

Oven-Series

Rapid Thermal Process Oven Reflow Solder Oven

SPS_Soft

Software for programming SPS based VPO/VSS/RTP/RSO series









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1. Starting and operation of the SPS Soft software

1.1 Automatic start of controller

After switching on the system (RTP, VPO, RSO, VSS), the SPS module in the control unit and the touch panel are automatically booting. On the touch panel the start screen appears.



Figure 1: Start screen (after booting of touch panel) with explanation of some touch buttons

The start screen provides information on the system status (e.g. temperature of substrate (figure in green color), pressure (in hPa) inside process chamber, outside temperature of chassis (small figure)) and also offers several buttons (rectangular icons with grey background color). The action resulting from pushing the button depends on the button:

- i) "Exit" button. Pushing this button will cause leaving the user interface level.
- ii) "Language" button: this allows to select another language (German, English)
- iii) Configuration, PID controller, Manual control, Messages, Data logger (top row): this will lead to a different menu (see next chapters)
- iv) Im-export: this will enter the import/export menu
- v) edit: this will enter the program edit menu
- vi) start: this will cause the start of the selected program shown in bottom line
- vii) Pull down menu for program selection: this will allow to quickly select the program from a list of 50 programs



Notice: the previous version of SPS_Soft features 12 programs. Here the start screen looks slightly different.

1.2 Menu overview

The following diagram shows the hierarchy between the start screen and the five control menus:

Selecting the respective control menu is done by pushing the respective menu button (config, PID control, manual control, messages, data logger).





Home button:

Each of the control menu screens shows a button "home" in the top line. Pushing the home button will lead back to the start screen.



Language button:

Pushing this button will change the language of the menus from English to German and back.



1.3 Open/close status of front loading system (RTP, RSO)

The status of opened or closed carriage tray is shown by the respective icon (picture symbol).

In case of a closed carriage tray, the program start button is visible and can be pushed (see Figure 2).



Figure 2: Start screen with closed carriage tray and program start button

In case of an opened carriage tray, the program start button is greyed out and cannot be pushed (see Figure 3) as a result of safety interlock.



Figure 3: Start screen with opened carriage tray and with disabled program start button



1.4 Open/close status of top loading system (VPO, VSS)

The status of opened or closed top cover is shown by the respective icon (picture symbol).

In case of a closed top cover, the program start button is visible and can be pushed (see Figure 4).



Figure 4: Start screen with closed top cover and program start button

In case of an opened top cover, the program start button is greyed out and cannot be pushed (see Figure 5) as a result of safety interlock.



Figure 5: Start screen with opened top cover and with disabled program start button



1.5 Program start

If the process chamber is closed, the program which is shown in bottom line can be started by pushing the program start button.



Figure 6: Start screen with marked position of start button.

Then the system starts the program and the touch panel shows the program progress:



Figure 7: Program screen with display of important process parameters and values



All process relevant parameters and values are displayed in a text oriented screen. In order to visualize the trend of parameters (e.g. growing, falling, staying constantly), this screen can be shown in a diagram oriented way.



Figure 8: Program screen with graphical display of important process parameters and values

Once the program has reaches the end (last step), the background color of screen will turn to green.

WinVNC	₩ N			
🖀 🗈 🐼 😔 🕬 🌉 ctri Att 🖻 🦉 💭 🗙				
program	temperature	real	ramp	set
program 08 der test	⊯ 1 [°C]	21.3		0
step name no. 05/5	⊮ 2 [°C]	21.3		
gas1 [ln/min] 0.00 0.00	p 3 [°C]	0.0	t4 [°C]	0.0
	ume	real		set
	step [sec]		0	0
	process [sec]			23
	vacuum —	real		set
🔵 topheat	pressure [hPa]	1.2e+(003	301
🔵 botheat	- cooling	power		gger
	0.0 l/min	0.0 %		0
O N2-purge	t 22.0 °C			
N2-cool	b 24.2 °C			

Figure 9: Screen showing successfully finished program

The start screen can be reached by tapping the stop button.

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In case of an unexpected interrupt, the screen background color will turn to red.

