

DWA-Software

Activated Sludge Expert

Software for Standard ATV-DVWK-A 131E
Dimensioning of single-stage activated sludge plants

2011



The German Association for Water, Wastewater and Waste (DWA) is strongly committed to the development of secure and sustainable water and waste management. As a politically and economically independent organisation it is professionally active in the field of water management, wastewater, waste and soil protection.

In Europe DWA is the association with the largest number of members within this field. Therefore it takes on a unique position in connection with professional competence regarding standardisation, professional training and information. The approximately 14,000 members represent specialists and executives from municipalities, universities, engineering offices, authorities and companies.

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1 Introduction

1.1 About Activated Sludge Expert

ACTIVATED SLUDGE EXPERT is a program which has been produced together with the ATV-DVWK Specialist Committees 2.5 and 2.6 for the dimensioning and recalculation of single-stage activated sludge plants in accordance with the Standard ATV-DVWK-A 131E.

ACTIVATED SLUDGE EXPERT offers you:

- complete conversion of all calculation steps of the ATV-DVWK Standard, checked by Specialist Committees 2.5 and 2.6.
- provision of the calculation in logical, mutually supporting steps with concurrent updating of the results.
- possibility of customizing output on both screen and printer.

Data input

ACTIVATED SLUDGE EXPERT contains, as essential element, a multiple page input dialogue. On the individual pages of this dialogue all values and options necessary for the calculation are given in mutually supporting steps. With this, the program matches the requirements of inputs to the selected plant configuration and the desired treatment target, i.e. only the details are ascertained which are relevant for the respective situation. All data can be corrected and modified at all times and without limitations. Following complete input of the calculation data, the results are presented in a freely configurable propositional area on the monitor screen.

Calculation

The calculation takes place simultaneously with the input. Within the input dialogue you receive, via an integrated performance evaluation system, continuously updated information on standard and limiting values. The performance evaluation system also indicates possible implausible data and transmits warnings or error signals when there are critical or inadmissible values.

Data storage

The data input and calculated can be saved at any time in files and read-in as required for renewed calculation.

Output of results

ACTIVATED SLUDGE EXPERT makes available to you an extremely powerful principle for the output of results. Presentation of the results takes place both on screen and also through the printer via template files in HTML format. You can modify these templates and thus the complete presentation to a wide extent in that you create your own templates or modify those provided. To this end you can employ expanded word processing programs or text and HTML editors. If you are interested in creating individual output templates we recommend studying the chapter "Adjustment of presentation of results" in this manual. Otherwise you can make use of the flexibility of the output by selecting a suitable template from those provided.

Data export

Through an export feature, which is also configurated by using templates, the entered and calculated data are provided for further processing with other programs.

Assistance

In addition to the Online-Manual the program is equipped with a detailed, context-oriented help function. This contains all information as well as statements from the ATV-DVWK Standard necessary for the understanding of input values.

Expandability

ACTIVATED SLUDGE EXPERT is a member of a series of programs that go beyond the scope of the worksheet Standard ATV-DVWK-A 131 and offers calculations as for example alternative models and additional components like aeration systems and membrane stages.

1.2 Using this manual

This manual offers a comprehensive introduction into the operation and handling of the ACTIVATED SLUDGE EXPERT programm. For this, solely basic knowledge of the handling of important functions of the Windows operating system, such as, for example, dealing with directories and files, is presumed.

The manual does *not* include the description in substance of Standard ATV-DVWK-A 131E. Supplementary information on further statements by the committees and on the special features of the calculation, which result from the technicalities of the conversion of the program can be found in the chapter "Implementation of calculations" and in the integrated Online Help.

The following typography is employed (as examples):

■ **File | Open:** Menu items or submenus are separated from the above-lying main menu by a vertical line.

■ **ACTIVATED SLUDGE EXPERT:** Internal program names such as, for example, variable identifiers and program functions.

Should the examples from the manual not be completely identical with the status of the program supplied, this is not an error, but rather the result of an updating of the program or of the example.

1.3 User support

The following are available in the Internet as free information sources:

Answers to frequently asked questions and information on updates and supplements under

www.dwa.de

www.software.gfroese.de/

Proposals for improvement and information on possible program errors can be sent to the E-mail address:

bexpert@gfroese.de

In urgent cases you can call the telephone hotline:

+49 531 8661115

2 Installation

2.1 Prerequisites for operation

The computer, on which ACTIVATED SLUDGE EXPERT should be installed, must meet the following minimum requirements:

Processor: Pentium ® performance class with 100 MHz clock pulse frequency

Main memory: 32 MB

Free hard disk storage capacity: 7 MB

CD-ROM

Graphics: Resolution 800*600 Pixel, min. 256 colours (recommended: 64k colours)

Mouse: trackball or similar pointer

For the installation and operation of the program you should have available basic knowledge of handling the operating system.

Otherwise, ACTIVATED SLUDGE EXPERT has a comprehensive integrated manual as well as a context-oriented help system.

2.2 Carrying out installation

To install ACTIVATED SLUDGE EXPERT on your PC insert the program CD in your CD drive (e.g. drive D:) and select **Start | Execute | Search**. While searching you go to the drive letter of the CD drive (e.g. D:), according to the Windows directory structure, and select SETUP using double click.

The program and all necessary files are now copied on to the hard disk with the help of the installation program.

ACTIVATED SLUDGE EXPERT can be used immediately.

In order to get to know the program we recommend to carry out the steps in the following chapters. If you wish to start immediately with a new calculation then select the chapters from the contents list which are of interest to you or simply follow the integrated support function.

We wish you success with ACTIVATED SLUDGE EXPERT.

2.3 Registration

The program is generally delivered in a functionally limited evaluation version. In order to use the full functionality of the program, you need to purchase a license which has to be activated on your computer. Proceed as follows:

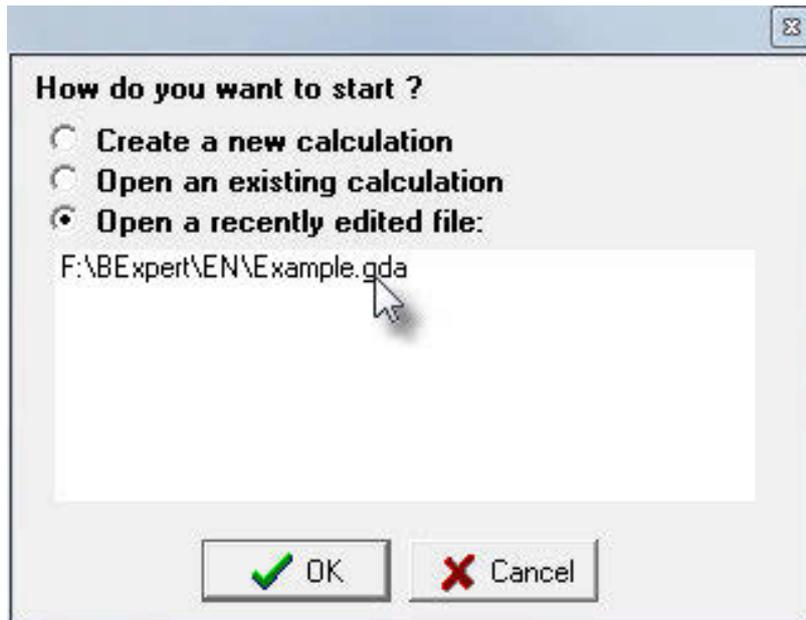
- Start the program on the computer on which you want to activate the ACTIVATED SLUDGE EXPERT license
- Call up the menu function **Help | Registration** and choose **Register now...** in the registration dialogue
- Follow the instructions given there

3 A quick walk through

Probably the simplest way to get to know ACTIVATED SLUDGE EXPERT in its most important functions is to go through the example provided.

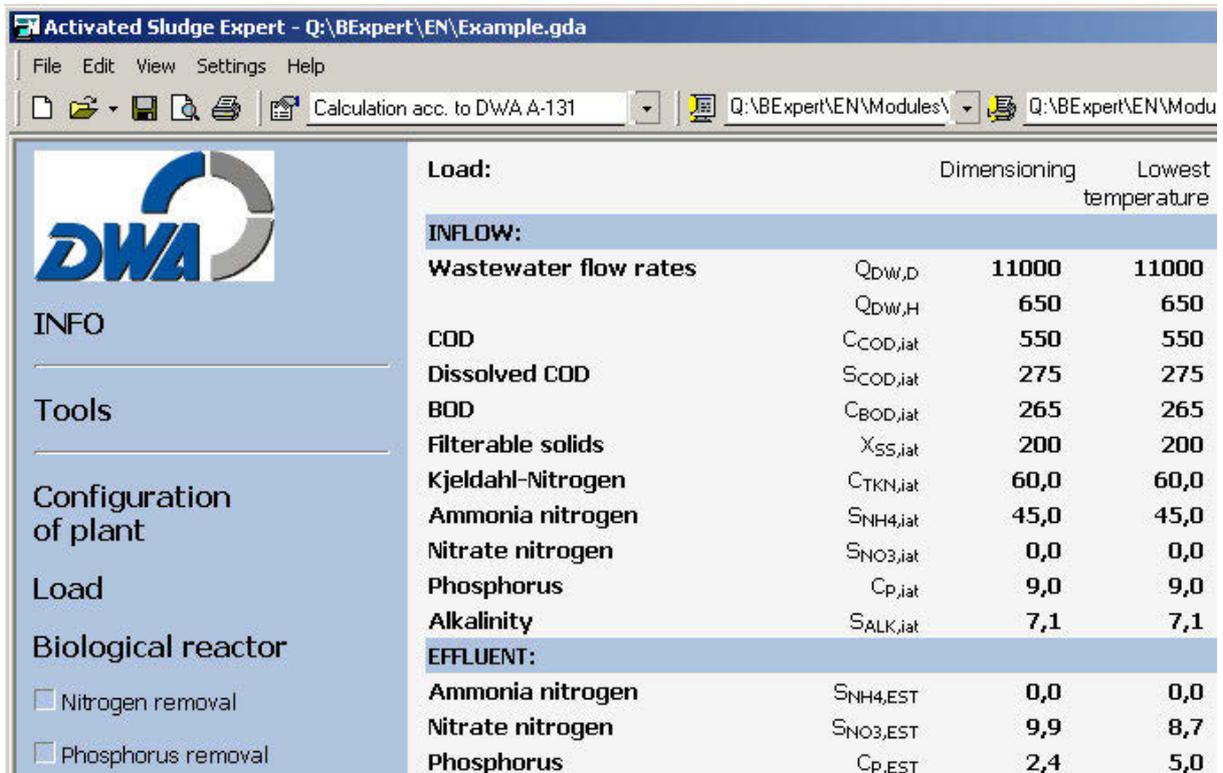
Proceed as follows:

Start ACTIVATED SLUDGE EXPERT and, in the open dialogue, click on the file ...\Example.gda in the list of recently edited files. Confirm your selection with OK.



You are taken into the dialogue **Open file**. There click on the file **example.gda**.

