(1000 . "PARAMETERS")       ..Mark for parameter data
(1000 . "Parameter")          ..Name of the parameter
(1040 . "Rea1")               ..Value of the parameter
                                (initially "#" if unknown)
(1000 . "Type")               ..NODE / ASK / FILE / CONST / MBNO
(1000 . "Info")               ..node name / prompt / fname rownumber
                                pnumber / "" / node name
```

```
                                (Total of 4 lines per parameter)
(1000 . "NODES")              ..Mark for node data
(1000 . "Node name")            ..Node name (same as in parameter data!)
(1011 x y z)                    ..3D world space position of the node (3 reals)
(1005 . "Handle")               ..Handle of adjacent block/module/line (initially "")
(1000 . "Flow number")          ..Flow number of the node
(1000 . "InOut")                ..Flow direction of the node ("in" or "out")
(1000 . "Material")             ..Material of the node
                                ("steam" etc., "*" if all materials allowed)
                                (Total of 6 lines per node)
(1002 . "}")                  ..EOF mark.
```

BLOCK

```
"DECADI_PULPSIM"              ..Name for application
(1002 . "{")
(1000 . "BLOCK")              ..Object type
(1000 . "Block type")         ..Block type number
(1000 . "#")                  ..Reserved for future needs
(1000 . "#")                  ..Reserved for future needs
(1000 . "#")                  ..Reserved for future needs

(1000 . "CROW")               ..Block configuration row data
(1000 . "Par1")               ..1st par
(1000 . "Par2")               ..2nd par
.                       .
.                       .
(1000 . "PROW")               ..Block parameter row data
(1000 . "Par1")               ..1st par
(1000 . "Par2")               ..2nd par
.                       .
.                       .
(1000 . "CALCULATE")          ..Mark for calculation data
(1000 . "Formula")            ..Formula
.
(1000 . "PARAMETERS")         ..Mark for parameter data
(1000 . "Parameter")          ..Name of the parameter
(1040 . "Rea1")               ..Value of the parameter
(1000 . "Type")               ..NODE / ASK / FILE / CONST / MBNO
(1000 . "Info")               ..node name / prompt / fname rownumber
                            pnumber / "" / node name
.
(1000 . "NODES")              ..Mark for node data
(1000 . "Node name")            ..Node name (same as in parameter data)
(1011 x y z)                  ..3D world space position of the node
(1005 . "Handle")               ..Handle of adjacent block/module/line
(1000 . "Flow number")          ..Flow number of the node
(1000 . "InOut")              ..Flow direction of the node
(1000 . "Material")             ..Material of the node
.
(1002 . "}")                ..EOF mark.
```

Additional information:

Parameter types:

The following parameter types are currently implemented:

NODE
Value: The block number or module number & flow number of the node to which the node given in info row is connected. The value is

filled when the input file of the simulation is written.
Info row: Name of the node.

ASK
Value: The value is asked from the user when the input file of the simulation is written. If a default value exists (the value is not "" or "#"), it is presented to the user and may be accepted with <Enter>.
Info row: The prompt to be presented to the user.

FILE
Value: The value is read from a user-specified file when the input file of the simulation is written.
Info row: File name, row number and parameter number (separated by spaces) from where the value is read.

CONST
Value: A constant value written in xdata, not accessible to the user.
Info row: "" (no info).

MBNO
Value: Number of the module or block to which the node given in info row is connected. The value is filled when the input file of the simulation is written.
Info row: Name of the node.

Calculation formulas:

Calculation formulas in CALCULATE section of module or block xdata are handled by AutoCAD Geomcal application. Thus, the functions available and the syntax to be used are explained in AutoCAD documentation.

Any numerical operator (+, -, *, /, ^, brackets) and numerical function (abs, sin, cos,...) available in Geomcal is allowed.

The names of Pulpsim parameters must be written with a preceding '$', for instance: the parameter LPSTEAM shall be written in formulas as $LPSTEAM.

In formulas, a space must be typed after a parameter name. Otherwise, there are no restrictions for the use of spaces.

Calculation formulas are solved after the values of the parameters are otherwise solved (i.e., the actions according to the types of the parameters are taken).