WinVNC		N		
🖀 🗈 🐼 😏 🖘 觸 Ctrl Alt 🛙	à 🖳 🔛 🗙	W		
Programm		Temperatur —	Roal Ra	imp Soll
Prog.Name Versuch 1	Prog.Nr. 01	Town 1 [90]		
Step Name Abpumpen	Step Nr. 01/2	remp i [-c]	20,9	0
- Gase				
Gas1 [In/min] N2	00,0 00,0	—7eit ———		
			Real	Soll
		Step [sec]	66	0
		Prozess [sec]		5
		Vakuum ———		() - 11
O Heizung oben	😑 Vakuum Ventil	S 1 1 5 1	Real	Soll
Heizung unten	😑 Vakuum Pumpe	Druck [hPa]	1,0e+003	
l k	HV Schieber	- Kühlung	Power	Datensätze —
▲ ND covilor		0,0 l/min	0,0 %	0
Hz spalen	Hv Pumpe	20.5.%		
N2-kühlen		20,5 C		

Figure 10: Running process screen with indication of alarm.



1.6 Editing of programs

The creation of recipes requires the login as user level "edit" in case the respective login requirement is not waived.

First select the desired program by tapping on the arrow in the bottom line.



Figure 11: Start screen with marked position of program selection pull-down menu

A pull-down menu appears which allows you to select the program which you like to edit. By grabbing the scroll bar (see Figure 12) you can scroll down the list to reach program number 50. Just again tap the program number you would like to edit.

WinVNC				
🖀 🗈 🔂 🔂 📾 觸 🤇	Xrl Alt Pe		83.11	9-25 9-14- 5
	2		nanual	data 🔛 🚝
program	01			
program	02			
program	03			\neg
program	04	program	03	
program	05			
program	06			
program	07			Ψ
program	80	der test		
program	09			-
program	01			-

Figure 12: Program selection menu with indication of scroll bar



Remark: the previous version of SPS_Soft allowed selecting one program out of a list of 12 programs.

WinVNC	
🖀 🗈 🐼 😏 🛷 😹 Ctrl Att 🖻 🖳 🗙	
Prog01: Test-1	Prog07:
Prog02: test-1000C	Prog08:
Prog03: vac-trigger	Prog09:
Prog04: Loetung	Prog10:
Prog05: test-flow	Prog11:
Prog06: Pdec-Pinc	Prog12:

Figure 13: Program selection menu (old version of SPS_Soft)

The first time a program is edited it consists of one step (step 01/1) which cannot be deleted. In order to insert a new step (after the current step), the icon "insert" needs to be pushed (see Figure 14).

🔉 WinVNC		ß		
🖀 🗈 🐼 🗲 🛷 網 Chi	Att 🛍 🖳 🔛 🗙			
	emp. 🦵 ramp 🗟	√ time	vacuum 厂	fill
value temp.	0 °C	tir	ne	20 sec
control 🔽 e	nabl			
№ N2 2.0	0 In/min 🔽 N	2-purge 🔽 vac	. valve	topheat botheat
		П ну	gate	
		J HV.	. pump	
	program	n name Pdec	-Pinc	
	step	01/5 name purg	e	
select program	m and save)1 Pdec-Pinc	— ×(⇒ 🏠

Figure 14: Location of insert icon in program edition menu



In order to delete a step from a program, the icon "delete" has to be pushed. In order to not delete a step unintentional, this deletion has to be confirmed.

WinVNC		R		
🖀 🗄 🔂 🕁 🚳 🖩	🏦 ctri Att 📭 🏪 🔚	X		
trigger F	temp.	ramp 🦹 🔽 time	∏ vacuum	fill
value ter	mp. 0 °C		time	20 sec
control [enabl			
№ N2	2.00 In/min	N2-purge	Vac. valve	topheat
			vac. pump	botheat
			🕅 HV gate	
			HV. pump	
		program name	Pdec-Pinc	
		step 01/5 nam	ne purge	
select pr	ogram and save			
program	m 01 Pdec-Pi	nc		

Figure 15: Location of icon delete icon in program edition menu

The question "segment delete?" in the following screen has to be confirmed by tapping the green "yes" button.

2	WinVNC		
[ê 🗈 🚱 😏	🛷 🍂 Ctri Ait 🖹 🖺 🖳	x
	trigger	temp.	ramp 🔽 time 🔽 vacuum 🔽 fill
	value	temp. 200 °C	time 30 sec
	control	🔽 enabled > ter	mperature band \pm 5.0 K $^{>=1 \text{ K}}_{< 99 \text{ K}}$ pressure
	∏ N2	0.00 In/min	N2-purge 🔽 vac. valve 🖵 topheat
			N2-cooling 🔽 vac. pump 🔽 botheat
			HV gate
			HV. pump
			program name Test
			step 02/3 name T trigger
			segment delete ?