After reading the file the standard output page for a complete calculation example with three load cases appears, here an extract therefrom:



The screenshot shows the 'Activated Sludge Expert' software window. The title bar reads 'Activated Sludge Expert - Q:\BExpert\EN\Example.gda'. The menu bar includes 'File', 'Edit', 'View', 'Settings', and 'Help'. The toolbar contains icons for file operations and a dropdown menu showing 'Calculation acc. to DWA A-131'. The main window is divided into a left sidebar and a main content area. The sidebar contains a 'DWA' logo, 'INFO', 'Tools', 'Configuration of plant', 'Load', and 'Biological reactor' sections. The 'Load' section has two checkboxes: 'Nitrogen removal' and 'Phosphorus removal', both of which are unchecked. The main content area displays a table with the following data:

Load:	Dimensioning	Lowest temperature
INFLOW:		
Wastewater flow rates	Q _{DW,D}	11000
	Q _{DW,H}	650
COD	C _{COD,iat}	550
Dissolved COD	S _{COD,iat}	275
BOD	C _{BOD,iat}	265
Filterable solids	X _{SS,iat}	200
Kjeldahl-Nitrogen	C _{TKN,iat}	60,0
Ammonia nitrogen	S _{NH4,iat}	45,0
Nitrate nitrogen	S _{NO3,iat}	0,0
Phosphorus	C _{P,iat}	9,0
Alkalinity	S _{ALK,iat}	7,1
EFFLUENT:		
Ammonia nitrogen	S _{NH4,EST}	0,0
Nitrate nitrogen	S _{NO3,EST}	9,9
Phosphorus	C _{P,EST}	2,4

On the right-hand side are presented in columns the values entered and calculated for the individual load cases. With the aid of the scroll bars you can displace the visible part of the output page and thus view all results.

On the left-hand side you will see a list of various entries. If you move the mouse pointer over the underlined text lines a hand appears as "mouse pointer", as you will probably recognise from applications such as, for example, your Internet browser. If you click on

Load

for example, the program leads you to the appropriate page of the main input dialogue, here to Page 5 with the loading data for the dimensioning load case.

Calculation acc. to A-131 - Page 5

Dimensioning load

Flow rates

Average daily dry weather flow $Q_{DW,d}$ m³/d
 Hourly dry weather flow $Q_{DW,h}$ m³/h Wet weather $Q_{WW,h}$ m³/h

Concentrations

Chemical Oxygen Demand $C_{COD,IAT}$ mg/l
 Dissolved Chem. Ox. Demand $S_{COD,IAT}$ mg/l
 Biochemical Oxygen Demand $C_{BOD,IAT}$ mg/l
 Filterable solids (0,45 μ m) $X_{SS,IAT}$ mg/l
 Total Kjeldahl-Nitrogen $C_{TKN,IAT}$ mg/l
 Ammonia nitrogen $S_{NH4,IAT}$ mg/l
 Nitrate nitrogen $S_{NO3,IAT}$ mg/l
 Total phosphorus C_P,IAT mg/l
 Alkalinity $S_{ALK,IAT}$ mmol/l

Peak factors use standard values

Peak factor for carbon respiration f_C
 Peak factor for ammonium oxidation f_N

Temperature

Temperature in the biological reactor T °C

At the bottom edge of the dialogue window you see buttons which make it possible for you to browse the pages of the input dialogue:



browse forwards to the next page of the dialogue,



browse backwards



quit the dialogue without data acceptance,



accept the data (if required modified) into the output sheet.

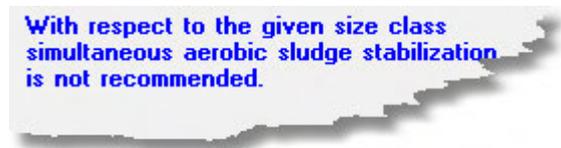
Within one page you move from field to field using a mouse click or by operating the tab-key. Using the input key or by leaving a field, confirm the value entered and force the program to carry out a check of the inputs as well as a completely new calculation.

In order to test the reaction of the program you should modify various values and, with this, deliberately make errors. For example, specify for the ammonium nitrogen in the influent a higher value than for the Kjeldahl nitrogen then, if you confirm the inputs using the input key, you obtain the following message:



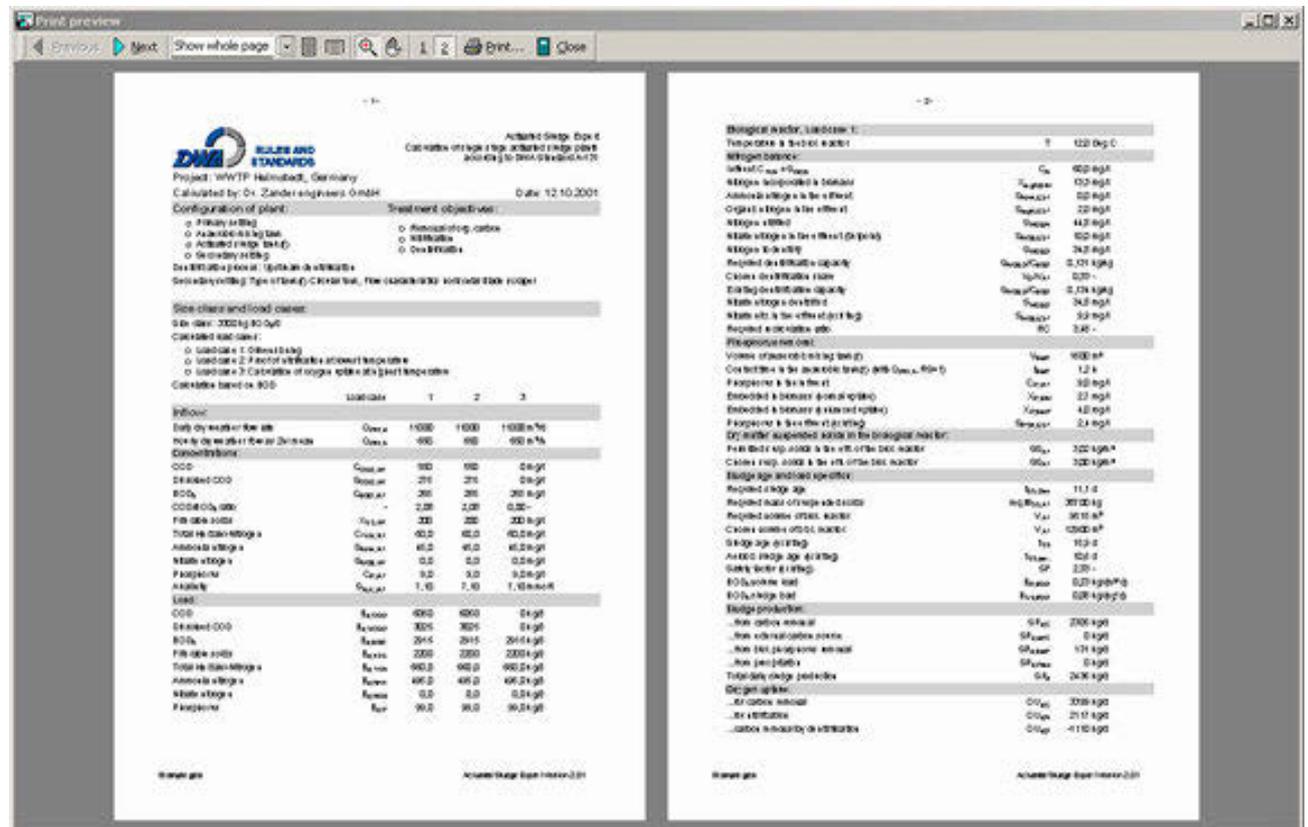
The red text colour signals that you are concerned with a serious fault which must, in any case, be corrected. Serious faults are also indicated by a red background of the input fields, if for example the value entered exceeds or undercuts limiting values.

In addition to such information on serious faults, you also receive warnings if a non-recommended combination of input data has been selected or a value entered exceeds or undercuts the allocated guidance values. If, for example, you give a size class of over 6000 kg BOD_d/d and select the treatment objective "Aerobic sludge stabilisation", a message appears that this constellation is not recommended. The text colour is blue to indicate that one is here not concerned with a serious fault but with a warning which, under certain circumstances, can also be ignored. Warnings which clearly refer to a certain input field are also given with a yellow background of the field concerned.



In order to take over the modified data in the output sheet press the box OK. If, on the other hand, you wish to reject all changes, press Quit. In both cases the input dialogue is closed.

Now click on to the symbol  in the symbol bar or select the menu function File | Print preview. After that you see the results in a multi-page representation which corresponds exactly with the output on the printer.



With the help of the buttons **Previous** and **Next** you can browse the output. Via other buttons you can modify the size and position of the displayed pages. If you have a printer connected you can print, completely or in part, via **Print....**With **Close** you end the printer preview and return to the standard display.

The printer output is based on the "Standard" printer template and is only one of several possibilities. As further printer templates, which essentially are considered as brief result overviews, "ASTank", "FinalClar" and "COD" are available. Set the desired template as you "open up" the right-hand selection list in the symbol bar and select the appropriate description from the list.

You can also print out the results as they are to be seen in the standard output sheet on the display. To this end click on to the symbol  or select the menu function **File | Templates | Printer output**. In the dialogue "Select printer template" give "HTML files" as file type and "StdTable.htm" as file name and then click on to **Open**.

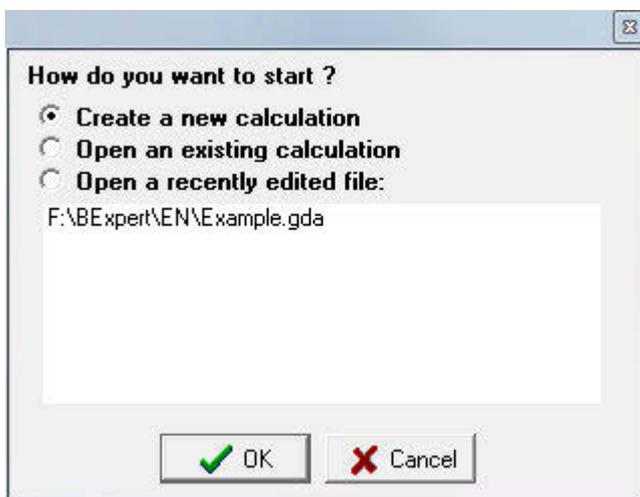
If you again call up printer preview you see the results in the presentation which corresponds with the template applied.

