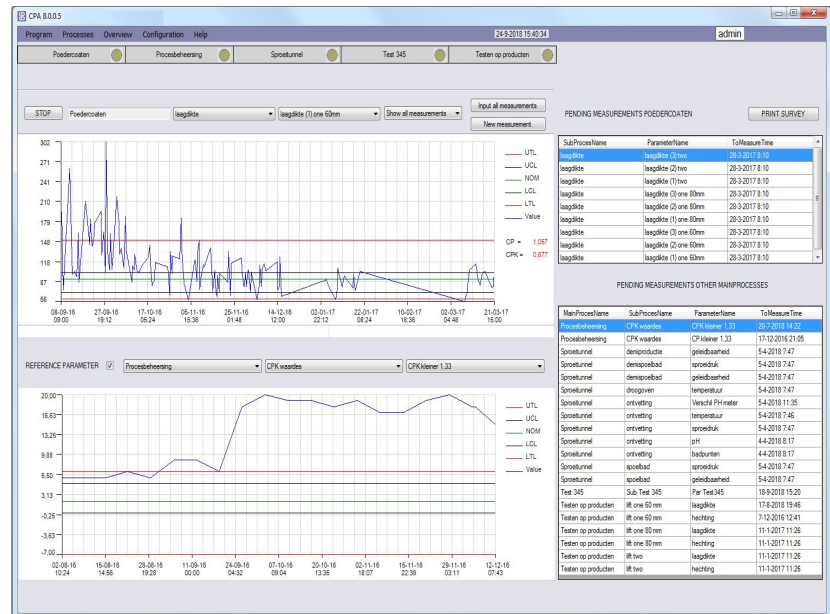


User manual Rev. 8005

Process control



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1 Preface

1.1 Purpose

This program has been developed to register and control process values, and to analyze processes using statistical algorithms.

Using this program will give you a good insight in your processes, their manageability and predictability.

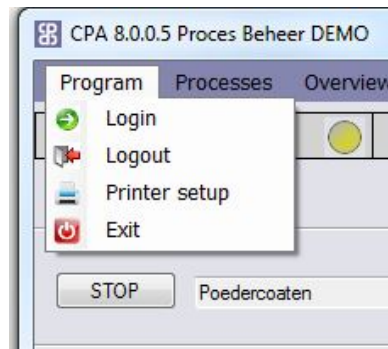
1.2 Measuring frequency assurance

For each parameter following time intervals are defined, time after start of process, time interval between two measurements and time after (corrective) action has been taken. The system will alert you after these times to perform a new measurement .

1.3 Overview of processes

As the process operator inputs measurements, graphs will be created to display a historical overview of the running processes. In the background statistical algorithms will be run on the processes to generate CP / CPK indexes.. These indexes can furthermore be used to determine stability and predictability e.g. what will be the change of large fluctuations in product quality that can lead to rejection of products.

2 Program



2.1 Login

When you run the program for the first time please login with default username / password (admin / cpa). See section "user management" for adding new users. Language can be selected for the specific user.



2.2 Logout

To start using the program as a different user / language please select program - > logout. Processes will continue to run.

2.3 Printer setup

Configure the printer setting. Reports generated by the program will all be in "landscape" mode. Change your printer setting accordingly.

2.4 Exit

By choosing exit the program will be closed and data will be saved to the database.

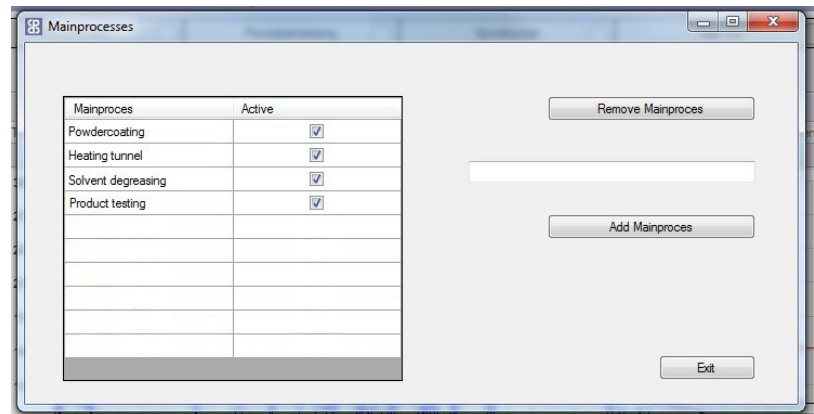
3 Processes

Menu item processes, view and define main processes, subprocesses and parameters.