Figure 16: Confirmation of segment deletion



1.6.1 Example program without use of trigger control

The next screenshots show the creation of a program with five steps.

In the first step (no. 01/5) 2.00 standard liters per minute (nlm) of nitrogen gas (N2) are flowing into the process chamber for 20 seconds. In addition, nitrogen gas is purged. As this step defines a process which has to take a fixed time, the trigger "time" is used.

WinVNC	6		
🖀 🗈 🚱 😔 🍩 🏭 Ctri Att 🖹 🖷 🖳	x		
trigger temp.	ramp 🔓 🔽 time	Vacuum	fill
value temp. 0 °C		time	20 sec
control 🔽 enabl			
₩2 2.00 In/min	₩ N2-purge	vac. valve vac. pump HV gate HV. pump	topheat botheat
	program name step 01/5 nam	Pdec-Pinc ne purge	
select program and save program 01 Pdec-Pi	nc	🗙 🗎 🗢	⇒ 🏠

The next Figure 17: Typical program step for purging with nitrogen gas step (no.

02/5) features the evacuation with rough (rotary vane) pump until a set pressure inside of process chamber (here: 5.0×10^{-2} hPa) has been reached. Please note that both boxes (vac. valve, vac. pump) are checked! Once this target pressure is reached, the next step will be performed.

WinVNC		
🖀 🗈 🔂 🗲 🛷 🏭 Ctri Att 🖻 🖳 🕻	X	
trigger temp.	ramp 🔽 time 🔽 vacuum 🔽 fill	
value temp. 0 °C	vacuum 5.0 x10 -2 Pa	
control 🔽 enabl		
N2 0.00 In/min	N2-purge 🔽 vac. valve 🥅 topheat	
	🔽 🔽 vac. pump 🔽 botheat	
	HV gate	
	HV. pump	
	program name Pdec-Pinc	
	step 02/5 name wait	
select program and save program 01 Pdec-Pin	inc 🗙 🗎 < 📄	
onremp onor - oenereider or	- 	nfo@unitemp.d



Figure 18: Typical program step for evacuation with vacuum trigger

Step number 3 (no. 03/5) contains an evacuation step (trigger: "time") of 20 seconds using the rough (rotary vane) pump.

×	WinVNC	Canada Sala		A.	
ľ	P 🗈 🐼 🗲	🛷 🍂 Ctrl 🗛 🐴 📮	X		
	trigger	temp.	ramp 🔽 time	Vacuum	🖵 fill
	value	temp. 0 °C		time	20 sec
	control	🔲 enabl			
	∏ №2	0.00 In/min	N2-purge	🔽 vac. valve	topheat
				🔽 vac. pump	botheat
				HV gate	
				HV. pump	
			program name	Pdec-Pinc	
			step 03/5 nan	ne pump	
	select program and save				
	program 01 Pdec-Pinc				

Figure 19: Typical program step for time based evacuation

In step number 4 (no. 04/5), nitrogen gas (N2) flows into the process chamber controlled at a MFC controlled flow rate of 2.00 nlm (ln/min). The trigger "pressure" causes this segment to remain active until a pressure of 1.0×10^2 hPa has been reached.

WinVNC				
🖆 🗈 🐼 🛠 av 🏨 cht Att 🛍 🖳 🗶				
trigger temp. ramp time vacuum 🔽 fill				
value temp. 0 °C vacuum 1.0 x10 +2 Pa				
control enabl				
N2 2.00 In/min N2-purge vac. valve topheat vac. pump botheat HV gate HV. pump				
program name Pdec-Pinc step 04/5 name fill				
select program and save program 01 Pdec-Pinc				

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Figure 20: Typical program step for process gas flow with pressure trigger

The last step (no. 05/5) features a hold	(pause) for a time of 300 seconds.
--	------------------------------------

WinVNC				
🖆 🗈 🔁 😏 😻 🞉 Citi Ait 🐁 🖳 🗶				
trigger 🔽 temp. 🔽 ra	amp 🔽 time 🦵 vacuum 🦵 fill			
value temp. 0 °C	time 300 sec			
control 🔽 enabl				
N2 0.00 In/min	N2-purge 🔽 vac. valve 🔽 topheat			
	vac. pump botheat			
	HV gate			
	HV. pump			
	program name Pdec-Pinc			
	step 05/5 name hold			
select program and save	select program and save			
program 01 Pdec-Pinc 🗡 📋 🗢 🖻				

Figure 21: Typical program step for time based hold event

1.6.2 Example program with use of different triggers

The next screenshots show a program with 9 steps making use of different types of triggers.