4 Operation

4.1 Opening dialogue

After the start of ACTIVATED SLUDGE EXPERT the opening dialogue appears in which you can select from **three** possibilities:

- █ Clicking on **Create a new calculation** and confirming with **OK** takes you into the input dialogue. Follow the descriptions given there.
- █ Clicking on **Open an existing calculation** and confirming with **OK** leads you into the dialogue **Open file**. You now have the possibility of searching within your directory structure for an existing ACTIVATED SLUDGE EXPERT file. You can find information in the description of the menu file.
- █ If you click on a filename in the list of the last edited files, the file will be read and the main programme window with the output sheet will be shown
- █ Cancel



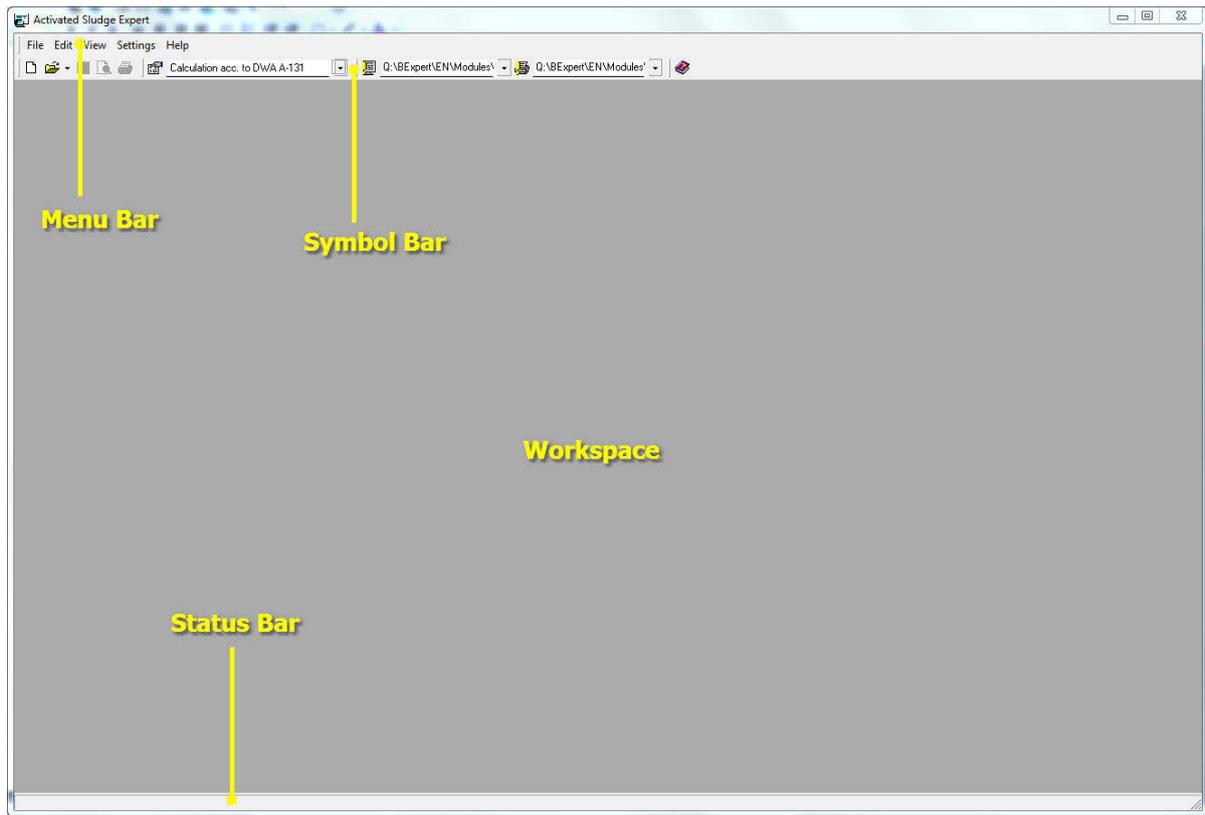
4.2 Screen layout

The user interface of ACTIVATED SLUDGE EXPERT is typical for many Windows programs:

- █ menu bar
- █ symbol bar
- █ status bars and
- █ working area,

the latter is represented in the following diagram without a result page – corresponding to the status with a new start of ACTIVATED SLUDGE EXPERT following the input of Quit in the opening dialogue.

In the headline (Windows program bar) the program name and, if available, the designation of the opened file appears.

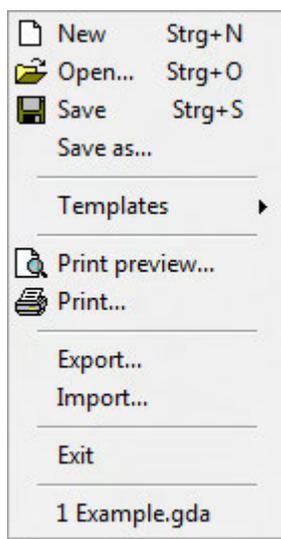


4.3 Menu functions

4.3.1 Menu "File"

The submenu items in the menu **File** are presented briefly below. The typical characteristics for ACTIVATED SLUDGE EXPERT are explained in detail in the chapters reserved for these.

The items are, in part, labelled using symbols, which you can find in the symbol bar. Behind some menu items, key combinations are given with which you can activate the relevant function at any time (e.g. **Ctrl+N** to create a new file).



The submenu presented here contains all menu items in black letters. This is the case if a file is opened or a new calculation is fully created with the aid of the input dialogue. If no calculation data are available, e.g. after program start, then the non-selectable points are indicated in grey.

File | New

By calling up this function you create a new calculation with the help of the **Input dialogues**. If a calculation is already opened and modified, then you will be asked with the following dialogue, whether the existing changes are to be saved:



Confirm with Yes, thus opening a window **Save File**, in which you can specify a file name. If here you select the function Quit instead of a file name, then the file is *not* saved!

With the selection of No the existing data are not saved.

Selection of Quit returns you to the original display.

File | Open

Open an existing calculation file for renewed processing or for output of results on the screen and on the printer. If a file is already opened and modified, here also a dialogue for the saving of the modified results appears place as under **File | New**.

File | Save

All inputs and results of the current calculation are saved in a calculation file. If no file name has been determined for the current file a call-up of the dialogue field **Save File** takes place automatically, otherwise the saved results are overwritten and the old file name is retained.

File | Save As...

Corresponds with the function Save. However, first a file name is requested via a dialogue window. You also call up this function if a file name already exists for the current file, but you wish to save the file under another name for later modification.

File | Templates >

Templates for the output of results on the screen or printer can be selected via further submenus:

The submenu items **Screen output...**, **Printer output...** and **Export...** lead to the respective dialogue boxes for the selection of the template files. These function are described in detail in the chapter template Files.

File | Print Preview

You obtain a complete preview of the printer results (WYSIWYG) according to the selected printer template. The functions of the print preview are explained in more detail in the chapter Print Preview.

File | Print

The results of the calculation are printed out on the printer using the selected printer template.

File | Export

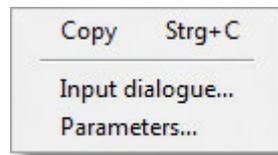
The results of the calculation will be written to the file using the selected export template. Before, a filename is requested via a dialogue window. The pre-installed file ending corresponds with the format of the current template; it should be maintained to avoid format problems with the further processing of the exported data with other programs.

File | Exit

The program is terminated.



The files saved most recently appear in the menu (here for example, **File Test0205.gda**), which you can open immediately by clicking on.

4.3.2 Menu “Edit”**Edit | Copy**

Areas in the output sheet can be marked (high-lighted) and the contents copied to clipboard using Edit | Copy . A transfer from the fields of the input dialogue is not possible.

Edit | Input dialogue...

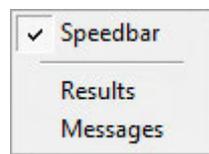
Calls up the main input dialogue to show or edit the dimensioning data

Edit | Parameters...

Calls up the parameter dialogue to show or edit the parameters of the calculation formulas.

4.3.3 Menu “View”

ACTIVATED SLUDGE EXPERT allows the following variants of screen output:

**View | Speedbar**

Turn display of the speedbar on or off.

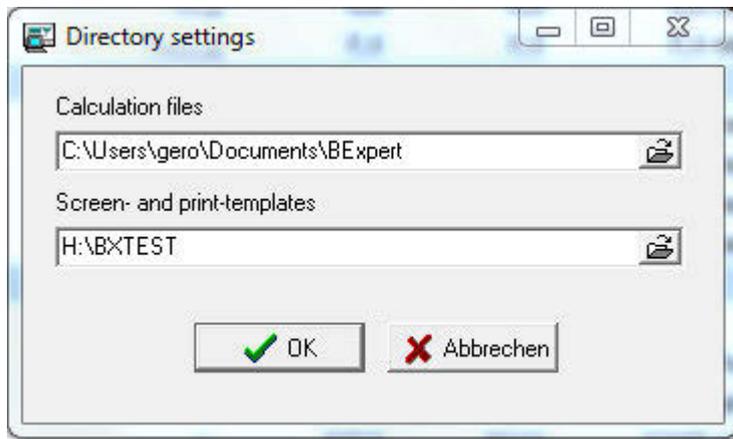
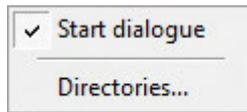
View | Results

Show the results of the current calculation. The design and formatting of the output corresponds to the selected screen template.

View | Messages

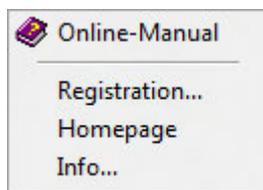
Show summary of messages related to the current calculation.

4.3.4 Menu Settings



4.3.5 Menu "Help"

ACTIVATED SLUDGE EXPERT has an efficient help function. This is integrated into the Windows Help and can be handled in the same way.



Help | Online-Manual

This function leads to this Online Manual.

Help | Registration

Help | Homepage

"Homepage" leads you to the internet homepage of the program (if you have an internet connection).

Help | Info...

The menu item Info opens a window showing program version, copyright and registration data.

4.4 Symbol bar

4.4.1 Using the symbol bar

As an alternative to a menu selection you can also call up some functions via the symbol bar. This consists of several sub-bars in which symbols, which logically belong together, are arranged together.

The sub-bars can be placed as desired on the screen surface by “capturing” the marked grips at the left-hand edge by clicking on using the mouse and keeping the key pressed and moving the bar to the desired position.



If this position is outside the area of the symbol bar, the bar appears as a normal window. You can return the displaced symbol bar to its original position at any time.

4.4.2 Description of the symbols

The symbol bar contains the same symbols and functions which you know from the descriptions of the menu functions.

A direct access to the first page of the input dialogue can be obtained via



(explanation in the chapter “Input Dialogue”)

In addition, the symbol bar contains selection menus on the available and the currently active screen and printer templates.

Selection of the screen template:



You can click on the symbol and obtain a file selection dialogue. Here you can select between the following types of file:

- screen templates (*.gst)
- HTML files
- all files.

More detailed explanation on the types of file can be found in the chapter “Adjustment of the Output”.

You can also select the template files existing in the program directory, via a selection list which you obtain following clicking on the small arrow. The list contains all *.gst files.

Selection of the printer template:



The selection of the printer template functions in the same way as the screen template, that is either via the file selection dialogue or via the folded-out selection list with ***.gpt files**.