3.1 Main processes

3.1.1 Add Main processes

To add a mainprocess please provide name and select button " add mainprocess". Name has to contain at least 5 characters.



3.1.2 Remove Mainprocess

! Main processes can only be removed if no subprocesses are associated. Please remove these subprocesses before removing main processes. !

3.2 Subprocesses

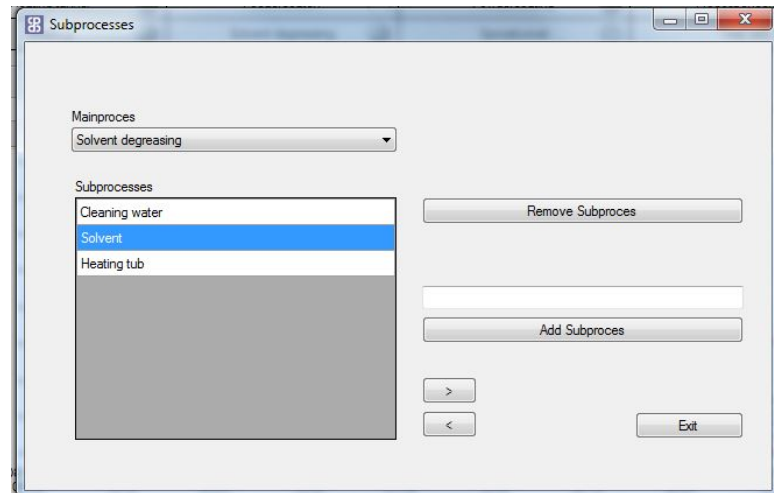
3.2.1 Add Subprocesses

To add a subprocess select mainprocess and provide name, select button " add subprocess".

! Name subprocess has to contain at least 5 characters. !

3.2.2 Remove Subprocess

To remove a subprocess, select subprocess in left panel, select button "Remove subprocess".

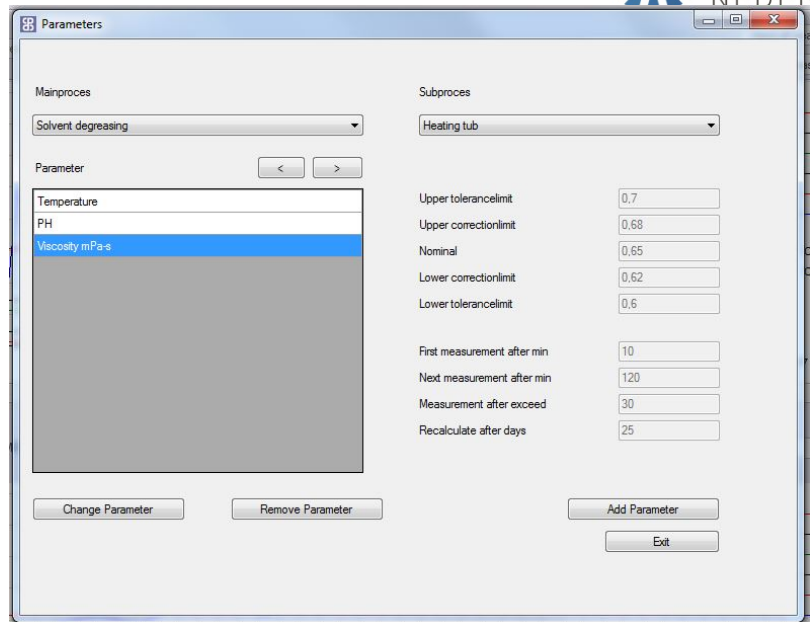


3.3 Parameters

In the submenu parameters multiple process parameters can be defined. Furthermore different aspects of the parameter can be defined like tolerance limits, correction limits and nominal value. Also time schedule of measurement has to be defined.

