# **Do-Exp software manual**



Author: Wojciech Stark.

Do-Exp program was created as part of the thesis at the Faculty of Chemistry of the Warsaw University of Technology.

This manual applies to the Do-Exp software (version 1.0.0.0).

The nzy3d-api library was used to generate the charts (Copyright (c) 2014, benoit74. All rights reserved).

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## Introduction

Software name: Do-Exp.

Version: 1.0.0.0.

Languages: Polish, English.

Web page: http://www.do-exp.com.

The Do-Exp program is used for planning experiments. It enables simple preparation of Design of Experiments and optimization of parameters affecting the studied process.

### System requirements:

- Operating system: Microsoft Windows XP, 7, 8, 10 or later,
- Microsoft .NET Framework 4.5 or later.

## Installation

Software installation starts after opening the "Do-Exp.msi" file.

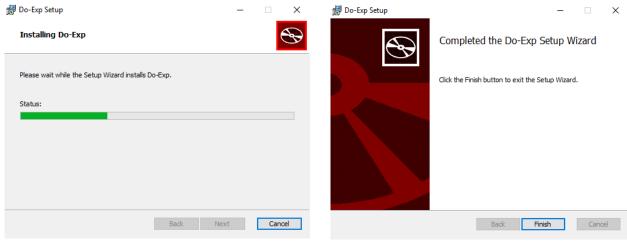
First, user must accept the License Agreement, then he can optionally use the advanced settings ("Advanced"), where the user can choose the destination path in which the program will be installed.

记 Do-Exp Setup —	× 🕏	Do-Exp Setup	_		$\times$
Please read the Do-Exp License Agreement	Ð	Destination Folder Click Next to install to the default folder or click Change to choose a	nother.		Ð
Do-Exp Copyright © 2018. All rights reserved. This End-User License Agreement ("EULA") is a legal agreement between you (either an individual or a single entity) and the mentioned owner of this Software for the software product identified above ("SOFTWARE	~	Install Do-Exp to: C:\Program Files (x86)\Do-Exp\ Change			
I accept the terms in the License Agreement Click Install to install the product with default options for all users. Click Advanced to change installation options.  Print Advanced Install C	ncel	Back	đ	Can	cel
	ncel	Back	đ	Can	icel

(a) Welcome window – Licence Agreement.

(b) Path changing window.

After clicking the "Install" button, installation of the program starts. It should take only a few seconds. When the installation is completed, the final window appears. The installation ends with pressing the "Finish" button. By default, the program icon will be placed on the Desktop and in the Start Menu.



(c) Installation window.

(d) "Installation completed" window.

# Working with the software

### Main Window



(e) Do-Exp software main window.

The main window is the first window visible after opening the program. It contains the area with the plan and results of the experiments, and the area with the results and the graph.

It consists of such elements as:

- 1 display area of the experimental plan,
- 2 area for displaying detailed data about variables (list of variables),
- 3 text fields in which the following are displayed: equation, value of the optimum (highest point) and values of the F coefficients: calculated and critical (to test the adequacy of the equation),
- 4 button that opens the optimization window,
- 5 a graph describing the dependence of the influence of variables on the result,
- 6 elements adjusting the name of the axis and variables used to draw the chart,
- 7 main program buttons ("Create new plan", "Settings", "Confirm results"). The "Settings" and "Confirm results" buttons are initially blocked. They unblock themselves after new plan is created.

#### Creating a new process

Creation of a new process takes place after pressing the "Create new plan" button in the main window. New window opens in which you first select the plan you want to use, and then you add the variables of which dependency is tested.

👺 Create n	ew design					- 0	×
Choose	e DOE plan						
Factor	rial or fractional facto	rial design 🛛 🗸					
Sign	Variable name	M	in	Max	Туре		
	Add variable	Edit selected	Remove	selected			
	Add interaction		И				
Add	fractional variable						
Number	of center points:	(default) ~					
Ba	ck					Next	

(f) New plan creator window.

#### Adding new variables

There are 3 types of variables to choose from: main, fractional and interaction effects. Ability to add fractional variables and interaction effects is gained (in the window of creating a new plan) only after adding at least two main variables. **Figures g-i** show windows for adding variables, which are opened after pressing the appropriate button in the new plan creator window.

🔀 Add new variable	×
	Add fractional variable X
Variable name:	Variable name:
Minimum value:	
Maximum value:	Minimum value:
	Maximum value:
Cancel Add	Select row with variables of which interdependence will be replaced with new fractional variable
<b>(g)</b> New variable form (main variable).	Variable 1 Variable 2
	Temperature Pressure
Add interdependence     —     —     X       Select variables for interdependence research:       Variable name       Temperature       Pressure	
	Cancel Add
	(h) New fractional variable form.