Examples:

To convert a percentage value to absolute (decimal) value, write:

```
$PAR = $PAR / 100.0
```

To combine a module number and a flow number (supposing that the module number is in parameter PAR1, the flow number is in parameter PAR2 and the result is put in parameter PAR1), write:

```
$PAR1 = round($PAR2 / abs($PAR2 ) * (1000 * $PAR1 + abs($PAR2 )))
```

Example of a XDT file:

1
2
3
4
5
6

```
7
8
9
10
"DECADI_PULPSIM"
(1002 . "{")
(1000 . "MODULE")
(1000 . "79")
(1000 . "#")
(1000 . "#")
(1000 . "#")
  (1000 . "ROW")
    (1000 . "PUTOM")
    (1000 . "LITOM")
    (1000 . "DILIN")
    (1000 . "PSPEC")
    (1000 . "CONSISTENCY_DILUT")
    (1000 . "EKVALUE")
    (1000 . "CONSISTENCY_DISP")
    (1000 . "CONSISTENCY_PRESS")
    (1000 . "CONSISTENCY_OUT")
    (1000 . "WASHLIQALT")
    (1000 . "WASHLIQFLOW")
    (1000 . "TEMPMAKEUP")
    (1000 . "COMPONENT_NR")
    (1000 . "E_FACTOR")
  (1000 . "CALCULATE")
    (1000 . "$CONSISTENCY_DILUT = $CONSISTENCY_DILUT / 100.0")
    (1000 . "$CONSISTENCY_PRESS = $CONSISTENCY_PRESS / 100.0")
    (1000 . "$CONSISTENCY_OUT = $CONSISTENCY_OUT / 100.0")
  (1000 . "PARAMETERS")
    (1000 . "PUTOM")
    (1000 . "#")
    (1000 . "NODE")
    (1000 . "node1")
    (1000 . "LITOM")
    (1000 . "#")
    (1000 . "NODE")
    (1000 . "node2")
    (1000 . "DILIN")
    (1000 . "#")
    (1000 . "NODE")
    (1000 . "node3")
    (1000 . "PSPEC")
    (1000 . "1")
    (1000 . "CONST")
    (1000 . "")
  (1000 . "NODES")
    (1000 . "node1")
    (1011  0.0 0.0 0.0)
    (1005 . "")
    (1000 . "#")
    (1000 . "in")
    (1000 . "pulp")
    (1000 . "node2")
    (1011  212.0 -24.0 0.0)
    (1005 . "")
    (1000 . "#")
    (1000 . "in")
```

```
    (1000 . "liquor")
    (1000 . "node3")
    (1011  212.0 56.0 0.0)
    (1005 . "")
    (1000 . "#")
    (1000 . "in")
    (1000 . "liquor")
    (1000 . "node4")
    (1011  212.0 0.0 0.0)
    (1005 . "")
    (1000 . "104")
    (1000 . "out")
    (1000 . "pulp")
    (1000 . "node5")
    (1011  0.0 -24.0 0.0)
    (1005 . "")
    (1000 . "-107")
    (1000 . "out")
    (1000 . "liquor")
    (1000 . "node6")
    (1011  112.0 -48.0 0.0)
    (1005 . "")
    (1000 . "-105")
    (1000 . "out")
    (1000 . "liquor")
    (1000 . "node7")
    (1011  196.0 100.0 0.0)
    (1005 . "")
    (1000 . "-117")
    (1000 . "out")
    (1000 . "liquor")
(1002 . "}")
```

MODULE.DAT

This file must be in the \PULPSIM\DAT directory like all *.DAT files. It orders where and how the missing information of configuration and parameter data is read to infile.in. A so-called module row in infile.in is produced only if MODxx.DAT and the corresponding part of the MODULE.DAT file cope together. This short infile.in generates a new infile, where all module rows are expanded to single blocks and parameter data is set to their places. After this expansion the actual calculation can take place.
To see the structure of a module row in infile.in an example is presented below in a table format. The location of this module row is in configuration + miscellaneous data section in infile.in. The figures above the table are column field numbers.