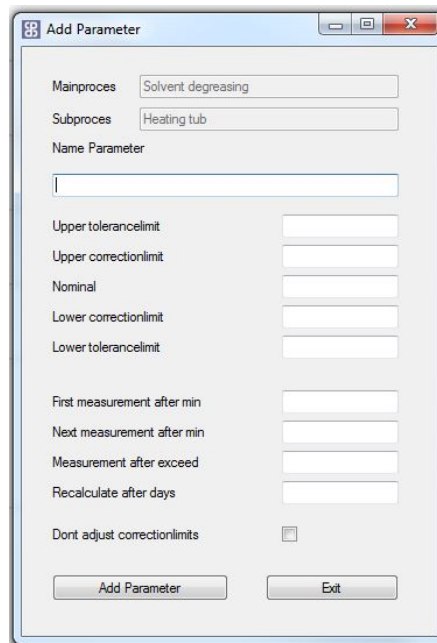
3.3.1 Add Parameters

Select mainprocess / subprocess to which parameters has to be added. Select button add parameter.



The Parameters dialog box is shown. It has two dropdown menus at the top: 'Mainproces' set to 'Solvent degreasing' and 'Subproces' set to 'Heating tub'. Below these are two buttons: '<' and '>'. A list box labeled 'Parameter' contains 'Temperature', 'PH', and 'Viscosity.mPa.s', with 'Viscosity.mPa.s' selected. To the right of the list box are input fields for various parameters: 'Upper tolerancelimit' (0.7), 'Upper correctionlimit' (0.68), 'Nominal' (0.65), 'Lower correctionlimit' (0.62), 'Lower tolerancelimit' (0.6), 'First measurement after min' (10), 'Next measurement after min' (120), 'Measurement after exceed' (30), and 'Recalculate after days' (25). At the bottom are three buttons: 'Change Parameter', 'Remove Parameter', and 'Add Parameter', with an 'Exit' button at the very bottom right.

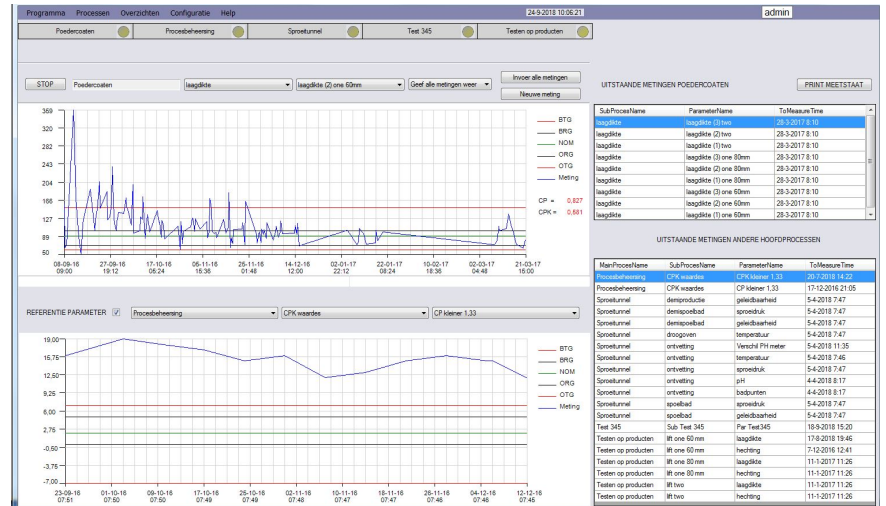
Push button "Add Parameter"



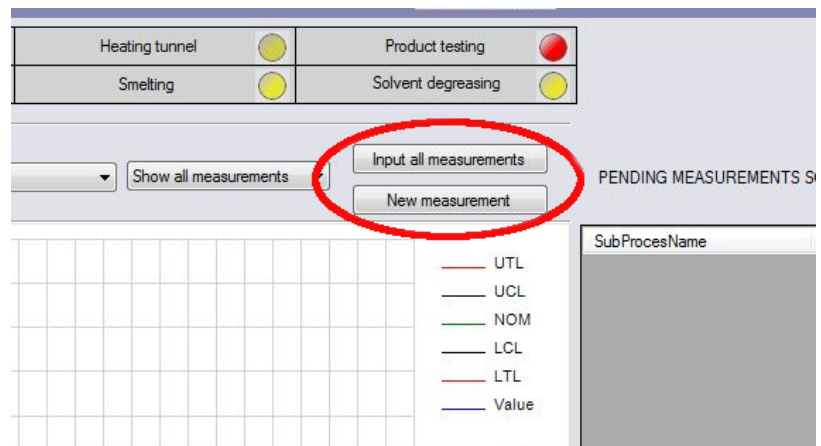
The Add Parameter dialog box is shown. It has two dropdown menus at the top: 'Mainproces' set to 'Solvent degreasing' and 'Subproces' set to 'Heating tub'. Below these is a text box labeled 'Name Parameter' which is empty. To the right of the text box are input fields for various parameters: 'Upper tolerancelimit', 'Upper correctionlimit', 'Nominal', 'Lower correctionlimit', 'Lower tolerancelimit', 'First measurement after min', 'Next measurement after min', 'Measurement after exceed', and 'Recalculate after days'. At the bottom is a checkbox labeled 'Dont adjust correctionlimits' which is unchecked. At the very bottom are two buttons: 'Add Parameter' and 'Exit'.