4.5 Data input

4.5.1 General

The input and/or processing of the calculation data takes place via two dialogue windows:

- Main Input Dialogue (design data)
- Parameter Dialogue (parameters of the calculation model)

In the usual case you will work almost exclusively using the main input dialogue, in order to enter and/or modify your data and thus produce your calculation interactively. The parameter dialogue, on the other hand, contains data which are more or less laid down in the Standard and are therefore to be modified only in special situations.

4.5.2 Main input dialogue

4.5.2.1 Structure and management

In all, the main input dialogue covers 19 pages which are broken down into the following sections:

- general specifications on documentation and control of the calculating operation.
- process selection
- load
- calculation of the final clarifier
- calculation of the biological reactor (aeration tank)

As the pages, in substance, are structured on each other it is recommended that they are processed in the given sequence. In some situations it can, nevertheless, be necessary to go back one or more pages as, for example, in the course of the calculation, other limiting values have appeared and an appropriate correction of already entered values is sensible or even necessary. In such cases you receive appropriate information. In addition, modifications of certain values can influence the correction of input values on other pages. In particular after modification of the treatment objectives or of the technical process specifications, you should therefore check all pages for possible warnings or error messages (example: through a change of the type of scraper, specifications for the scraper can be missing or inadmissible).

Please note also, that the program only demands the values which are required for the selected calculation run. This means that, depending on the treatment objectives and the technical process specifications, these can be shielded on certain pages and that, in addition, the content of the pages varies. If, for example, you have selected an inverse cone or hopper-bottom tank for the secondary settling facility the page "scraper" does not appear.

With the help of the input dialogue you can both create a new calculation and also process an existing calculation again.

In order to process an existing calculation you can deliberately call up individual pages of the dialogue – for this purpose a "Navigation bar" is available in the screen template **Standard.gst**.

With the creation of a new calculation you must "work through" the dialogue completely in order to ensure that the data required for the calculation has been entered completely.

The structure of individual pages of the input dialogue is matched to the contents of the input fields, these in turn are grouped by subject into input areas. With this, there is a fundamentally even distribution for all dialogue pages:

Calculation acc. to A-131 - Page 10

Secondary settling - Dimension of tank

Circular tank

Input area		
Number of tanks a	Diameter of tank d_{ST}	Depth of tank over 2/3 radius h_{ST}
Chosen: <input type="text" value="2"/>	Required: 28,07 m Chosen: <input type="text" value="32"/> m	Required: 3,61 m Chosen: <input type="text" value="3,61"/> m
	Diameter of stilling drum d_{SD}	Depth of inlet h_{in}
	Chosen: <input type="text" value="3"/> m	Rule value: 2,20 m Chosen: <input type="text" value="2,5"/> m

Result area

2/3 Radius	
Clear water zone (h1)	0,50 m
Return flow/separation zone (h2)	1,44 m
Density flow/storage zone (h3)	0,61 m
Thickening/removal zone (h4)	1,07 m

Output field

The chosen surface area $A_{ST} = 1608 \text{ m}^2$ leads to a surface overflow rate $q_A = 1,03 \text{ m/h}$ and a sludge volume load $q_{SV} = 385 \text{ l/(m}^2\cdot\text{h)}$

Messages

The permitted sludge volume load of $q_{SV} = 500 \text{ l/(m}^2\cdot\text{h)}$ is kept.

Cancel Previous Next OK

The areas highlighted in light blue contain Input Fields, which are collected together by subject with a title to input areas (in the example above "circular tank"). The different types of input field are explained in the following chapter.

Grey highlighted areas are reserved for Messages and Results. There, if required, you obtain information from the evaluation module of ACTIVATED SLUDGE EXPERT. Should the message text exceed the size of the area, scroll bars typical for windows appear at the edges. The image section can be adjusted using these.

In the lower area you see the operator elements for working through the complete input dialogue.

4.5.2.2 Control elements

At the lower edge of the dialogue field you see boxes, which permit you to browse through the pages of the dialogue and to close the dialogue with or without data acceptance:



browses forward to the next page of the dialogue,



browses backwards,



closes the dialogue without data acceptance,



closes the dialogue with data acceptance.

With a new calculation (File | New) the box "OK" is missing. Instead of this there is the box "Finish" on the last page of the dialogue. Through this it is to be prevented that you close the dialogue before all pages have been processed. From the functional aspect "Finish" corresponds with the box OK.



4.5.2.3 Input fields

The main input dialogue contains various types of input field:

Numerical input fields

Numbers are entered normally in white highlighted blocks. Only numbers and the decimal point are accepted. You can move the cursor in the field using the Control key <- (Left) and -> (Right).

Average daily dry weather flow Q_d 11000 m³/d

Input into the field is considered as a valid acceptance if the Enter key is pressed or if field is left using the Tabulator key or the mouse pointer.

The background colour of the numerical fields may be modified from the program:

- yellow with a guidance value violation, as presented in the example of the volume for the anaerobic mixing tank (Page 14 of the input dialogue):

Volume
Rule value: 650 - 975 m³
Chosen: 1600 m³

- red with a warning initiating limiting value violation, as shown in the example of the volume of the biological reactor (Page 14 of the input dialogue):

Activated sludge tank

Volume V_{AT}

Minimum: 9515 m³

Chosen: 9000 m³

- grey, if the filling-in of a value is undertaken by the program, e.g. with the selection of "Use standard values" (peak factors on Page 5 of the input dialogue). An explicit representation of the value is not given as this first results with later calculation.

Peak factors use standard values

Peak factor for carbon respiration f_C 1.15

Peak factor for ammonium oxidation f_N 1.7

Text input fields

All representable symbols are accepted. Text inputs are to be found only on the first page of the input dialogue for project designation.

Options and selection fields

As usual, option fields allow to choose one or more **yes/no** specifications. The example shows the selection of the "Treatment objectives" on Page 2 of the input dialogue.

Carbon removal +

Nitrification

Denitrification

Aerobic sludge stabilization

If a selected option includes another, this is taken into account automatically by the program.

Note:

A special type of option fields are the fields "use standard values" and "copy from dimensioning load case" on the dialogues for the loading cases. The effect of the field "use standard values" has already been illustrated by the field colours.

The marking of the field "copy from dimensioning load case" has the effect that, in the subsequent group of input fields, the appropriate value is adopted from the loading case (see Page 5 of the input dialogue).

If one of these numerical values is modified, ACTIVATED SLUDGE EXPERT automatically cancels the tick in the option field in order to signal that now the values from the dimensioning case are no longer *automatically* adopted in the appropriate input area. The previously adopted and unmodified values, however, remain as they are. If one activates the option field again through a tick, the adoption of the numerical value from the dimensioning case takes place again.

"Radio button" groups and drop down lists are used to make an alternative selection of settings.

In the following example (Page 1 of the input dialogue) one can select between the alternatives **Concentration input** and **Load input**. The last pressed button in a group remains valid.



Another example (Page 2 of the input dialogue) shows two drop down list fields to choose a type of tank for the final clarifier tank and the type of scraper. In this example the field scraper type follows the specifications in the field Type of tank. Thus, with the selection of a hopper-bottom tank, for logical reasons a selection of a scraper type is no longer possible.

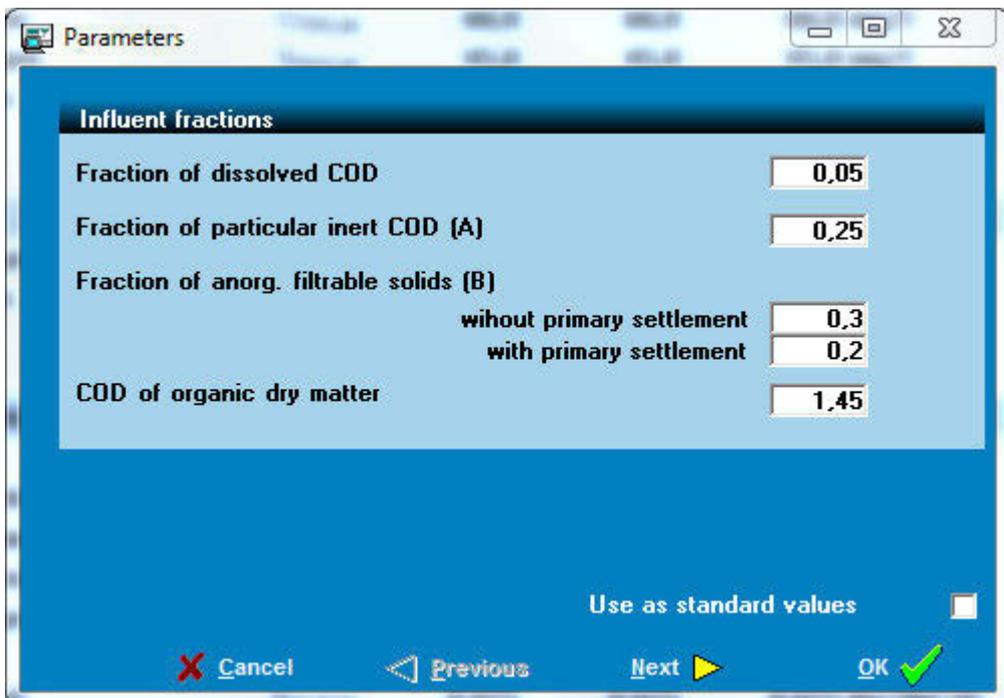


4.5.3 Parameter dialogue

Via the menu function View | Parameters



a dialogue window appears for the modification of the parameters defined in Standard ATV-DVWK-A 131E for nitrogen and phosphorus incorporation into the biomass as well as for COD balancing:



The handling of the input fields corresponds with the main input dialogue. Please note that modified parameters have an influence only on *all* subsequent *newly created* calculations. Existing calculations are *not* changed through the parameter modification – not even following recent conclusion of the input dialogue using OK.

A listing of Parameters can be found in the Variables list in the appendix.

4.6 Data import

Via the import feature data can be imported from other programs. The data should be provided in the following format (CSV-format, e.g. from Excel):

Project;central wastewater treatment plant model village

BDBSB;5555

QD;22222

QT;1234

When importing the files, the variables bearing the value Project will be worth (text) "central wastewater treatment plant model village", the variable "BDBSB" will be worth "5555" etc.

As in the input dialogue the list of variables does not have to be complete, also a subset of the needed requirements can be imported. The other values processed by ACTIVATED SLUDGE EXPERT are filled with their default settings (generally zero) unless input is given.

4.7 Data export

With the export feature the input values and results can be written in a file. This feature enables the user to further processing the ACTIVATED SLUDGE EXPERT data with other programs. Feature operation corresponds largely with the print function. For data export, templates are used which can be modified or replaced by the user as needed. Data export as well as printer output is therefore configurable within wide limits. Details for creation or modification of templates are described in the chapter "Adjustment of presentation of results". Standard delivery contains the screen template "standard.gxt". An export using this template creates a file which corresponds largely to the printer output of the printer template „standard.gpt“.

4.8 Carrying out calculations

During the processing of the pages of the main input dialogue the program respectively carries out a complete calculation as well as an updating of messages and intermediate results if you leave an input field or press the input key within an input field.