1	2	3	4	5	6	7	8	9	10		15	16
-1 Module number with - sign	79 Module type number	1 In flow to block 101 in MOD79	2 Liquor to block 105 in Mod79	3 Diluting flow to block 117 in Mod79	1 PSPEC-location of sorption constants in blocks 102,103 and 106	0.04 Pulp consistency in block 101 in Mod79	1.0 E-value in block 103 in Mod79	0.35 Pulp consistency in block 103 in Mod79	0.1 Pulp consistency in block 106 in Mod79	.....	0 E-value for deviating component in block 103 in Mod79	/ End of row-mark

MODULE.DAT is a file that is necessary for activating MODxx.DAT files for the infile.in and its enlargement. There is defined the type of module, number of blocks in the module and how the missing

data of the module is filled in to the <drawingname>.IN file. The example module's section of the MODULE.DAT file is presented below. This file like all other files concerning modules can have only numeric data in it. After the end of row-mark, it is possible to set alphanumeric strings as comments, but they have no effect at all. Each module type section is separated with a 0 (zero) row. The whole file must end to at least three 0 (zero) rows.

```
-79 1 15 15 606 1010 / WASH PRESS = MOD79
  1 3 3  / pulp in
  5 4 4  / wash water in
 15 3 5  / dilution water in
  2 4 6  / row number of sorption constant alternate
  3 5 6  /
  6 4 6  /
101 1 7  / dilution consistency (%/100)   ( 4 %)
103 1 8  / E-value                        (1.0)
103 2 9  / displacement consistency (10 %)
106 1 10 / press consistency    (%/100)   (35 %)
104 1 11 / pulp consistency out,(%/100)  (10.0 %)
109 5 12 / wash liq. alternate (0=All to wash|1=Flow, t/h|2=W|3=DF)
109 6 13 / wash liq. flow which unit depends on alternate given
105 1 14 / temperature of fresh make-up water (0=same as incoming)
103 3 15 / component number for deviating E-value
103 4 16 / E-value for deviating component
0 /
```

The same file is in table format below having declarations in fields. The large marks in the table represent the actual string in the file and the small text is only to declare the meaning of the figures.

-79 Module type number with the minus sign ahead.	1 Number of strings in Mod79 module. (always = 1)	15 Total number of blocks in Mod79 module.	15 Number of blocks in first string (same as previous)	606 See separate note 1 below this table.	1010 See separate note 1 below this table.	/ End of row-mark
1 In what row in Mod79.DAT	3 What column in Mod79.DAT	3 In what column must be placed in input.IN file	/ End of row-mark			
5 In what row in Mod79.DAT	4 What column in Mod79.DAT	4 In what column must be placed in input.IN file	/ End of row-mark			
15	3	5	/ End of row-mark			
2	4	6	/ End of row-mark			
3	5	6	/ End of row-mark			
6 In what row in Mod79.DAT	4 What column in Mod79.DAT	6 In what column must be placed in input.IN file	/ End of row-mark			

101 Block number in MOD79.DAT	1 Parameter number to be filled	7 In what column must be placed in input.IN file	/ End of row-mark			
103	1	8	/			
103	2	9	/			
106	1	10	/			
104	1	11	/			
109	5	12	/			
109	6	13	/			
105	1	14	/			
103	3	15	/			
103 Block number in MOD79.DAT	4 Parameter number to be filled	16 In what column must be placed in input.IN file	/ End of row-mark			
0 End of modtype 79 section	/ End of row-mark					

Note 1) 6***06*** is a figure where the right part of it (***two last digits***) tell how many columns must be filled in the module row in INPUT.IN file before parameter data is given. The number(s) on the left side tell the amount of configuration+miscellaneous data that must be placed. Remember that the left part can have one or two digits and the right side must always be a two-digit number. So the maximum value can be 9999. This means that configuration + miscellaneous data can have 99 missing values, which can maximally occupy 99 columns before parameters are given in a module row.

Note 2) 10***10*** is a figure where the right part of it (***two last digits***) tell how many columns are filled with parameter information in the module row in INPUT.IN file. The number(s) on the left side tell to how many columns the parameter data must is placed in a module row. Remember that the left part can have one or two digits and the right side must always be a two-digit number. So the maximum value can be 9999. This means that parameter data can have 99 missing values, which can maximally occupy 99 columns in a module row.