3.4 Reference parameter

By selecting checkbox reference parameter a second graph will be displayed so correlation between processes can be determined. E.g. thickness of paint layer related to temperature of material.



4 Input measurements



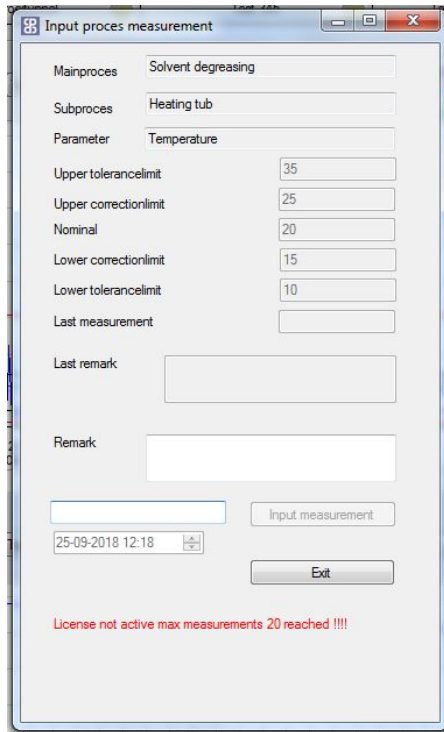
The screenshot displays the 'Manual Process control' interface. At the top, there are four status indicators: 'Heating tunnel' (yellow circle), 'Product testing' (red circle), 'Smelting' (yellow circle), and 'Solvent degreasing' (yellow circle). Below these, there are two buttons: 'Show all measurements' and 'Input all measurements'. The 'Input all measurements' button is circled in red. To the right of these buttons is a section labeled 'PENDING MEASUREMENTS S'. Below the buttons is a large grid area. To the right of the grid is a legend with five entries: 'UTL' (red line), 'UCL' (black line), 'NOM' (green line), 'LCL' (black line), and 'LTL' (red line). Below the legend is a section labeled 'SubProcesName' with a grey background.

4.1 Input only one measurement

To input just one measurement:

- Double click on pending measurement in table view pending measurements.
- Click on button "New Measurement"

In both cases following window will be shown.



If value exceeds the limits a remarks has to be given, otherwise value won't be committed.

4.2 Input multiple measurements

To input multiple values, (e.g. after process operator has filled the survey list) , select "Input all measurements". However, no different measurement times can be given !

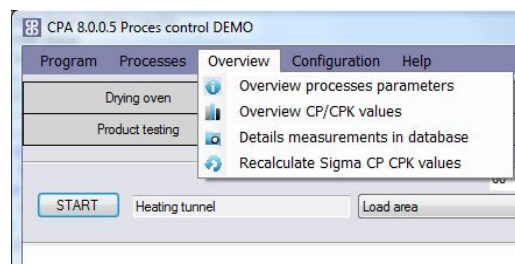
Input all measurements

Hoofdproces	Subproces	Parameter	Waarde	Opmerkingen
Powdercoating	Layer thickness	thickness (1) two		
Powdercoating	Layer thickness	thickness (2) two		
Powdercoating	Nozzles	Gap		
Powdercoating	Nozzles	Cleaning		
Powdercoating	Voltage	Ground difference		
Powdercoating	Voltage	Left plug		
Product testing	Layer thickness	Inside		
Product testing	Layer thickness	Outside		
Heating tunnel	Load area (Q)	Temp		
Heating tunnel	Load area (Q)	Humidity		
Solvent degreasing	demi	Voltage		
Solvent degreasing	demi	Resistance		
Solvent degreasing	droogoven	Temp		
Drying oven	demi	geleidbaarheid		
Powdercoating	Nozzles	Gap		
Powdercoating	Nozzles	Cleaning		
Powdercoating	Voltage	Ground difference		
Powdercoating	Voltage	Left plug		
Product testing	Layer thickness	Inside		
Product testing	Layer thickness	Outside		
Heating tunnel	Load area	Temp		
Heating tunnel	Load area	Humidity		
Solvent degreasing	Heating tub	Temperature		
Solvent degreasing	Heating tub	PH		
Solvent degreasing	Heating tub	Viscosity mPa s		