This calculation, with regard to scope and the procedure, keeps strictly to the definitions in Standard ATV-DVWK-A 131E. In the case of unclear points you should therefore check the situation based on the Standard. In addition, the context-oriented help system is available at any time.

Several points which, in part, result from frequently asked questions from users, in part from peculiarities of the technical program translation of the Standard and, in addition, result from extensive determinations by the specialist committee, are to be examined in detail below, referred to the dialogue pages.

Page 3 (Process specification)

The scope of the calculation with regard to step-feed denitrification corresponds with the Standard. For the calculation of the average mixed liquor suspended solids (SS_{AT}) in step-feed denitrification the following formulations are employed:

two-step cascade: $SS_{AT} = 1.14 * SS_{EAT}$

three- and more step cascade: $SS_{AT} = 1.2 * SS_{EAT}$

The statement whether a primary settling stage is present or not serves exclusively for the calculation of the inorganic component in the filterable substances of the influent. This component is required for the COD balance.

Pages 5-8 (Loading)

The influent concentration or influent loading rates refer to the influent to the biological stage.

In case no measured values exist for the peak factor there is a possibility of calculating the program standard values in accordance with Table 8 of the Standard. For this, activate the appropriate option. As the peak factors can be dependent on the sludge age, the calculation is only possible after the sludge age has been laid down. This prerequisite, in the process of the calculation, is still not met with the processing of the loading data. The input fields are therefore underlined in grey and their content is without significance. If measured values are available deactivate the option "Use standard values" and enter the measured values into the fields.

Page 9 (Return sludge and concentration of suspended solids)

In order to make possible a check of existing secondary settling tanks, the quantity of influent is given independent of the existing amount of (combined) wastewater. The designation "(proportional) amount of influent" is to draw attention to this possibility. With a check, the amount of influent is to be so selected that the various limiting values (surface overflow rate, sludge volume surface loading rate) are maintained.

Pages 9 and 10 (Calculation of the secondary settling facility; general)

The program automatically calculates the type of flow (horizontal, vertical or transition area) from the selected tank geometry. As various limiting values are dependent on the type of flow, displacement of limiting values can occur in the course of the calculation which require or make sensible a modification of certain input data. In such situations you receive appropriate information. The program cannot carry out the necessary modifications automatically as, in each case, several input values are involved and a suitable constellation can be derived only from planning considerations.

In the case of a hopper-bottomed tank, the depth of the tank cannot be given directly. In order to achieve a certain tank depth the tank diameter and the cone slope are to be varied.

Page 11 (Scrapers)

This page is not visible if the selected tank has no scraper (hopper-bottomed tank) or one is concerned with a suction dredge.

Page 12 (Nitrogen balance)

The option "External C-Dosing" is only offered if the denitrification part has the maximum value (50 %) and the calculated nitrate effluent value exceed the design value.

Page 13 (Phosphorus removal)

The guidance values for the volume of an anaerobic combined tank are based on the contact time of from 0.5 h to 0.75 h with dry weather inflow and a return sludge ratio $RS = 1$.

5 Customization of output

5.1 Basic functions

Specifications

A particular strength of ACTIVATED SLUDGE EXPERT is the flexibility in the presentation of the output of results. Doubtless, you will first carry out your tasks using the specification file provided. However, in case you wish to integrate your firm's logo or plant-specific pictures into the output, or wish to carry out additional calculation steps, an individual tailoring of the output formats will be unavoidable.

For output on the screen and printer use the program template files (s. chapter Menu File). The output of the result report is designated as Report below. It takes place via a so-called report generator, which interprets the instructions on format and content of the result report contained in the template file and produces the actual output accordingly.

To differentiate between screen template and printer template, the file endings **".gst"** and **".gpt"** are used respectively. In both cases one is concerned with files in the internationally normal **HTML** format. HTML means *Hypertext Markup Language* and is a page description language. It consists of instructions where and in which format something is to be arranged on one page. The format is standard for the exchange of information in the Internet.

As HTML files are pure text files they can be considered and modified using all text editors such as, for example Notepad. Users without HTML experience are, however, recommended to use "normal" word processing programs for the creation and processing of the appropriate files. All common Office Programs such as Microsoft Office from Version 97, StarOffice 5.1, as well as programs of other offers, support the saving of the data input as HTML file.

With this an individual design of the template files, even without knowledge of HTML is possible without difficulty.

Experienced users will probably use a special "HTML editor" for an effective utilisation of the HTML format. HTML editors are a component part of Internet browsers (Netscape, Internet Explorer, StarOffice, etc.). Every simple text editor or the HTML kit provided can also be used. In this way it is ensured that the desired presentation is achieved and not modified or limited through the formatting of other programs.

Essentially the template files contain:

- formatting instructions e.g. for the arrangement of the background and the font type,
- formatting instructions for lists and tables,
- instructions for the input of graphics, e.g. for logos, diagrams or photos,
- instructions for the input of specifications and results of the calculation.

In order to make possible the insertion of input values and calculation results, the program makes these available as variables. The variables can be reached under their name and can be formatted individually. The procedure is demonstrated using the following example.

Variables examples

In the case of a numerical variable the value is entered in the output text in that one writes the variable identifiers, the desired number of digits and the number of the places after the decimal point in the template. In order to make the complete object recognisable as an input position, it is framed with vertical strokes "|". (Note: the vertical stroke can be produced on a German keyboard layout via the key combination **< + Alt Gr.**)

For example, the character string **|QDWD,5,0|** in the template, causes the value of the average dry weather inflow quantity (variable identifier "QDWD" according to the variable list) in the output to appear with, in all, 5 places and without places after the decimal point.

If one is concerned with a text variable, which contains text as a value, then one uses the same spelling. Instead of the number of places and places after the decimal point a certain part of the text can, however, be selected via both numerical inputs. With the first figure after the variable identifier it is indicated how many characters of the text are to be given; the start position in the text can be determined using the second figure.

Two examples as illustration:

The project designation is to be output using the variable identifier "PROJECT". The output is to have a max. of 40 characters. Then the following must be in the template:

|PROJECT,40,0|

In order to print the month and the year of the calculation, in the template write:

|DATE,7,4|

Using the figure "7" you arrange that the output includes a maximum of 7 characters, the "4" causes the output to begin with the fourth character. This means that details of the day in the date are skipped.

5.2 Example Printer Template 1

The aim in this very simple example is to produce a small table of the relevant quantities of water. This table is, in each line, to contain designations for the value, the value itself and the unit and to have roughly the following appearance (to begin with, the character strings xxxxxx, yyyy and zzzz substitute for a figure to be inserted later):

average daily wastewater flow with dry weather:	xxxxxx	m ³ /d
dry weather flow in 2 h peaks:	yyyy	m ³ /d
stormwater flow:	zzzz	m ³ /h

Note: in this example it is assumed that Microsoft Word is being used as word processing program.

Step 1:

Start Word and write the text which is to appear in the table. Between the designations, which "stand in" for the numerical values and the units, for practical purposes, introduce a tab sign; close the individual lines of the table using a paragraph separator (in Word: Input).

Mark the complete text and then, in Word, call up the menu function **Table | Convert text in table**. The adjustment dialogue which appears after this can be confirmed without modification using "OK", if you have used the tab and line-end characters as described.

Tables produced using Word can – if you are familiar with the formatting functions of the text program – now still be enhanced as desired. If the desired appearance has been achieved, call up the menu function **File | Save as HTML**. Specify your choice of file name in order to save your file in "HTML" format. You may ignore the notice warning of possible loss of certain formatting characters with the use of the HTML format.

Then close the file (**File | Close**), in order to enable access to other applications. However, leave Word active as application.

Step 2:

Start ACTIVATED SLUDGE EXPERT and open any calculation using **File | Open**. Then call up the menu function **File | template | Printer output** and select in the file selection dialogue your table saved with Word. As Word uses the ending ".HTML" as a standard, set "HTML Files" as file type. After ACTIVATED SLUDGE EXPERT has read the file call up the print preview **File | Print Preview**.

As result a table is to be seen which has (approximately) the appearance of your Word table. "Approximately" as, through the HTML format, possibly some of the finer details of the formatting are lost (this is the reason for the warning notice which Word issues when saving). Therefore, you should avoid particularly "exotic" layouts; HTML should, nevertheless, offer sufficient arrangement possibilities in each case.

However, overall the result appears unsatisfactory as, instead of the desired numerical value, the substitutes xxxxxx, yyyy etc. only appear in the table. This problem is removed in the next step. However, before this, please close the print preview.

Step 3:

Change to Word (which hopefully you have not closed after Step 1, otherwise you have to restart the program) and open your file again which, in all probability, is at the top of the list of most recently processed files.

Now search in the ACTIVATED SLUDGE EXPERT variable list for the code designations of the variables whose values you wish to enter into the table, in which the average daily quantity of wastewater has, for example, the code designation "QDWD". In place of the substitute "xxxxxx" now write "[QDWD,6,0]" in the table. Please do not type the inverted commas they serve here solely for the marking of a character string. On the other hand, as you have already discovered, the "vertical strokes" and the beginning and end of a chain are important. Insertion means that the value of the variable "QDWD" with, in all, 6 valid digits of which there are 0 places after the decimal point. Proceed with the other insertion positions in the same manner and finally resave. As opposed to the original saving this time calling up the menu function Save surfaces – Word, in the meantime, has noticed that it is concerned here with a HTML file and automatically applies this format. Do not forget to close the file in Word.

Step 4:

Change to ACTIVATED SLUDGE EXPERT, again read in the file as printer template and call up the print preview (see Step 2). If you have carried out everything correctly the current values for the water quantities must now appear in the table.

Step 5:

At this point you could well ask whether it would not be simpler to adopt the figures by simply typing them into a Word document. The answer is: **YES**.

However, you have to be reasonable and take into account that here you are concerned with an extremely simple example with very limited value for repeated application.

Normally printer templates are considerably more complicated and serve, for example, to give the calculation results a common appearance for the purpose of easy orientation and/or to position the firm's logo in the printout. Perhaps you want to make the templates available also in Intranet. In any case, practically all the design possibilities of the page description language "HTML" are available to you. In addition, the ACTIVATED SLUDGE EXPERT report generator allows, within the pages created, the execution of calculations using variable values, the definition of new variables, the overlaying or masking of certain sections of text and working with text modules. If you are interested in these very powerful functions you should understand the second example after studying the following chapter.

5.3 Advanced functions

User defined variables and formulas

You have now got to know and have already used the output of values of the program variables. Perhaps you would now like to determine and publicise results beyond the values provided by ACTIVATED SLUDGE EXPERT. In this case it is important to know that the output possibility is not limited to the predefined values given in the variable list, but can also define formulas and new variables.

The syntax, on the basis of the variable output, is similar: vertical strokes again serve as limitation to the other text for the marking of the relevant formula.