MODTEXT.DAT

If you want to have additional information from a module, you must edit the \PULPSIM\DAT\MODTEXT.DAT file. The \PULPSIM\BIN\RESULT.EXE program makes a \MODx.OUT file from each existing module in simulation. The x in the filename stands for the module number (not the type). The section in MODTEX.DAT file concerning the example module is presented below.

****WASH PRESS***

```
TYPE: 79
CON| 101 3      | PULP CONSISTENCY TO WASH PRESS         | %
CON| 101 0      | PULP CONSISTENCY AFTER DILUTION        | %
CON| 102 0      | PULP CONSISTENCY IN DISPLACEMENT ZONE  | %
CON| 106 0      | PULP CONSISTENCY IN PRESS              | %
CON| 104 0      | PULP CONSISTENCY FROM WASH PRESS       | %
P  | 103 1      | EK-VALUE IN DISPLACEMENT ZONE          |
DF | 109 0      | DILUTION FACTOR                        | t/bdt
C  | 102 4      | SORPTION CONSTANT ALTERNATE            |
F  | 101 3      | PULP FLOW TO WASH PRESS                |
F  | 104 0      | PULP FLOW FROM WASH PRESS              |
F  | 105 4      | WASH LIQUOR TO IN TO WASH PRESS        |
F  | 110 0      | WASH LIQUOR TO DISPLACEMENT            |
F  |-105 0      | EXCESS WASH LIQUOR OUT                 |
F  | 112 0      | MAKE-UP WATER NEED IN WASH PRESS       |
F  | 117 3      | DILUTION LIQUOR IN TO WASH PRESS       |
F  | 117 0      | DILUTION LIQUOR NEEDED BEFORE MC-PUMP  |
F  |-117 0      | EXCESS DILUTION LIQUOR OUT             |
F  |-107 0      | FILTRATE FROM WASH PRESS               |
END
```

MODFLOW.DAT

All flows in a module, which are not connected, must be defined in this file. With the help of this file the RESULT.EXE program can tell all flows in a module that are leaving the system. Outgoing flows with no values are not although displayed. The results of this operation show by pressing the Unconnected flows button in Module info.
In the beginning of this file there is information how to add a new module section to it. See below how the example module's part in the MODFLOW.DAT file is formatted.

```
*WASH PRESS
TYPE: 79
F  | 104 0      | PULP FLOW FROM WASH PRESS              |
F  |-107 0      | FILTRATE FROM WASH PRESS               |
F  |-105 0      | EXCESS LIQUOR OUT                      |
F  |-110 0      | HEAT LOSS IN WASH FLOW                 |
F  |-115 0      | HEAT LOSS IN FILTRATE FLOW             |
F  |-117 0      | EXCESS DILUTION LIQUOR OUT             |
END
```

Note that the areas extracted with piping marks must have right size.

CHAPTER 11
PulpSim 4
Different versions

We provide at the moment two different PulpSim Setups.
1) PulpSim 4.1 for AutoCad 14.01
2) PulpSim 4.1 for AutoCad 2000-2

PulpSim 4.x has new blocks for pH calculations. The old PulpSim 3.x versions can not calculate simulations that have these new blocks. Earlier PulpSim drawing files can also be calculated with the new PulpSim version, but to make sure nothing is corrupted **do not use any earlier made drawings as bases of a new drawing**, since the earlier used template drawing Psim\Common\Pulpsim.dwg is no more valid with AutoCad 2000 series versions. You can check if your simulation drawing is new (based on ..\Common\Pulpsim.dwt or ..\Common\Pulpsim.dwg dated in Aug 2002) by typing layer to the command prompt. If you see "results" layer typed with small letters the drawing is not valid for future so do not edit it. Even it works now you will have problems with it specially when you update your AutoCad from 14 to 2000 series. Also the IN block is different. The earlier version had only 32 components at maximum, but now the maximum of components is 64.

pH calculation

PulpSim 4.x drawing with pH calculation must have a Projects\< filename>.met file that is a text file containing information on component properties (acids and metals). This file can be produced and edited through User Components dialogue box.