Input measurements 26-09-2018 12:09

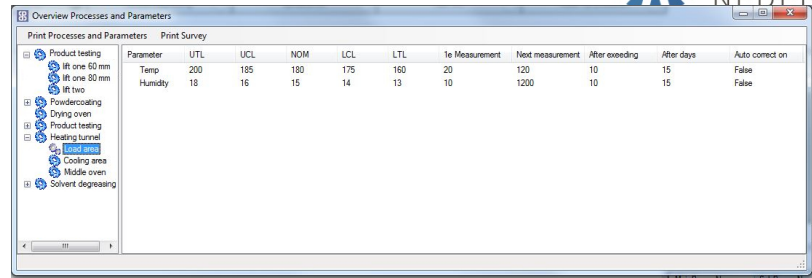
Exit

5 Overview



5.1 Overview processes parameters

Overview of processes and parameters, clicking the "+" sign will expand the tree view.



Parameter	UTL	UCL	NOM	LCL	LTL	1e Measurement	Next measurement	After exceeding	After days	Auto correct on
Temp	200	185	180	175	160	20	120	10	15	False
Humidity	18	16	15	14	13	10	1200	10	15	False

5.1.1 Print survey

Select menu "print survey". By printing to a PDF printer a pdf file will be generated containing all process info.

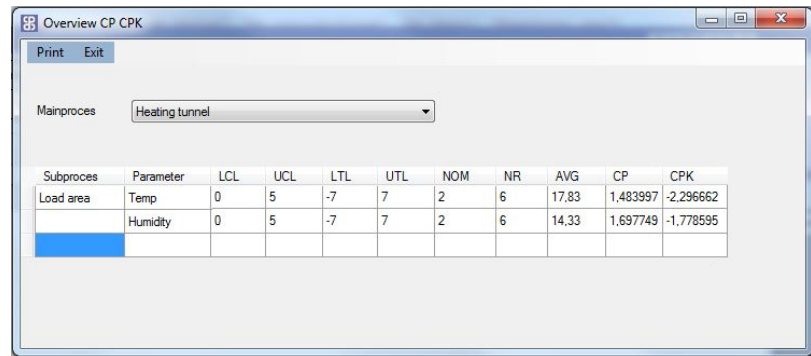
Report overview Processes Subprocesses Parameters 26-9-2018 14:47:43

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Gap	10	9	8	7	6	1	1	1	15	False
Cleaning	3	2	1	0	-1	10	11	11	11	False
Subprocess Voltage										
Parameter	UTL	UCL	NOM	LCL	LTL	1e input	Next input	After exceeding	After days	Auto correct on
Ground difference	3	2	1	0	-1	1	1	1	1	False
Left plug	5000	4800	4600	4400	4200	1	1	1	1	False
Mainprocess Drying oven										
Mainprocess Product testing										
Subprocess Layer thickness										
Parameter	UTL	UCL	NOM	LCL	LTL	1e input	Next input	After exceeding	After days	Auto correct on
Inside	45	20	15	10	0	10	20	1200	15	False
Outside	65	60	55	50	45	10	20	1200	15	False
Subprocess UV resistance										
Parameter	UTL	UCL	NOM	LCL	LTL	1e input	Next input	After exceeding	After days	Auto correct on
Subprocess Layer thickness										
Parameter	UTL	UCL	NOM	LCL	LTL	1e input	Next input	After exceeding	After days	Auto correct on
Mainprocess Heating tunnel										
Subprocess Load area										
Parameter	UTL	UCL	NOM	LCL	LTL	1e input	Next input	After exceeding	After days	Auto correct on
Temp	200	185	180	175	160	20	120	10	15	False
Humidity	18	16	15	14	13	10	1200	10	15	False
Subprocess Cooling area										
Parameter	UTL	UCL	NOM	LCL	LTL	1e input	Next input	After exceeding	After days	Auto correct on
Subprocess Middle oven										
Parameter	UTL	UCL	NOM	LCL	LTL	1e input	Next input	After exceeding	After days	Auto correct on
Mainprocess Solvent degreasing										
Subprocess Cleaning water										
Parameter	UTL	UCL	NOM	LCL	LTL	1e input	Next input	After exceeding	After days	Auto correct on
Subprocess Solvent										

