NanoTechPRO
Version 1.6.0
Software User's Manual

JSC RM Nanotech / 224D Dobroselskaya Str., Vladimir, 600031, Russia
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1. Software's Functions

The software is designed to compute parameters of reverse-osmosis systems that use RM Nanotech's membrane elements and allows predicting performance of elements in specific conditions.

The software employs the same 3-stage procedure as those used by other manufacturers:

1) Input of Data on Feed Water
   - balancing anions and cations with sodium or chlorides,
   - use of several feed flows,
   - use of water database,
   - use of Na-softener or pH correction to prevent scaling.
2) System Configuration Selection
   - use of multiphase and multistage configurations as well as recycles and admixtures,
   - membrane element database with the possibility of using other manufacturers' membranes,
   - database of frequently used industrial systems.
3) Estimation of Results and System's Cost
   - filter by system's flows and elements,
   - report print-out or export to a PDF file,
   - displaying warnings and recommendations.

As well:

- user-friendly interface
- save and upload for projects
- creation of several versions of a system within a single project
- comprehensive calculation of system's cost
- use of various measurement units
- warnings available at design phase

2. Installation and Start-Up

The software does not require any installation and can run from a folder on any media. It requires a PC with Windows XP or higher. The software is currently available in English and Russian.

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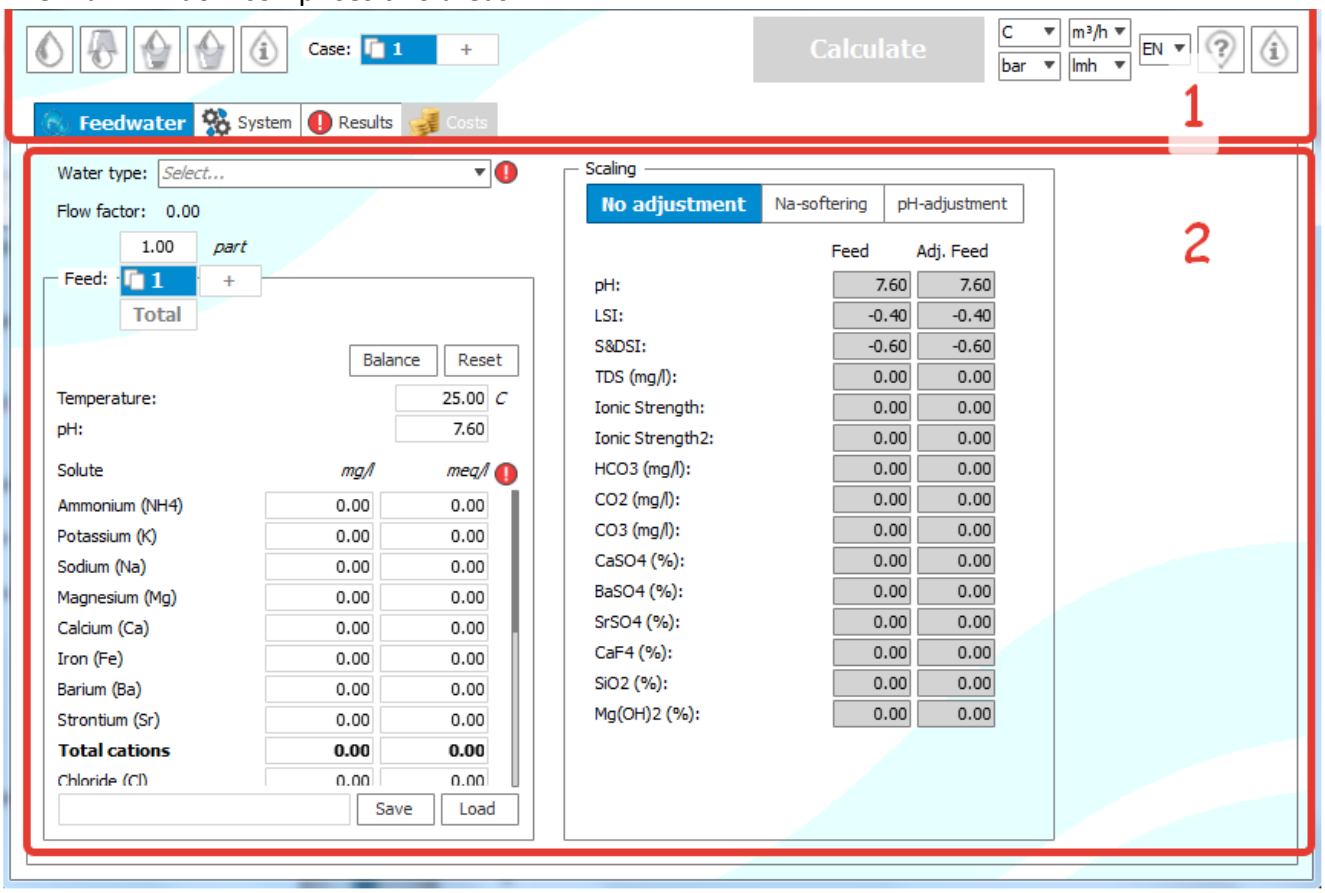
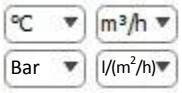
3. Interface