In the following example the sums which substitute as Value1 and Value2 designated variables, are displayed:

|Value1+Value2, 6, 1|

Value1 and Value2 are added together, the sum is printed out in 6 columns with a decimal point. The comma as separator ensures the differentiation of calculation instruction and formatting data.

If you want to use the sum of the given values repeatedly within the output, then it is recommended that a new variable is created, e.g. using the name ValueSum as follows:

|ValueSum=Value1+Value2|

Through this a new variable with the designation ValueSum is defined. You obtain the value of the expression and can subsequently use it like a program-internal determined variable. ACTIVATED SLUDGE EXPERT, with names does *not* differentiate between upper and lower case.

A further example:

|NewVar=Var*100|

A new variable with the designation NewVar is defined. It contains the value of the expression "Var*100" and can thereafter be used. Thus, you could, for example, give the denitrification share VD/V in percent instead of as a fraction:

|VDV100=VDV*100|

The so designed variables naturally are available only after the loading of the relevant template file. Please also note that you always allocate self-created variables with a value in the manner shown, otherwise the output is not defined.

Calculation

As you have seen in the previous examples, ACTIVATED SLUDGE EXPERT can also carry out calculation functions with numerical variables within report templates. To this belong not only the four basic types of calculation but also the following mathematical functions:

ABS(x):	Absolute value of x
INT(x):	Next integral value of x
SQR(x):	Square of x
SQRT(x):	Square root of x
SQRT3(x):	Cube root of x
EXP(x):	e to the power of x
LN(x):	natural logarithm of x
^:	Power, z.B. x^y

The functions are described as shown, that is with round brackets and enclosed variable identifiers, e.g. using this instruction create

|QInt=INT(Q)|

a variable **QInt**, which contains the value of Q in rounded form. Nevertheless, an output of places after the decimal point in the report (the positions then receive a zero).

Selection

In certain situations it can be sensible to arrange that the output text is dependent on the results of the calculation or to skip parts of the template with the output. In the following example a certain section of the text is only dealt with and displayed if the denitrification volume determined by the program is greater than zero.

For the marking of sections to be displayed conditionally, ACTIVATED SLUDGE EXPERT uses the Dollar sign \$. The text to be displayed conditionally is, for this purpose, to be enclosed by Dollar signs and a condition for the display given behind the first Dollar sign according to the following pattern:

`$?Value>0:`

...

text

...

\$

The condition for the display is contained in the string `?Value>0:`, that is between the question mark and the colon (:). If the condition applies then the content of the report template is displayed up to the next \$-sign. Here, the end character can certainly be separated by several pages. Otherwise these contents would be skipped.

The somewhat oddly cryptic character string `>` results from the HTML language, it signifies "greater than". As further comparison operator there are available in appropriate form the string `<` ("smaller than") and the equals sign. Thus in the example below a variable "greater than zero" is requested.

The following example deliberately shows a somewhat extensive section from a report template in order, at the same time, to demonstrate the application of the HTML language. If the case arises, using the so-called "Tags" `<TABLE>` ... `</TABLE>` a complete table is created with five lines `<TR>` ... `</TR>`. Each line includes four columns `<TD>` ... `</TD>`, whose widths here are 60 %, 20 %, 10 % and 10 % of the overall table width. The initial condition `$?VD>0:` causes the complete table to be displayed only if the denitrification volume VD is greater than zero:

`$?VD>0:`

```
<TABLE CELLSPACING=0 BORDER=0 CELLPADDING=2 WIDTH=640>
<TR VALIGN="TOP">
<TD WIDTH="60%">nitrate to be denitrified</TD>
<TD WIDTH="20%" ALIGN="RIGHT">S<SUB>N03,D</SUB></TD>
<TD WIDTH="10%" ALIGN="RIGHT">|SN03D0,6,1|</TD>
<TD WIDTH="10%">mg/l</TD>
</TR>
<TR VALIGN="TOP">
<TD WIDTH="60%">required denitrification capacity</TD>
<TD WIDTH="20%" ALIGN="RIGHT">S<SUB>N03,D</SUB>/C<SUB>BOD</SUB></TD>
<TD WIDTH="10%" ALIGN="RIGHT">|SN03D0/CBODIAT,6,3|</TD>
<TD WIDTH="10%">kg/kg</TD>
</TR>
<TR VALIGN="TOP">
<TD WIDTH="60%">denitrification share</TD>
<TD WIDTH="20%" ALIGN="RIGHT">V<SUB>D</SUB>/V<SUB>BB</SUB></TD>
<TD WIDTH="10%" ALIGN="RIGHT">|VDV,6,2|</TD>
<TD WIDTH="10%">-</TD>
</TR>
<TR VALIGN="TOP">
<TD WIDTH="60%">existing denitrification capacity</TD>
<TD WIDTH="20%" ALIGN="RIGHT">S<SUB>N03,D</SUB>/C<SUB>BOD</SUB></TD>
<TD WIDTH="10%" ALIGN="RIGHT">|SN03D/CBODIAT,6,3|</TD>
<TD WIDTH="10%">kg/kg</TD>
```

```

</TR>
<TR VALIGN="TOP">
<TD WIDTH="60%">denitrified nitrate</TD>
<TD WIDTH="20%" ALIGN="RIGHT">S<SUB>N03,D</SUB></TD>
<TD WIDTH="10%" ALIGN="RIGHT">|SN03D,6,1|</TD>
<TD WIDTH="10%">mg/l</TD>
</TR>
</TABLE>
$

```

End of the section to be displayed conditionally:

A further overview of the efficient output functions of ACTIVATED SLUDGE EXPERT is given by the following example for a printer template.

5.4 Example Printer Template 2

In this example a printer template is to result which consists of the following sections:

- listing of the wastewater flow rates, the concentrations and the loading rates for all load cases,
- specification of the treatment objectives and the selected process options,
- a nitrogen balance, in case a plant with nitrogen oxidation or nitrogen removal has been calculated.

In addition, a graphic firm's logo is to appear in the title.

As tool for the creation of this printer template we use, as in the first example, MS Word 97 (those familiar with HTML can naturally use a "proper" HTML editor and carry out the steps analogously – the editor "HTML-Kit" proved itself with the creation of the ACTIVATED SLUDGE EXPERT standard templates). In this example a detailed description of the individual steps is dispensed with: if required, you can find appropriate information in **Example 1**.

Using Word create tables for the quantities of water and the concentrations:

Wastewater flow rates	QDW,d	QDWD,6,0	QDWD#1,6,0	QDWD#2,6,0	QDWD#3,6,0	m3/d
	QDW,h	QDWH,6,0	QDWH#1,6,0	QDWH#2,6,0	QDWH#3,6,0	m3/h
COD	CCOD,iat	CCODiat,6,0	CCODiat#1,6,0	CCODiat#2,6,0	CCODiat#3,6,0	mg/l
Dissolved COD	SCOD,iat	SCODiat,6,0	SCODiat#1,6,0	SCODiat#2,6,0	SCODiat#3,6,0	mg/l
BOD5	CBOD,iat	CBODiat,6,0	CBODiat#1,6,0	CBODiat#2,6,0	CBODiat#3,6,0	mg/l
Filterable solids	XTS,iat	XTSiat,6,0	XTSiat#1,6,0	XTSiat#2,6,0	XTSiat#3,6,0	mg/l
Kjeldahl-Nitrogen	CTKN,iat	CTKNiat,6,1	CTKNiat#1,6,1	CTKNiat#2,6,1	CTKNiat#3,6,1	mg/l
Ammonia nitrogen	SNH4,iat	SNH4iat,6,1	SNH4iat#1,6,1	SNH4iat#2,6,1	SNH4iat#3,6,1	mg/l
Nitrate nitrogen	SNO3,iat	SNO3iat,6,1	SNO3iat#1,6,1	SNO3iat#2,6,1	SNO3iat#3,6,1	mg/l
Total phosphorus	CP,iat	CPiat,6,1	CPiat#1,6,1	CPiat#2,6,1	CPiat#3,6,1	mg/l
Alkalinity	SALK,iat	SAlat,6,2	SAlat#1,6,2	SAlat#2,6,2	SAlat#3,6,2	mmol/l

In comparison with the first example you will notice that variable designations with a post-positive "#" character as well as a figure appear. The values from certain loading cases are selected with the help of this specification: "CCODzb#1", for example, signifies that, at this point, the value of the COD influent concentration for Loading Case 1 is to be displayed. Variable designations without specification always refer to the dimensioning case ("Loading Case 0").

In order to create a table of the inflow loads for this purpose mark the concentration table, copy this to clipboard and insert the copy behind the concentration table.

Subsequently write the formula for the calculation of the individual loads in the fields of this copied table. Due to the length of these formulas, line make-up often undertaken within the fields. Please do not try to suppress this in that you match the column width to the length of the formula. In the printed result only as many figures appear as you have respectively specified through the number of positions. For example, in the result table, instead of "SNH4zb#2*QD#2/1000,6,1" a 6 position comprehensive number with one place after the decimal point is printed.

COD	Bd COD	CCODiat*QDwd/1000 ,6,0	CCODiat#1*QDwd#1 /1000,6,0	CCODiat#2*QDwd#2 /1000,6,0	CCODiat#3*QDwd#3 /1000,6,0	kg/d
Dissolved COD	Bd SCOD	SCODiat*QDwd/1000 ,6,0	SCODiat#1*QDwd#1 /1000,6,0	SCODiat#2*QDwd#2 /1000,6,0	SCODiat#3*QDwd#3 /1000,6,0	kg/d
BOD5	Bd BOD	CBODiat*QDwd/1000 ,6,0	CBODiat#1*QDwd#1 /1000,6,0	CBODiat#2*QDwd#2 /1000,6,0	CBODiat#3*QDwd#3 /1000,6,0	kg/d
Filterable solids	Bd XTS	XTSiat*QDwd/1000, 6,0	XTSiat#1*QDwd#1/ 1000,6,0	XTSiat#2*QDwd#2/ 1000,6,0	XTSiat#3*QDwd#3/ 1000,6,0	kg/d
Kjeldahl-Nitrogen	Bd TKN	CTKNiat*QDwd/1000 ,6,1	CTKNiat#1*QDwd#1 /1000,6,1	CTKNiat#2*QDwd#2 /1000,6,1	CTKNiat#3*QDwd#3 /1000,6,1	kg/d
Ammonia nitrogen	Bd NH4	SNH4iat*QDwd/1000 ,6,1	SNH4iat#1*QDwd#1 /1000,6,1	SNH4iat#2*QDwd#2 /1000,6,1	SNH4iat#3*QDwd#3 /1000,6,1	kg/d
Nitrate nitrogen	Bd NO3	SNO3iat*QDwd/1000 ,6,1	SNO3iat#1*QDwd#1 /1000,6,1	SNO3iat#2*QDwd#2 /1000,6,1	SNO3iat#3*QDwd#3 /1000,6,1	kg/d
Total phosphorus	Bd P	CPiat*QDwd/1000,6 ,1	CPiat#1*QDwd#1/1 000,6,1	CPiat#2*QDwd#2/1 000,6,1	CPiat#3*QDwd#3/1 000,6,1	kg/d

Next, lists of the selected treatment objectives and the process options are now to be entered.