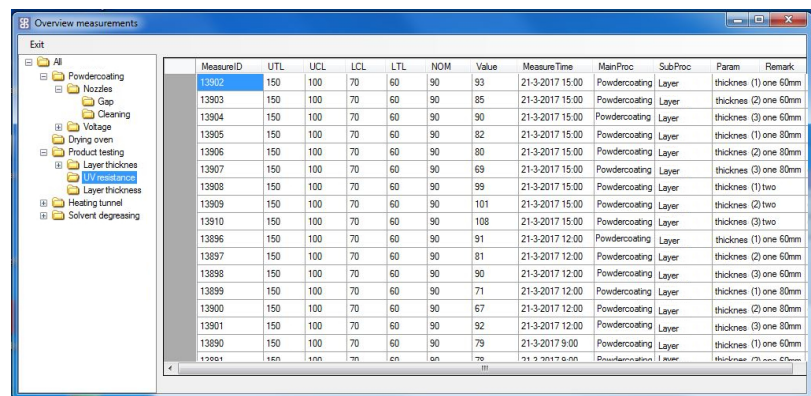
5.2 Overview CP/CPK values

Selecting this menu option will give you a quick overview of the CP/CPK values of the parameters. Every industry has it's own standard, in the Coating industry CPK-values smaller than 1,3 are considered too low !



Subproces	Parameter	LCL	UCL	LTL	UTL	NOM	NR	AVG	CP	CPK
Load area	Temp	0	5	-7	7	2	6	17,83	1,483997	-2,296662
	Humidity	0	5	-7	7	2	6	14,33	1,697749	-1,778595

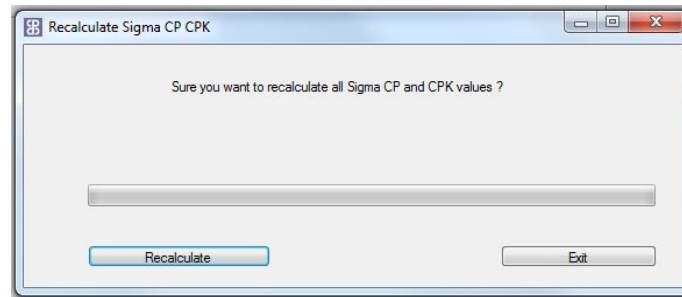
5.3 Detailed overview measurements



MeasureID	UTL	UCL	LCL	LTL	NOM	Value	MeasureTime	MainProc	SubProc	Param	Remark
13902	150	100	70	60	90	93	21-3-2017 15:00	Powdercoating	Layer	thickness (1) one 60mm	
13903	150	100	70	60	90	85	21-3-2017 15:00	Powdercoating	Layer	thickness (2) one 60mm	
13904	150	100	70	60	90	90	21-3-2017 15:00	Powdercoating	Layer	thickness (3) one 60mm	
13905	150	100	70	60	90	82	21-3-2017 15:00	Powdercoating	Layer	thickness (1) one 80mm	
13906	150	100	70	60	90	80	21-3-2017 15:00	Powdercoating	Layer	thickness (2) one 80mm	
13907	150	100	70	60	90	69	21-3-2017 15:00	Powdercoating	Layer	thickness (3) one 80mm	
13908	150	100	70	60	90	99	21-3-2017 15:00	Powdercoating	Layer	thickness (1) two	
13909	150	100	70	60	90	101	21-3-2017 15:00	Powdercoating	Layer	thickness (2) two	
13910	150	100	70	60	90	108	21-3-2017 15:00	Powdercoating	Layer	thickness (3) two	
13896	150	100	70	60	90	91	21-3-2017 12:00	Powdercoating	Layer	thickness (1) one 60mm	
13897	150	100	70	60	90	81	21-3-2017 12:00	Powdercoating	Layer	thickness (2) one 60mm	
13898	150	100	70	60	90	90	21-3-2017 12:00	Powdercoating	Layer	thickness (3) one 60mm	
13899	150	100	70	60	90	71	21-3-2017 12:00	Powdercoating	Layer	thickness (1) one 80mm	
13900	150	100	70	60	90	67	21-3-2017 12:00	Powdercoating	Layer	thickness (2) one 80mm	
13901	150	100	70	60	90	52	21-3-2017 12:00	Powdercoating	Layer	thickness (3) one 80mm	
13890	150	100	70	60	90	79	21-3-2017 9:00	Powdercoating	Layer	thickness (1) one 60mm	