The main window comprises two areas:



The upper area (1) contains settings and general tools

- Tools to set measurement units for core system parameters (temperature, pressure, flow, specific permeate flux rate):

Unit of measurement: 

Measurement units can be changed at any time with values being immediately recalculated.

- Project-related buttons:

- New Project

- Open Project

- Save Current/Opened Project

- Save Project As New

- About Project

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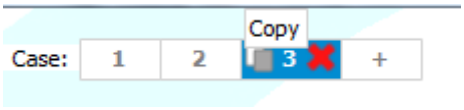
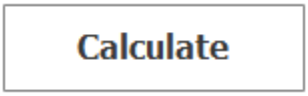


- Versions panel:

The panel allows creating several versions of various systems within a single project.

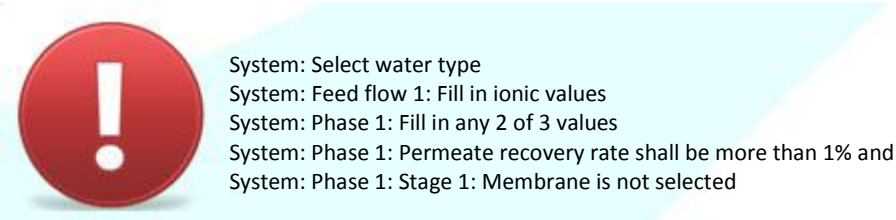
- Information button:

- There is also a "Compute" button in the upper panel:



By pressing the button, the system will compute data for the current selected Case. The button will only be active if there are no critical errors in the system.

Critical error is an error that precludes computation, e.g. field blank, incorrect details or parameters set incorrectly. Such fields will be accordingly marked with a symbol. A full list of errors in the system is on the "Results" tab. Here is an example of an error window:



Each listed message indicates error source and error correction method.

Non-critical errors or *warnings* represent the second type of errors displayed in the system. For example, a warning occurs when feed water is not anion and cation-balanced or if the maximum permeate recovery rate is exceeded for a membrane element. Warnings are marked with the symbol.

The contents of the rest of the area (2) depend on a *tab* selected. Each tab helps setting certain parameters of the system.

Tabs are depicted in the figure below:

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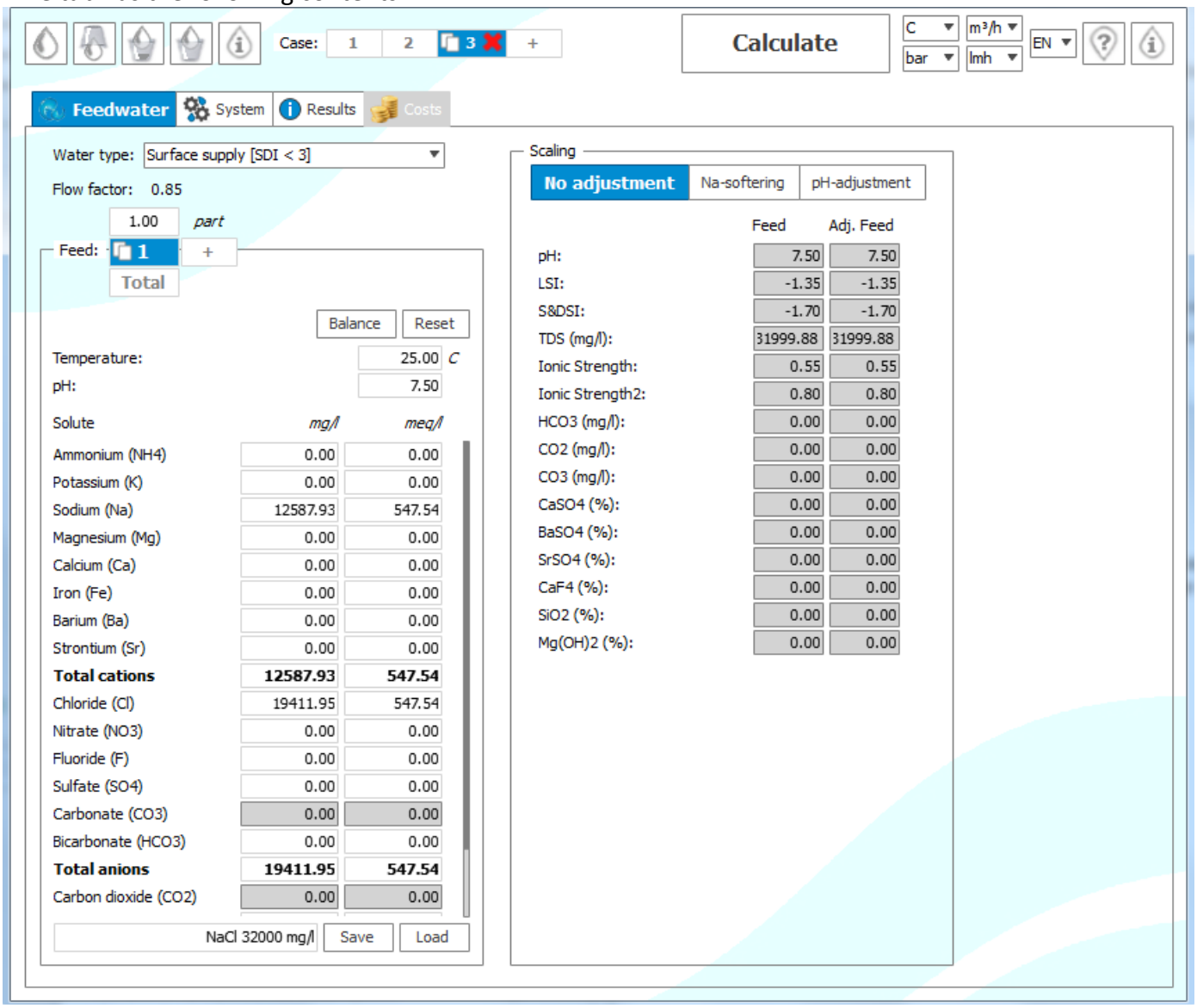
3.1 "Feed Water" Tab

The tab has the following contents:



Feed-flow control tool:

Here, 1.00 *part* a part of current flow can be changed within the entire flow.

Button + adds a new flow to the system.

Button adds a new flow to the system by copying data of a selected flow.

Button removes current flow.

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Button

shows data on the resultant flow in the system. Values of the resultant flow cannot be directly changed and therefore they are locked.

If the system uses various feed-flow modifiers from a "Sedimentation" block, a corrected-flow button ("Corr.") will appear under the total-flow button.

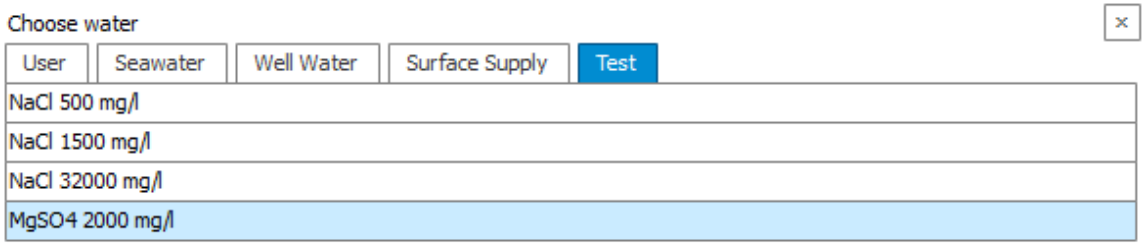
The following data can be changed for every flow:

- Temperature
- pH
- Data on every element of water

Data on ions can be set in mg/l or mEq/l and further adjusted using buttons:

"Save" and "Download" buttons allow saving and downloading water parameters from water database.