For the designation of the treatment objective use the variable with the designation "RZ". This contains the information on the selected treatment objective in the form of a code number (see Variables List):

Code	Meaning
1	carbon degradation only
3	carbon degradation + nitrification
19	carbon degradation + nitrification + denitrification
7	carbon degradation + nitrification + aerobic sludge stabilisation
23	carbon degradation + nitrification + denitrification + aerobic sludge stabilisation

In order, depending on the treatment objective, to issue a certain text, write the already mentioned conditional instructions. These are respectively initialised by a "\$" character. This is followed by a question mark and a formula expression which can give either "applicable" or "non-applicable". In the case of "applicable", it is displayed behind a colon with a text closed with a second "\$" character. If, on the other hand, the formula display is "non-applicable", then this text is ignored.

\$?RZ=1: carbon degradation\$

\$?RZ=3: carbon degradation + nitrification\$

\$?RZ=7: simultaneous aerobic sludge stabilisation\$

\$?RZ=19: carbon degradation + nitrification + denitrification\$

\$?RZ=23: carbon degradation + nitrification + denitrification + aerobic sludge stabilisation\$

This string of instructions, for example, has the effect that, with a treatment objective with the code number 3, only the text "carbon degradation + nitrification" is displayed.

For the listing of the process options proceed in a similar manner. The relevant information is found in the variables "PS" (primary settling), "MT" (anaerobic mixing tank), "AS" (aerobic selector), "DN" (denitrification), "FS" (simultaneous phosphorus precipitation). These variables respectively contain the value 0 or 1, whereby a value of 1 means, that an appropriate process option has been chosen.

\$?PS=1: primary settling\$

\$?MT=1: anaerobic mixing tank\$

\$?AS=1: aerobic selector\$

\$?DN=1: denitrification\$

\$?FS=1: simultaneous phosphorus precipitation\$

In order to design the display in a clearer fashion, you should allot the designations or lists with titles. For example before the instruction chain for the printout of the treatment objectives write "Treatment Objective(s)" and before the list of process options "Process Options". Format these titles in such a way that they stand out from the other text (e.g. through bold letters, larger figures, underlining). Then your text can look something like this in Word:

Treatment Objective(s):

\$?RZ=1: carbon degradation\$

\$?RZ=3: carbon degradation + nitrification\$

\$?RZ=7: simultaneous sludge stabilisation\$

\$?RZ=19: carbon degradation + nitrification + denitrification\$

\$?RZ=23: carbon degradation + nitrification + denitrification + aerobic sludge stabilisation\$

Process Options:

\$?PS=1: primary settling\$

\$?MT=1: anaerobic mixing tank\$

\$?AS=1: aerobic selector\$

\$?DN=1: denitrification\$

\$?FS=1: simultaneous phosphorus precipitation\$

According to plan there now follows a nitrogen balance, in the case that a plant with nitrogen oxidation or nitrogen removal has been calculated.

This should appear as follows:

Total nitrogen in the influent:	xxxx.x	mg/l
Org. nitrogen in excess sludge:	xxxx.x	mg/l
Org. nitrogen in the effluent:	xxxx.x	mg/l
Ammonia nitrogen in the effluent:	xxxx.x	mg/l
Nitrogen nitrified:	xxxx.x	mg/l
nitrogen denitrified:	xxxx.x	mg/l
Nitrate nitrogen in the effluent:	xxxx.x	mg/l

For demonstration purposes a text module is to be used for the nitrogen balance. In order to create this text module first open a new (empty) file in Word. Then create the following table within the file:

Total nitrogen in the influent:	CN	CTKNiat+SNO3iat,5,1	mg/l
Org. nitrogen in excess sludge:	XN,BM	XNBM,5,1	mg/l
Org. nitrogen in the effluent:	SorgN,EST	SORGNest,5,1	mg/l
Ammonia nitrogen in the effluent:	SNH4,EST	SNH4est,5,1	mg/l
Nitrogen nitrified:	SNH4,N	SNH4N,5,1	mg/l
Nitrogen denitrified	SNO3,D	SNO3D,5,1	mg/l
Nitrate nitrogen in the effluent:	SNO3,EST	SNO3est,5,1	mg/l

Save this file as HTML file (for example with the name "NBalanc.htm") and then change again into the previously processed Word document. There enter:

`$?RZ>1:${NBALANC.HTM} $`

This admittedly cryptic character string is a conditional instruction which causes the text saved in the file "NBALANC.HTM" to be displayed if the code number for the treatment objective (RZ) is greater than (">") 1. If you take a glance at the treatment objectives and their code numbers, you will detect that with this the balance is only printed out if one is concerned with a plant with nitrogen oxidation or nitrogen removal. The somewhat peculiar way of writing "greater than" for the comparison operator is conditioned by HTML.

With this, the objective specifications are almost complete, only the firm's logo on the first page is missing.

This should be available in "GIF" or "BMP" format. In case there is no suitable file available you can use the example in the file "IWC.BMP".



In order to insert this logo into the title place the cursor in Word at the beginning of the document (here that is before the table of water quantities). Then call up in Word the menu function **Insert | Graphics**, select the option **From file..** and seek the given or desired file from the file selection dialogue.

If you now save the Word document as HTML file and subsequently select it in ACTIVATED SLUDGE EXPERT as printer template (file type HTML files), then you must obtain, at least approximately, the desired result.

5.5 Special functions of screen templates

Screen templates differentiate from printer templates mainly in that in screen templates the possible links (connections) can also be sensibly applied in HTML. The **standard.gst** file menu.htm contained in the screen template gives an example for the application for these links for the deliberate call-up of the input dialogue.

At first it appears as if this possible entry were an integral part of ACTIVATED SLUDGE EXPERT. In fact, the instructions for this are contained only in the template file, ACTIVATED SLUDGE EXPERT makes available only certain program functions and the *possibility* of undertaking such an entry. In the template mentioned the calling-up of the input dialogue is used as program function.

Links

In the example mentioned there are connections between entries in the navigation bar (e.g. influent) and appropriate pages of the input dialogue. Such links are characterised by the conversion of the mouse pointer into a hand symbol. Internal and external links are differentiated.

Internal links

You can call up certain program functions via internal links. In addition to the already mentioned call-up of the input dialogue, ACTIVATED SLUDGE EXPERT provides the following functions for this:

- load file
- save data in file
- load a printer template
- print results of a calculation
- carry out calculation

In practice these functions are called up in HTML instructions as follows:

Load file

```
<A HREF="FILEOPEN filename">
```

Import data

```
<A HREF="FILEIMPORT filename">
```

Save data in file

```
<A HREF="FILESAVE filename">
```

Load printer template

```
<A HREF="PRINTTEMPLATE filename">
```

In all above mentioned instructions "filename" substitutes for a complete file name (with details of path).

Print results

```
<A HREF="FILEPRINT">
```

Carry out calculation

```
<A HREF="CALCULATE">
```

Display input dialogue:

```
<A HREF="„EDITDLG x">
```

whereby x stands for the page number with which the input dialogue is to appear.

External links

From screen templates you can also call up internet pages and send via so-called external links.

Call up a WWW page in Internet (example):

```
<A HREF="http://www.bexpert.gfroese.de">
```

Link to an E-mail address (example):

```
<A HREF="mailto:info@gfroese.de">
```

An example on using external links can also be found in File Menu.htm.

6 Print

6.1 Print preview

The menu Print Preview activates the page break in an interface window Print status and then opens a separate window, shown here with the template `standard.gpt` and the file `Example.gda`.

The screenshot shows a 'Print preview' window with a menu bar containing 'Previous', 'Next', 'Show whole page', a search icon, a magnifying glass, a printer icon, and 'Close'. The main content area displays a technical report for 'Activated Sludge Expert'.

Project: WWTP Helmstedt, Germany
Calculated by: Dr. Zander engineers GmbH
Date: 12.10.2001

Configuration of plant:

- Primary settling
- Aerobic nitrification tank
- Aerobic nitrification tank
- Secondary settling

Treatment objectives:

- Removal of org. carbon
- Nitrification
- Denitrification

Size class and load cases:
 Size class: 3300 kg BOD/d
 Calculated load cases:

- Load case 1: 1.0 times inflow
- Load case 2: 2.0 times inflow at lowest temperature
- Load case 3: Calculation of oxygen uptake at 15°C and 20°C

Calculated based on BOD

		LOAD CASE 1	2	3
Inflow:				
Daily dry weather flow rate	Q _{dw,th}	11000	11000	11000 m ³ /d
Hot dry weather flow rate	Q _{dw,h}	600	600	600 m ³ /h
Concentration:				
COD	C _{org,th}	500	500	0 mg/l
Dissolved COD	C _{org,d}	275	275	0 mg/l
BOD ₅	C _{org,th}	365	365	365 mg/l
COD/BOD ₅ ratio	r _{cod}	2,08	2,08	0,00 -
Filtrable solids	X _{5,th}	200	200	200 mg/l
Total Nitrate-Nitrogen	C _{N,th}	60,0	60,0	60,0 mg/l
Ammonia-Nitrogen	C _{N,th}	45,0	45,0	45,0 mg/l
Nitrite-Nitrogen	C _{N,th}	0,0	0,0	0,0 mg/l
Phosphorus	C _{P,th}	9,0	9,0	9,0 mg/l
Alkalinity	S _{th,th}	7,10	7,10	7,10 mmol/l
Load:				
COD	R _{cod,th}	6000	6000	0 kg/d
Dissolved COD	R _{cod,d}	3000	3000	0 kg/d
BOD ₅	R _{cod,th}	2015	2015	2015 kg/d
Filtrable solids	R _{cod,th}	2000	2000	2000 kg/d
Total Nitrate-Nitrogen	R _{N,th}	600,0	600,0	600,0 kg/d
Ammonia-Nitrogen	R _{N,th}	495,0	495,0	495,0 kg/d
Nitrite-Nitrogen	R _{N,th}	0,0	0,0	0,0 kg/d
Phosphorus	R _{P,th}	90,0	90,0	90,0 kg/d

Bottom left: DWA-Software
 Bottom right: Activated Sludge Expert Version 2.01

This part of the program again also contains components typical for Windows programs

- program bar with the designation Print Preview
- symbol bar with buttons for function selection
- display area with the representation of the printed page(s)

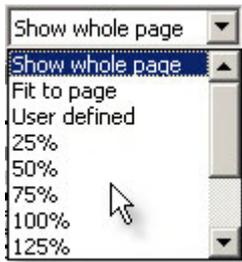
The buttons are fundamentally self-explanatory and certainly known from other Windows programs. Therefore here there is only a brief summary.

Browse through the print preview

Using buttons Previous and Next you can browse by page through the data output in the menu bar.