(i) New interdependence variable form.

After "Add variable" button is clicked, a new window (**Fig. g**) is opened, and after completing the text fields in the newly displayed window (with the name and range of variables in which it will be examined), the new variable is added.

To add the interaction variable, press the "Add interaction" button, which opens the new window (**Fig. h**), and then select the variables (it is preferable to choose two variables), the interaction of which you want to investigate. Variables should be selected with the Ctrl key pressed, allowing selection of multiple rows.

Adding a fraction variable is done by clicking on the "Add fractional variable" button and filling in newly opened window (**Fig. i**) – text fields with the name and ranges of the variable value, and then selecting the combination of variables (chosen interaction effect), in which place the variable will be added.

After all variables are added, user should choose the amount of center points (or leave the "default" option).

### Experimental plan and settings

After pressing the "Next" button, the user receives the plan of experiments (in area 1 of the main window). The settings and validation buttons are also activated. User can optionally make changes to the statistical settings (the confidence level setting and whether irrelevant variables should be included) and optimization (the accuracy of the optimization setting and, if necessary, the range of the value of the parameter being tested).

🔛 Settings 🛛 🕹	🖁 Settings X
Statistics Optimization	Statistics Optimization
✓ Do you want to include insignificant variables in calculations? Variables significance —	Optimisation precition: Edit (The higher the value, the better the accuracy, but larger granutization time)
Test:       t-Student (t)         Level of significance:       0.05         Equation adequence	Investigated parameter range: MIN: Currently: - MAX: Currently: 99999 Edit Delete Currently: 99999
Level of significance:     0.05       Save changes       Back	Back

(j) Statistics settings tab.

(k) Optimization settings tab.

After filling in the results column in the main view (the first column of the plan area), confirm the results by clicking the "Save changes" button. It causes results to be display of optimization and

	Options - About								
	Result Y	a	b	с	ab	bc	ac	Factorial or fractional factorial design	CORRECT MOD
	0.234903891	400	0.33	2	133.2	0.67	800	Name Min Max Coefficient t Sign	ficant Optimal value
	0.107031069	300	0.33	2	99.9	0.67	600		
	0.098821315	400	0.12	2	50	0.25	800		
	0.10333743	300	0.12	2	37.5	0.25	600		
I	0.254383042	400	0.33	1	133.2	0.33	400		
(	0.155965822	300	0.33	1	99.9	0.33	300	ab Interaction 1 37.5 133.2 0.006303 6.1873 YES bc Interaction 2 0.125 0.666 -0.1755 1.7228 NO	
	0.08309432	400	0.12	1	50	0.12	400		
	0.114475147	300	0.12	1	37.5	0.12	300		
	0.172533172	350	0.23	1.5	80.15	0.34	525	y = 0.497 - 0.00139x <sub>0</sub> - 1.5189x <sub>0</sub> - 0.07433x <sub>0</sub> + 0.006303x <sub>0</sub> x <sub>0</sub> Opt value: 0.2532	
	0.20218206	350	0.23	1.5	80.15	0.34	525		F crit.: 18.51
	0.183607251	350	0.23	1.5	80.15	0.34	525		O Natural O Coded
								0.25 0.2 Result Y 0.15	Set optimal va Y result Result Y Sign Name Variable X Temperature Sign Name
	eate new pla			ç <sub>o</sub> etting			Confirm	400 350 Temperature 300 0.3 Concentration	Variable Z Concentration

(I) Final results view.

graph details (an exemplary final view is shown in **Fig. I**). In the case when the chosen model proves to be an appropriate model for describing the tested process, the text fields on the right part of the window are green and the word "CORRECT MODEL" appears. Otherwise, it is the red color and the inscription "WRONG MODEL".

#### Optimization

When the user received the results of optimization and analysis of the significance of variables and the adequacy of the equation, he has the possibility to adjust the optimal value by his needs. It could be helpful, for example, when variable does not affect the process much, and lowering its value would significantly reduce costs. This is enabled by the variable value optimization window (**Fig. m**).

Results - variables value optim	nization				- 🗆 X
					_
Name	Min	Max	Optimal value	Actual value	Choose variables type
Temperature	300	400	400	400.001	O Natural
Concentration	0.125	0.333	0.332	0.332	
Pressure					Regression results Calculated actual value: 0.2532 Calculated optimal value: 0.2532
Temperature	<b>400.001</b>	<			›
		300		400	
Back					Save actual values as optimal

(m) Variables value optimization window.

In order to adjust the optimal value of a certain variable, it should be selected on the list, and then the slider should be changed to the wanted value. To accept your settings, click "Save actual values as optimal".