Below an example of the file ..Projects\PHSPEC4.met

```
11
Flow Val   Mole       KMe     M1      M2      M3      M4      M5
17   -2  40.00000   0.00    0.00    0.00    0.00    0.00    0.00
18   +1   1.00000   0.00    0.00    0.00    0.00    0.00    0.00
19    0   1.00000   0.00    0.00    0.00    0.00    0.00    0.00
20   +1  40.00000   0.00    0.00    0.00    0.00    0.00    0.00
23   +2  55.00000   0.00    0.00    0.00    0.00    0.00    0.00
24   +2  63.00000   0.00    0.00    0.00    0.00    0.00    0.00
25   +2  40.00000   0.00    0.00    0.00    0.00    0.00    0.00
26   +2  24.31000   0.00    0.00    0.00    0.00    0.00    0.00
27   +1  39.00000   0.00    0.00    0.00    0.00    0.00    0.00
28   +1  23.00000   0.00    0.00    0.00    0.00    0.00    0.00
29   -1  35.50000   0.00    0.00    0.00    0.00    0.00    0.00
7
Flowe    pK-value    Mole
43       0.600       1.00000
44       1.400       1.00000
45       4.000       1.00000
46       6.000       1.00000
47       8.000       1.00000
48       3.300       1.00000
49        11.000       1.0000
EDTA              35   1.00000
 pK1    pk2    pk3    pk4
 2.00   6.00   8.00   9.00
```

11								
Flow	Val		Mole	KMe	M1	M2	M3	M4	M5
17	-2		40.00	0.00	0.00	0.00	0.00	0.00	0.00
18	1		1.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0		1.00	0.00	0.00	0.00	0.00	0.00	0.00
20	1		40.00	0.00	0.00	0.00	0.00	0.00	0.00
23	2		55.00	0.00	0.00	0.00	0.00	0.00	0.00
24	2		63.00	0.00	0.00	0.00	0.00	0.00	0.00
25	2		40.00	0.00	0.00	0.00	0.00	0.00	0.00
26	2		24.31	0.00	0.00	0.00	0.00	0.00	0.00
27	1		39.00	0.00	0.00	0.00	0.00	0.00	0.00
28	1		23.00	0.00	0.00	0.00	0.00	0.00	0.00
29	-1		35.50	0.00	0.00	0.00	0.00	0.00	0.00
7									
Flowe	pK-value		Mole						
43	0.60		1.00						
44	1.40		1.00						
45	4.00		1.00						
46	6.00		1.00						
47	8.00		1.00						
48	3.30		1.00						
49									
EDTA		35	1.00						
pK1	pk2	pk3	pk4						
2.00	6.00	8.00	9.00						

Notes and declarations:
pH calculations need metal file information given in a ASCII text file that has the same name as the simulation except the extension is MET. The components and their parameters can be added and edited through User Components dialogue box that opens the corresponding met file.

= Amount of components
= Amount of acids
= Number of component in simulation
= Chelate and metal equilibrium constants
= pk values of EDTA
=pk values of acids

FIGURE 32: The structure of a MET file

to understand the meaning and the structure of the MET-file needed, see above:

The new pH blocks

The new PulpSim 4.0 version has blocks that are not known by the earlier versions. Those are:

NTHICK New thickener (type number = 403)
NW New washer (type number = 605)
AR Acid reactor (type number = 711)
PH Calculate pH of the stream (type number = 1811)

Those blocks can be found gathered in **pH blocks** under the **Unit Operations:** in **Equipment Selection** dialogue box.