5.4 Recalculate Sigma CP CPK values

CP/CPK values are calculated immediately when inputting a new value. However if measurements are inserted instead of appended or parameter settings have been changed this will ensure that all CP/CPK values are recalculated. This won't be necessary in normal operating mode !



6 Configuration

6.1 General

General configuration like database location, scheduling of backup and log levels.

6.2 Users

To administer users of the system, add, change and delete users.

User can be one of the following user types :

User type	Permissions
Operator	Insert measurements on actual date, view and print. Change own password.
Admin	Delete measurements, change time of measurements, recalculate CP/CPK , add change all users.

6.3 Registration

Registration of license.

6.4 Save database

Save database to location given in Configuration -> General. Before making large changes to the database best practice will be to backup the database.

6.5 Input measurement

Input only one measurement.

6.6 Clean database

Remove inconsistencies in database like multiple measurements on same time, measurements for non-existing / removed parameters. Remove all measurements before given date thus reducing the size of your database.

6.7 External output, CSV

Generate a file containing measurements in a Comma Separated Values (CSV) format.

File generated will contain the following 8 columns

Measurement time, Mainprocess, Subprocess, Parameter , Value ,CP , CPK ,
Remark

7 Restore database backup

Open Configuration -> registration write down / copy license numbers. The database contains the registration keys and will be reinstalled in case you are restoring a database with old registration keys.

Stop the program , Program -> exit.

The file c:\spc\spc.spf contains the database, before overwriting it would be good practice to copy the file to a safe place !

Next rename or copy the backup file (e.g. spc201808221030.bak) to c:\spc\spc.spf

Start the program and if needed adjust Program -> Configuration -> Registration.

In case of problems please contact info@coatingadvies.nl

8 Glossary

Mainprocess	An production installation like powder coating machinery or an end product like bumpers.
Subprocess	Part of the mainprocess like heating oven or the subpart of a product e.g. bolts of a bumper.
Parameter	Values of a subprocess to be measured like temperature or diameter.
Nominal	The most ideal value of a parameter.
Correction limits	When a measurement exceeds these limits, the chances that this is a value normally to be expected within process, are so slim to action needs to be taken. According to the statistical algorithm $RG = NOM \pm (\sigma * 1.88)$
Tolerance limits	Whenever a measurement exceeds this limits the quality of the end product can no longer be guaranteed. It would be best to stop the processes related to this measurement and to register all products made during the arising of these values. Tolerance limits have to be determined in accordance with supplier and process manager (e.g. tolerance limits of chemicals may vary based upon supplier and used machinery)
1° measurement after	Time in minutes between start of process and first measurement.

Next measurement after	Time between consecutive measurements after first measurement has been succeeded.
Measurement after exceeding limits	Time between two measurements of which the first has exceeded the correction / tolerance limits. After exceeding these limits process has to be adjusted and therefore next measurement has to be shortly after exceed occurred.
Recalculate after	Number of days upon which the CP and CPK values will be calculated. Please notice that when with time interval number of measurements is less than 30 no CP / CPK value will be calculated.
CP value	<p>This number represents how much the process is expected to operate between the tolerance limits. If this number is below 1,3 the process isn't predictable enough. The CP value determined by the following algorithm:</p> $CP = (UTL - LTL) / (6 * \sigma)$
CPK value	<p>This number represents how much the process will operate between the tolerance limits. Goal is to keep this value above 1,3. The CPK value is determined by the following algorithm:</p> $CPK = (\min(x' - LTL), (UTL - x')) / (3 * \sigma)$

9 Liability

This Process control software will help you administer and improve the manageability of your process(parameters). However, the liability for checking these parameters and their tuning will still be the responsibility of the process controller or process manager. Therefore, unless we specifically agree in writing to do so, we do not accept any liability whatsoever or howsoever arising out of the use of this software.