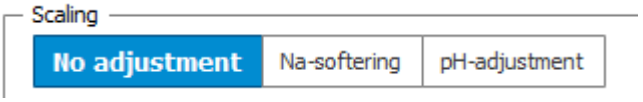
By pressing the "Download" button, the following window will appear:



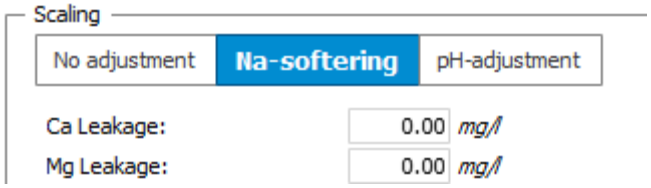
In this window, the user will select water type (user; Seawater; Surface supply) by switching between the above buttons.

To save the selected water type, the user have to enter it in a field near the "Save" button and press the "Save" button. The selected water type will be added to user water group.

In the "Scaling" block, the user may either use the softener or adjust pH:



In the "Softener" tab, the user can set Ca and Mg target values for feed water with the difference between the source and target values being converted to Na:



The "pH Adjustment" tab allows setting acid and alkali for dosing, target pH, and solution concentration:

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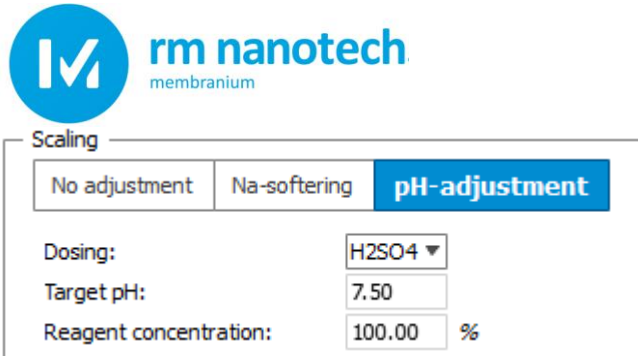
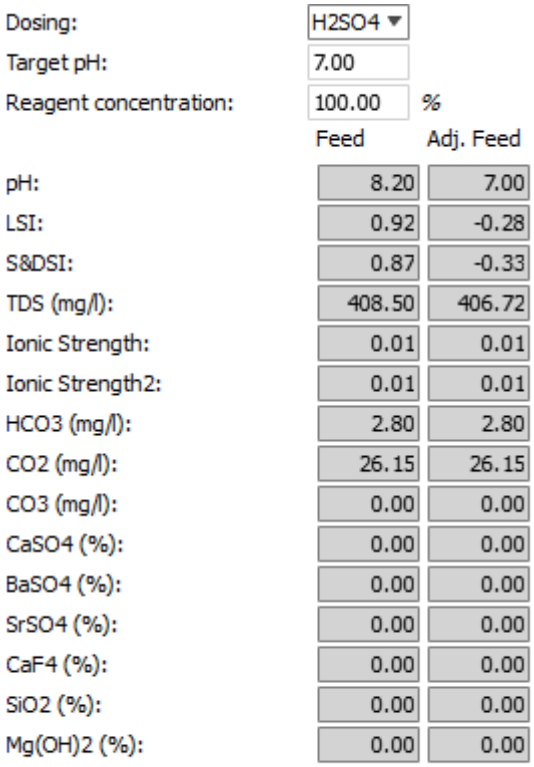


Also, the "Scaling" block contains various data and factors for feed flow and corrected flow:



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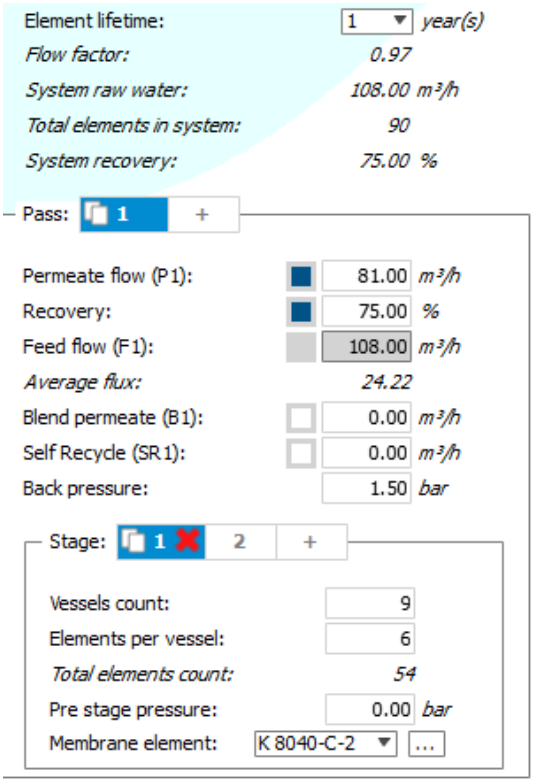
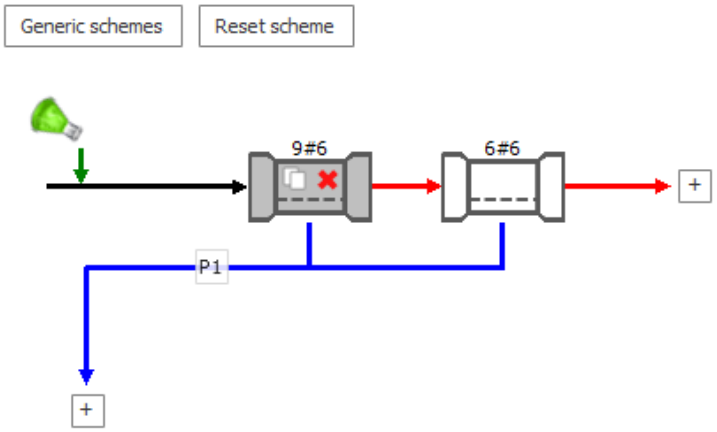
3.2 "System" Tab