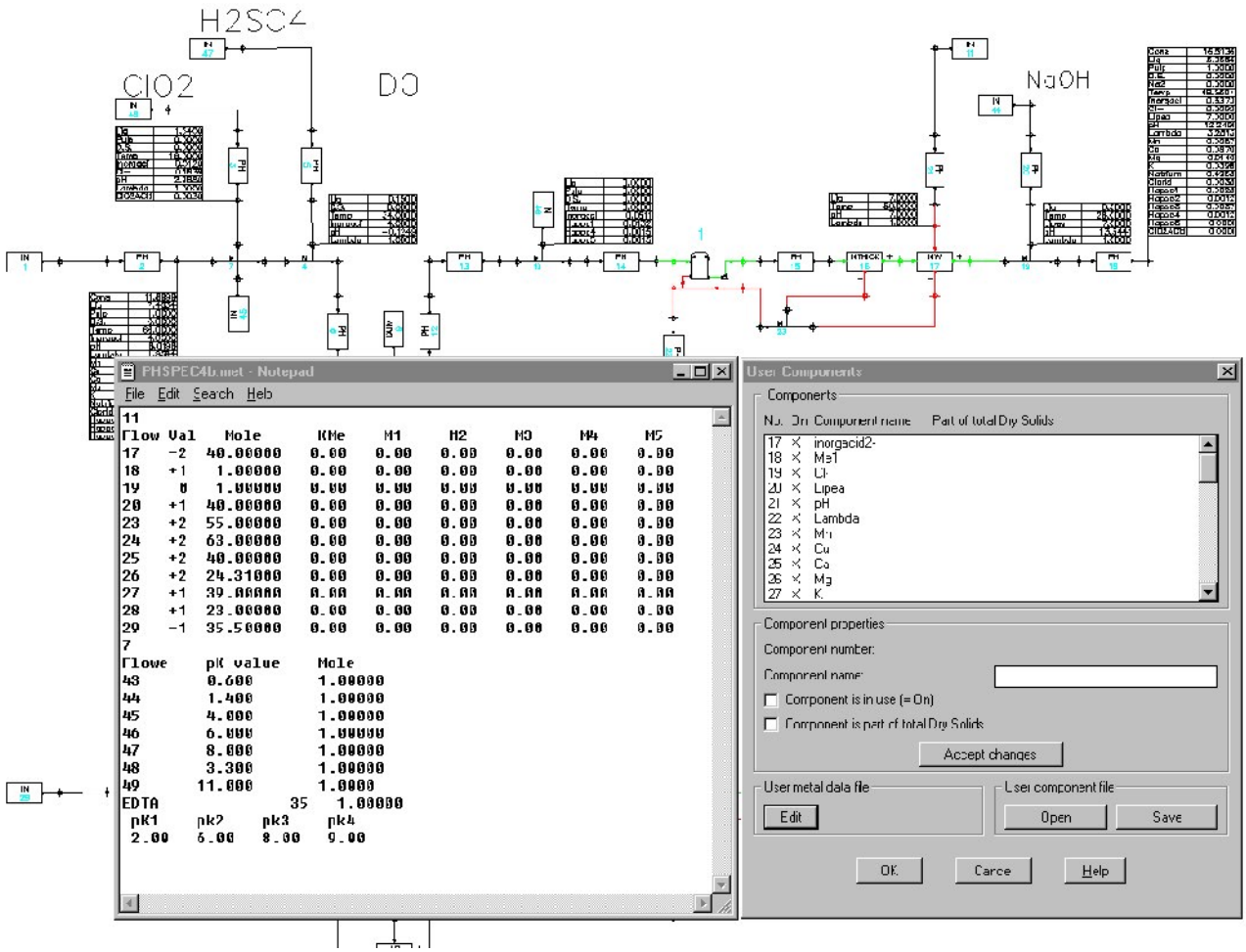


FIGURE 33: An example of a pH simulation and its corresponding met file

The new recovery modules

The old recovery boiler module works also in the new PulpSim, but we have separated the recovery into five different modules to make the calculations more precise. These new modules are:

MOD110 **New recovery boiler**
MOD111 **Smelt dissolving tank**
MOD112 **New electrostatic precipitator**
MOD113 **Chloride removal process**
MOD114 **Flue gas scrubber**

Updates

Every now and then we add and update some files in PulpSim program. To get these files load the latest Update_PSim4.zip Winzip archive file from our internet page and extract it to PSim directory. Remember to have **Use folder names** and **Overwrite existing files** options on when extracting.

APPENDIX 1
Files in PulpSim
The directory tree of PulpSim

To the right you see the necessary directories and their hierarchy in the PulpSim when the default name of PSim has been used in the installation.

The names of the directories show the contents. The directory where the simulation files are can be chosen freely. Don't delete any files or subdirectories in PSIM... directory, because PulpSim needs them.