Change view

You can change the view in different ways: the selection list in the menu bar, in addition to Browse-Switch, offers a direct selection by number or by page:



you can also activate view dimensions Complete page and Page width directly via the buttons



You can adjust the individual zoom levels via a mouse click, if you activate the magnifying glass with the button selection



The left-hand mouse key enlarges the view, the right-hand mouse key decreases it.

By activating the hand you can displace the active section ("Panning").

If you wish to have an overview of the complete layout, then it is recommended to view two adjacent pages via key selection.



Selection is automatically cancelled if you set a larger zoom factor or change the view to Width of page.

Activate printer



branches to the Windows standard dialogue via the printer output.

Close the print preview



by clicking on or pressing the ESC key closes the print preview and returns to the main screen of ACTIVATED SLUDGE EXPERT.

6.2 Printer output

The printer output starts from the symbol bar or from the Print Preview using the Windows standard dialogue Print. The options which can be set depend on the printer selected. All other settings are functions of the operating system and can be looked up in the appropriate manual.

7 Appendix

7.1 List of variables

List of Variables

(All entries in the format Variable name: Explanation)

General variables

Project:	Designation of the project or the calculation
Revisor:	Name of the person responsible
Date:	Calculation date
Mode:	Code calculation mode (0=BOD basis, 1=COD basis)
RZ:	Code treatment objective (1=org.C-degradation, 3=nitrification, 7=aerobic sludge stabilization)
RZIEL:	Designation of the treatment objective
DN:	Code denitrification (0=no denitrification, 1=denitrification)
FS:	Code Simultaneous precipitation (0=no precipitation, 1=precipitation)
VK:	Code primary settling: (0=none present, 1=present)
MB:	Code aerobic mixing tank: (0=none present, 1=present)
AS:	Code aerobic selector: (0=none present, 1=present)
NS:	Code anaerobic post-stabilisation: (0=none present, 1=present)
FT:	Code precipitant (1=Fe ₃ , 2=Fe ₂ , 3=Al ₃)
FTYP:	Precipitant designation
BDBOD:	BOD ₅ load for classification in the size class
_SSAT:	Necessary content of suspended solids in the biological reactor
_SSEAT:	Necessary content of suspended solids in the effluent of the biological reactor
TSS:	Existing sludge age
_TSSA:	Required aerobic sludge age
_SF:	Required safety factor
VAT:	Existing volume of the biological reactor
_VAT:	Required volume of the biological reactor
VMB:	Volume of an aerobic mixing tank
VAS:	Volume of an aerobic selector

Inflow rates

QDWD	Daily wastewater inflow with dry weather
QDWH	Hourly dry weather flow rate as 2 hr mean
QWWH	Dimensioning peak flow rate with stormwater

Concentrations in the inflow to the biological reactor

CCODiat	COD
SCODiat	Dissolved COD
SCODiiat	Dissolved inert COD
XCODiiat	Particular inert COD
SCODaiat	Degradable dissolved COD
XCODaiat	Degradable inert COD
SCODext	COD through external C dosing
CBODiat	BOD5
XTSiat	Filterable matter
XTSiat	Filterable inert matter
SNH4iat	Ammonium nitrogen
SN03iat	Nitrate nitrogen
CorgNiat	Organically bonded nitrogen
CPiat	Total phosphorus
SAiat	Alkalinity

Biological reactor

SNH4n	Nitrified nitrogen
SN03d0	Nitrogen available for denitrification
SN03dmax	Maximum denitrifiable nitrogen
SN03d	Denitrified nitrogen
XPPREC	Precipitated phosphorus
SSAT	Concentration of dry solid matter in the biological reactor
SSEAT	Concentration of dry solid matter in the outflow of the biological reactor
T	Temperature in the biological reactor
TSS	Existing sludge age
TSSa	Existing aerobic sludge age
SF	Existing safety factor
MH	Sludge mass from degradation of C (without external C)
MX	Sludge mass from external carbon source
MI	Sludge mass from accumulation of non-degradable solid matter
MP	Sludge mass through biol. P-removal
MF	Precipitated sludge mass
VdV	Percentage denitrification volume
DV	Code Denitrification process (1=upstream, 2=step-feed, 3=simultaneous, 4=alternating, 5=intermittent)
DVERF	Designation of the denitrification process
RC	Internal return feed
tT	Maximum cycle time(intermittent and alternating denitrification)
fC	Peak factor for carbon respiration

fN	Peak factor for nitrogen oxidation
cs	Oxygen saturation value
cx	Oxygen concentration
OUc	Oxygen uptake for carbon degradation
OU _n	Oxygen uptake for nitrification
OU _d	Oxygen uptake for carbon removal by denitrification
OU _{cc}	Oxygen uptake for carbon degradation (calculated on basis of COD)
OU _h	Maximum hourly oxygen consumption (total)
OCh	Required hourly oxygen transfer
QKask	Percentage influent in last cascade (step-feed denitrification)
_RC	Minimum return feed (upstream denitrification)
_tT	Maximum cycle time (alternating and intermittent denitrification)
_QKask	Maximum percentage influent in the last cascade (step-feed denitrification)
FM	Required quantity of precipitant (referred to metal precipitant)
XNBM	in biomass of incorporated nitrogen
XPBM	in biomass of incorporated phosphorus (normal P take-up)
XPBIOP	in biomass of incorporated phosphorus (raised P take-up)

Secondary settling

STYP:	Designation of the flow characteristics
NT:	Code tank type (1=circ. tank, 2=hopper-bottomed tank, 3=rect. tank)
NTYP:	Designation of tank type
QIST:	Relevant quantity of water
A:	Number of secondary settling tanks
AST:	Existing secondary settling tank surface area
_AST:	Required secondary settling tank surface area
ASTEFF:	Effective secondary settling tank surface area
VST:	Secondary settling tank volume
QA:	Existing surface overflow rate
_QA:	Permitted surface overflow rate
QSV:	Existing sludge volume surface loading rate
_QSV:	Permitted sludge volume surface loading rate
SVI:	Sludge Volume Index
TTH:	Thickening time
RS:	Existing return sludge ratio
_RS:	Permitted return sludge ratio
SSRS:	Dry matter suspended solids concentration of the return sludge
SSBS:	Concentration of suspended solids at the tank bottom
R2B:	Ratio SS_{RS}/SS_{BS}

SSIST:	Existing content of suspended solids in the inflow to secondary settling
_SSIST	Permitted content of suspended solids in the inflow to secondary settling
QShort	Short-circuit sludge flow
QRS	Sludge removal volume flow
H1	Depth of clean water zone
H2	Depth of separation and return flow zone
H3	Depth of density flow and storage zone
H4	Depth of thickening and sludge removal zone
HST	Existing secondary settling tank depth
_HST	Required secondary settling tank depth
HINL	Depth of inlet below water level

Circular tanks

DST	Existing tank diameter
_DST	Required tank diameter
DSD	Diameter of stilling drum

Rectangular tanks

WST	Tank width (on the inlet side)
LST	Existing tank length (in the direction of flow)
_LST	Required tank length

Hopper-bottomed tanks

HVST	Vertical wall height below water level
DBST	Diameter at the tank bottom
XST	Cone slope

Scrapers

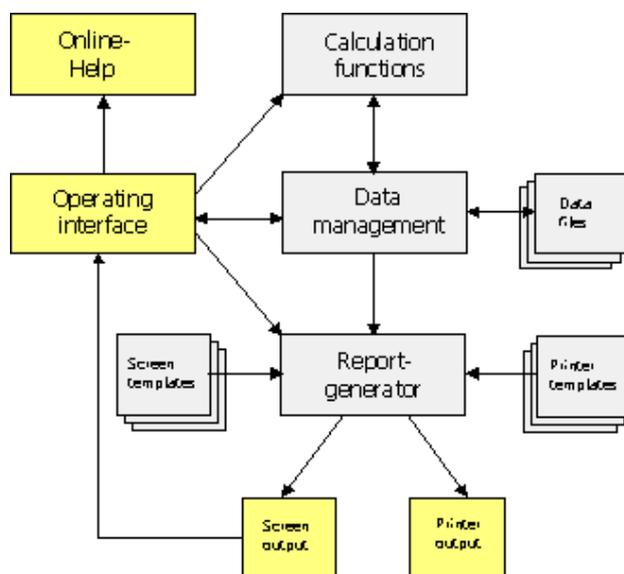
RT	Code scraper type (1=suction dredge, 2=sludge scraper, 3=flight scraper)
QSR	Sludge removal volume flow
RTYP	Designation of scraper
AR	Number of scraper arms
FSR	Sludge removal factor
BSR	Length of scraper blade or scraper bar
HSR	Height of scraper blade or scraper bar
TSR	Sludge removal interval
TS	Time for raising and lowering the sludge scraper
LSL	Length of the sludge layer moved by a scraper blade
LRW	Length of the runway of the scraper bridge
LSR	Length of scraper blade or scraper bar
VSR	Velocity of the scraper bridge
VRET	Return velocity of the scraper bridge
NTR	Number of sludge hopper rows

Effluent

SNH4est	Ammonium nitrogen effluent concentration
SN03est	Nitrate nitrogen effluent concentration
_SN03est	Nitrate nitrogen (design value)
CorgNest	Org. nitrogen effluent concentration
SP04est	Phosphate-P effluent concentration
_SP04est	Phosphate-P effluent concentration (design value)
SAest	Alkalinity in the effluent

Parameters

fXNBM	Factor nitrogen uptake in the biomass
fXNBM_C	Factor nitrogen uptake in the biomass for the calculation on COD basis
fXPBM	Factor "normal" P uptake in the biomass
fXPBM_C	Factor "normal" P uptake in the biomass for the calculation on COD basis
fXPBIOPT	Factor enhanced P uptake in the biomass (normal case with anaerobic mixing tank)
fXPBIOPT_C	Factor enhanced P uptake in the biomass for calculation on COD basis
fXPBIOPT	Factor enhanced P uptake in biomass (with anaerobic mixing tank, low temp.)
fXPBIOPT_C	Factor enhanced P take-up in biomass (upstream or step-feed denitrification without mixing tank)
fXPBIOPT_C	Factor increased P take-up in biomass for calculation on COD basis

7.2 Program structure

ACTIVATED SLUDGE EXPERT consists of several modules which each carry out a certain range of functions largely independently and, with this, communicate with each other mainly via instructions and messages.

Visible to the user are only: **Operating interface**, Online Help system, output of the report generator on screen or by printer.

All calculation algorithms and series of steps defined by the model are in the module "Calculation functions". On demand, the module "collects" the current data from data management, carries out the desired steps and passes the possibly modified data back to data management.

Data management is responsible for the reading and writing of files. Appropriate instructions are received from the operator interface.

The so-called report generator is a completely independent subsystem for the creation of the presentation of results on the screen and for the printer. These outputs are created based on templates.

An interesting feature is the connection of the screen template to the operating interface. This connection signifies that essential functions of the control surface and thus also the complete program, can call-up results from the graphic presentation via so-called links. In the latter instance, it is thus possible to exchange the complete control surface (e.g. to control the program via an internet WWW page).