The tab has the following contents:





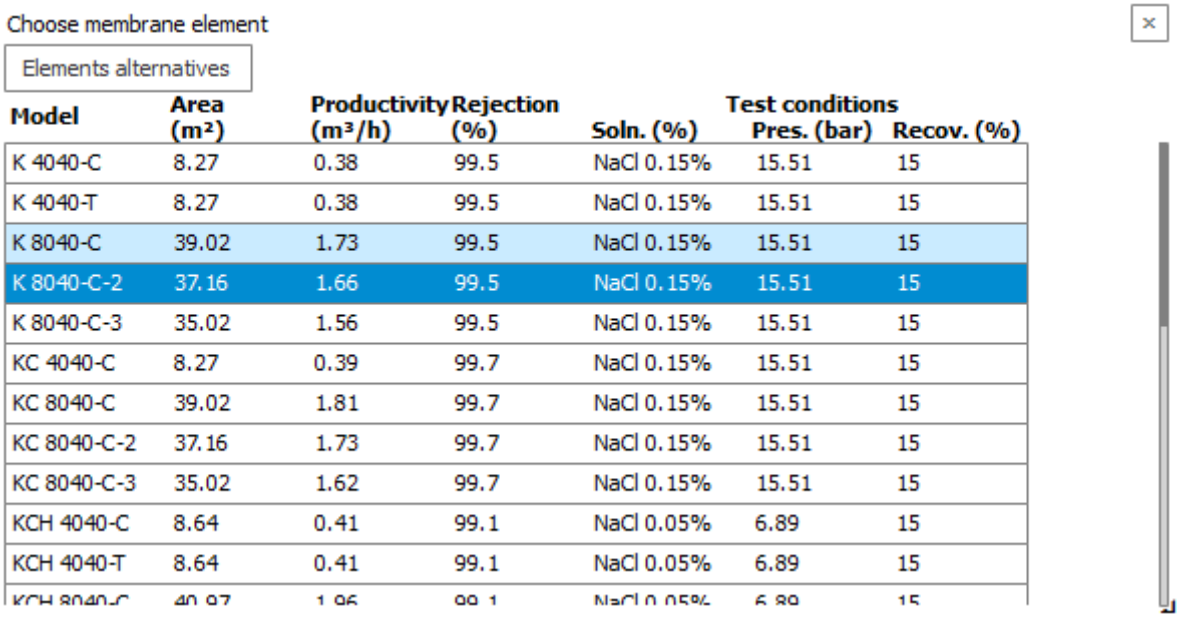
The tools that control phases and stages are identical to the above feed-flow control tools.

System data are depicted in the flow diagram on the right. The software provides the possibility of choosing from frequently encountered flow diagrams and booting them by pressing the "Flow Diagram Variants" button.

Feed flow volume, permeate recovery rate and permeate flow volume are interrelated quantities, that is why only two of them can be changed at a time. The third quantity will be calculated automatically.

Mixing is possible only in the last stage. If the scheme is a single-stage, the admixture is added to the input stream to the system (System raw water). If the scheme is a two-stage or more, the admixture will be deducted from the filtrate of the previous stage.