You can save your disk space by deleting *PROJECTS*.OUT* and *PROJECTS*.IN* files, but if you do so you must always make new infiles and calculate them first in able to see the results.

Keep all *PROJECTS*.DWG* files, because those are the files needed when recalculating, without reconstructing the simulation all over.

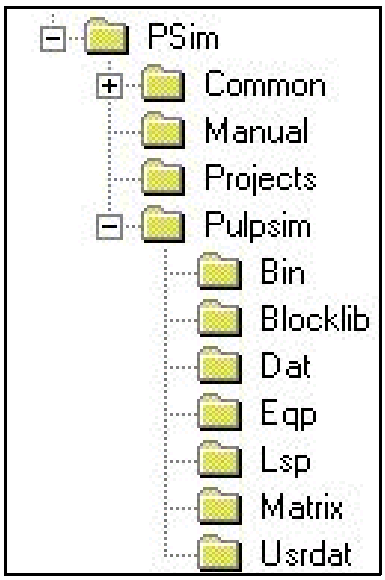


FIGURE 34: : PulpSim directory hierarcy.

File types and their extensions

*.BAK = Drawing backup files
*.BAT = Batch files (ASCII)
*.EXE = DOSXMSF or DOS executable files
*.DAT = Data files (ASCII)
*.DCL = Dialog box definition files (ASCII)
*.DWG = Drawing files (AUTOCAD BINARY)
*.DXF=Drawing interchange files (ASCII)
*.HLP = Help files (ASCII)
*.IN = PulpSim generated input files (ASCII)
*.LSP = AutoLISP program files in protected mode (protected ASCII)
*.MET = Component properties file (ASCII)
*.MNL = AutoLISP functions associated with menu file
*.MNU = Menu source files (ASCII)
*.MNX = Menu compiled files (BINARY)
*.OUT = PulpSim generated output files (ASCII)
*.PLT = Plot output files (BINARY)
*.SCR = Command script files
*.SLD = Slide files (BINARY)
*.XDT = Information file for AutoLISP (ASCII)

APPENDIX 2
Pull-down menu structure

File	Assist	Construct	Modify	Display	Settings	Simulation
New...	Help Menu	Insert Equipment	Edit Parameters	Redraw	Go to POWER PLANT >	Calculate
Open...	Cancel	Process Line	Erase	Regen	User Components	Results
Save...	Undo	User Sets >	Move	Zoom Window	V SI Units	
Save As...	Redo		Rotate	Zoom Dynamic	US Units	
Export...	Matrix/Equipment viewer		Mirror Block(s)	Zoom Previous	Iteration Values	
Plot...	Pulpsim Status		Stretch Process Line	Zoom All	Precision for Result Boxes	
Drawing Utilities >	Check Connection		Remove all Result Boxes	Zoom Extents	V Show Points	
Options...	Check Layer		Scale	Zoom In 50 %		
About PSim...				Zoom Out 50%		
				Pan		
Exit Pulpsim						

APPENDIX 3
Troubleshooting

If the calculation halts and no out file exists, here are some possible reasons:

1) Error message: Key not found.
STOP PROGRAM

This message appears if you try PulpSim calculating without the hard lock. Insert it and try again.

2) You see the text Calculation started, but no iterations are made. Then your infile has probably a faulty parameter. You can check it by checking the Error File. It gives you clues what is wrong. The most common faulty parameter is that pressure value is zero in steam in block or there is no pulp = fiber in chips input.

3) If you get to the text screen message bad character in input field it means usually that all ingoing flows are not connected and there is a non-numeric character in infile. You have achieved this by pressing enter when some connection point (node) was not connected when calculation was started. Usually module or block that is not connected is shown dotted. To correct this you can erase it and insert it again. If our screen is so large that you do not notice the dotted equipment, go to results and see the in file. The row where the # mark is, shows in which block or module is the missing connection. Correct the problem as previously mentioned.

In all your problems and questions give us a call. Our on-line help numbers are:

? +358-2-7215105 or 04 Andreas Ramsay telefax +358-2-7215110

You can also ask and report bugs via email: Andreas.Ramsay@agco.fi

And see our PulpSim pages in Internet address: http://www.agco.fi/