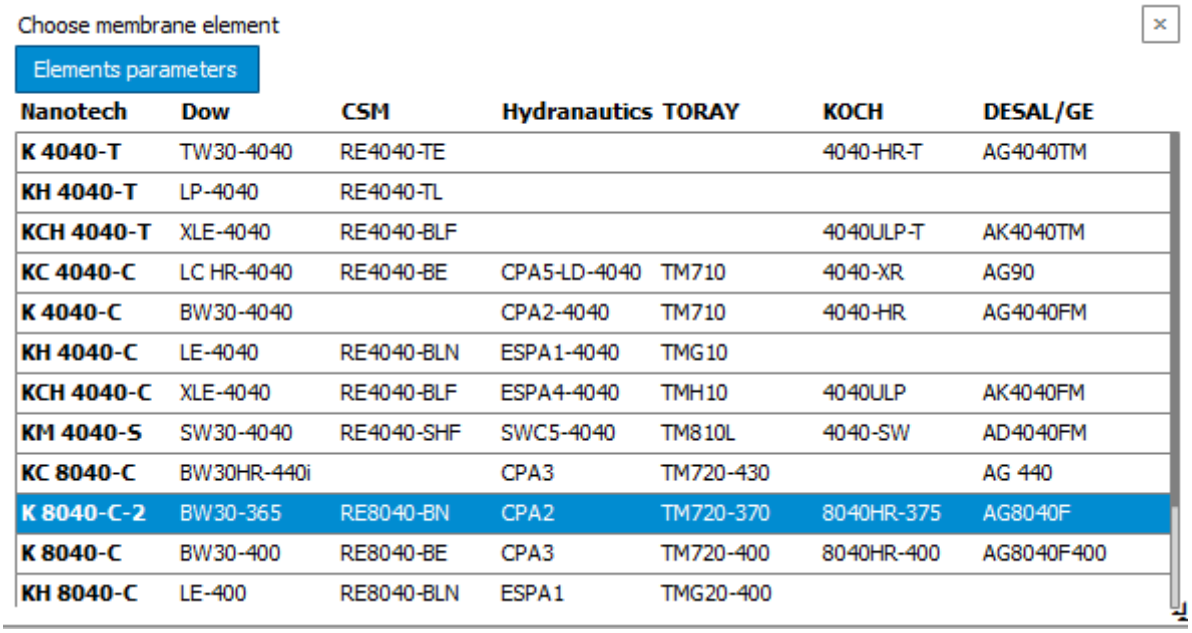
Membrane type can be chosen from a drop-down list, or if additional information on a membrane is needed or an alternative to be selected for a manufacturer, press the button [...]. The following window will show up:


Choose membrane element

Elements alternatives

Model	Area (m²)	Productivity (m³/h)	Rejection (%)	Test conditions Soln. (%)	Pres. (bar)	Recov. (%)
K 4040-C	8.27	0.38	99.5	NaCl 0.15%	15.51	15
K 4040-T	8.27	0.38	99.5	NaCl 0.15%	15.51	15
K 8040-C	39.02	1.73	99.5	NaCl 0.15%	15.51	15
K 8040-C-2	37.16	1.66	99.5	NaCl 0.15%	15.51	15
K 8040-C-3	35.02	1.56	99.5	NaCl 0.15%	15.51	15
KC 4040-C	8.27	0.39	99.7	NaCl 0.15%	15.51	15
KC 8040-C	39.02	1.81	99.7	NaCl 0.15%	15.51	15
KC 8040-C-2	37.16	1.73	99.7	NaCl 0.15%	15.51	15
KC 8040-C-3	35.02	1.62	99.7	NaCl 0.15%	15.51	15
KCH 4040-C	8.64	0.41	99.1	NaCl 0.05%	6.89	15
KCH 4040-T	8.64	0.41	99.1	NaCl 0.05%	6.89	15
KCH 8040-C	40.97	1.96	99.1	NaCl 0.05%	6.89	15

By pressing "Replace Elements", you will be offered to select and replace manufacturer's model with RM Nanotech's membrane elements:


Choose membrane element

Elements parameters

Nanotech	Dow	CSM	Hydranautics	TORAY	KOCH	DESAL/GE
K 4040-T	TW30-4040	RE4040-TE			4040-HR-T	AG4040TM
KH 4040-T	LP-4040	RE4040-TL				
KCH 4040-T	XLE-4040	RE4040-BLF			4040ULP-T	AK4040TM
KC 4040-C	LC HR-4040	RE4040-BE	CPA5-LD-4040	TM710	4040-XR	AG90
K 4040-C	BW30-4040		CPA2-4040	TM710	4040-HR	AG4040FM
KH 4040-C	LE-4040	RE4040-BLN	ESPA1-4040	TMG10		
KCH 4040-C	XLE-4040	RE4040-BLF	ESPA4-4040	TMH10	4040ULP	AK4040FM
KM 4040-S	SW30-4040	RE4040-SHF	SWC5-4040	TM810L	4040-SW	AD4040FM
KC 8040-C	BW30HR-440i		CPA3	TM720-430		AG 440
K 8040-C-2	BW30-365	RE8040-BN	CPA2	TM720-370	8040HR-375	AG8040F
K 8040-C	BW30-400	RE8040-BE	CPA3	TM720-400	8040HR-400	AG8040F400
KH 8040-C	LE-400	RE8040-BLN	ESPA1	TMG20-400		

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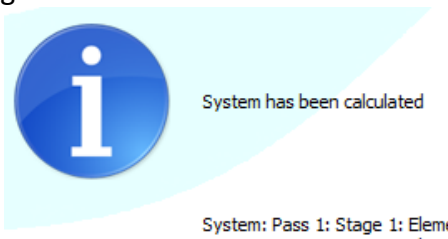
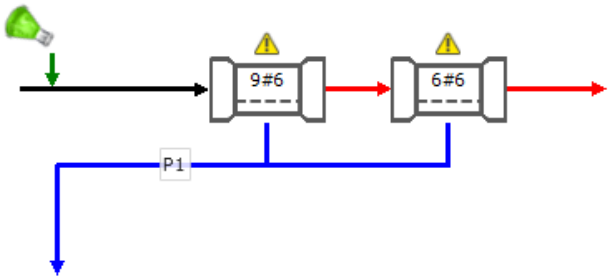
3.3 "Results" Tab

This tab contains a table of calculated system parameters, including data on errors and warnings. A consolidated table will be built upon successful calculation:



System: Pass 1: Stage 1: Element 3: Concentrate LSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 1: Element 3: Concentrate S&DSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 1: Element 4: Concentrate LSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 1: Element 4: Concentrate S&DSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 1: Element 5: Concentrate LSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 1: Element 5: Concentrate S&DSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 1: Element 6: Concentrate LSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 1: Element 6: Concentrate S&DSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 1: Concentrate LSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 1: Concentrate S&DSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 2: Concentrate LSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 2: Concentrate S&DSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 3: Concentrate LSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 3: Concentrate S&DSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 4: Concentrate LSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 4: Concentrate S&DSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 5: Concentrate LSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 5: Concentrate S&DSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 6: Concentrate LSI > 0. It is necessary to add acid and/or antiscalant in inlet water
System: Pass 1: Stage 2: Element 6: Concentrate S&DSI > 0. It is necessary to add acid and/or antiscalant in inlet water



System details

Common

Water type					UF Permeate [SDI < 2]
Temperature	C	20	Raw water flow	m³/h	108

"Print" and "Export to PDF" buttons are in the upper right corner:

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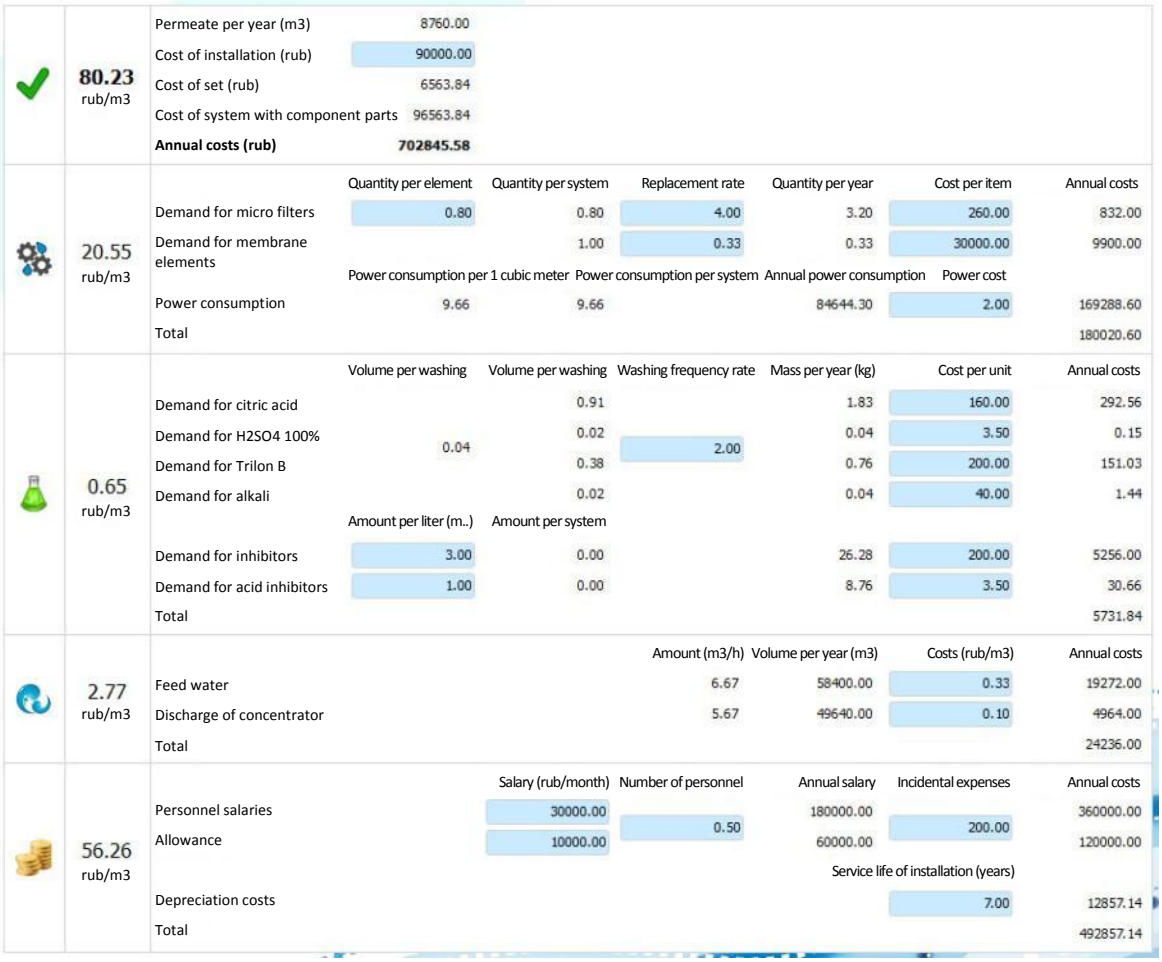
3.4 "Costs" Tab

The tab provides information that allows calculating system's cost, as well as its further maintenance. Most of the values will be calculated automatically based on project data, although several coloured parameters have to be set manually.



80.23 rub/m3	Permeate per year (m3)	8760.00					
	Cost of installation (rub)	90000.00					
	Cost of set (rub)	6563.84					
	Cost of system with component parts	96563.84					
	Annual costs (rub)	**702845.58**					
20.55 rub/m3		Quantity per element	Quantity per system	Replacement rate	Quantity per year	Cost per item	Annual costs
	Demand for micro filters	0.80	0.80	4.00	3.20	260.00	832.00
	Demand for membrane elements		1.00	0.33	0.33	30000.00	9900.00
		Power consumption per 1 cubic meter	Power consumption per system		Annual power consumption	Power cost	
	Power consumption	9.66	9.66		84644.30	2.00	169288.60
	Total						180020.60
0.65 rub/m3		Volume per washing	Volume per washing	Washing frequency rate	Mass per year (kg)	Cost per unit	Annual costs
	Demand for citric acid	0.04	0.91	2.00	1.83	160.00	292.56
	Demand for H2SO4 100%		0.02		0.04	3.50	0.15
	Demand for Trilon B		0.38		0.76	200.00	151.03
	Demand for alkali		0.02		0.04	40.00	1.44
		Amount per liter (m..)	Amount per system				
	Demand for inhibitors	3.00	0.00		26.28	200.00	5256.00
	Demand for acid inhibitors	1.00	0.00		8.76	3.50	30.66
	Total						5731.84
2.77 rub/m3				Amount (m3/h)	Volume per year (m3)	Costs (rub/m3)	Annual costs
	Feed water			6.67	58400.00	0.33	19272.00
	Discharge of concentrator			5.67	49640.00	0.10	4964.00
	Total						24236.00
56.26 rub/m3			Salary (rub/month)	Number of personnel	Annual salary	Incidental expenses	Annual costs
	Personnel salaries		30000.00	0.50	180000.00	200.00	360000.00
	Allowance		10000.00		60000.00		120000.00
						Service life of installation (years)	
	Depreciation costs					7.00	12857.14
	Total						492857.14

For more details on prices and dates, contact RM Nanotech's office.

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