Step 1 (Figure 22) uses a trigger type "vacuum" with a set value of 5.0×10^{-5} hPa by using both fore pump and high vacuum (HV) pump. Once the set pressure is reached the program will continue with next step (Step 2).

WinVNC				
e 🖸 🗈 😔	🛷 🎉 Chi, Alt 🗞 📆 🛄 🗙			
trigger	temp. 🔽 ramp 🔽 time 🔽 vacuum 🔽 fill			
value	temp. 0 °C vacuum 5.0 x10 -5 hP	^a		
control	active			
□ N2	0.00 In/min vac. valve			
	🔽 🔽 N2 fill 🛛 🔽 vac. pump 🔽 botheat			
	🦵 cooling 🔽 HV gate			
	air-cool 🔽 HV. pump			
	program name HV-T+300C			
	step 01/9 name pump-trigger			
sele	ect program and save 📉 💊 🐑 🦰 👞			
program 02 HV-T+300C				

Figure 22: Program step for evacuation using high vacuum pump system



Step 2 is a heat up step (trigger "ramp") under HV evacuation with a set ramp rate of 0.7 K/sec. Once the set temperature of 265 °C is reached step 3 will continue.

WinVNC				
🖀 🗈 🚱 😔 🕬 🌉 Ctri Att 🖹 📲	×			
trigger 🔽 temp.	ramp 🔽 time 🔽 vacuum 🗖 fill			
value temp. 265 °C	ramp +0.700 K/sec			
control				
N2 0.00 In/min	✓ vac. valve ✓ N2 fill ✓ vac. pump ✓ botheat ✓ cooling ✓ HV gate ✓ air-cool ✓ HV. pump			
	program name HV-T+300C step 02/9 name ramp-1			
select program and save				
program 02 HV-T+300C 🔽 🗡 📋 🗢 🔿 🏠				

Figure 23: Program step for heating up with fixed ramp up rate

Step 3 defines a heat up step (trigger "ramp") still under HV evacuation at a smaller rate of 0.1 K/sec. Please notice that a trigger "ramp" does not wait for a certain temperature as start condition. In the present case the smaller ramp (step 3) helps to prevent overshooting of temperature under high vacuum condition.

WinVNC		N		
🖀 🗈 🔂 😏	🔊 😹 ctri Att 🐴 🐴 🖬 🕯	X		
trigger	Temp.	ramp 🦵 time	Vacuum	fill
value	temp. 300 °C		ramp +0.10	0 K/sec
control				
∏N2	0.00 In/min	N2 fill cooling air-cool	vac. valve vac. pump HV gate HV. pump	botheat
		program name step 03/9 nam	e HV-T+300C ne ramp-2	
sele	select program and save			
program 02 HV-T+300C 🔽 🗡 📋 🗢 🖻 🟠				

Figure 24: Program step for heating up with smaller fixed ramp up rate



Step 4 using a "time" trigger defines a heating step under high vacuum and a set temperature of 300 °C for a time of 600 sec.

WinVNC		2		
🖀 🗈 🐼 😏	🕫 🍂 Ctrl Att 🗎 🐴 👫	X		
trigger	temp.	ramp 🏷 🔽 time	Vacuum	∫ fill
value	temp. 300 °C		time	600 sec
control	active			
∏N2	0.00 In/min		Vac. valve	
		N2 fill	🔽 vac. pump	🔽 botheat
		Cooling	🔽 HV gate	
		🔲 air-cool	🔽 HV. pump	
		program name	e HV-T+300C	
		step 04/9 nam	ne hold	
sele	select program and save			
pro	program 02 HV-T+300C 🔽 👗 🖆 🌨 🏠			

Figure 25: Program step for keeping constant temperature under HV condition

Step 5 (using a "time" trigger) sets the set temperature back to 0 °C, closes the gate valve and switches off the high vacuum pump while keeping the fore pump active.

WinVNC		
😭 🗈 🐼 😔	🔊 🍂 Ctri Alt 🐴 🖳 🔒	x
trigger	temp.	ramp 🔽 time 🔽 vacuum 🔽 fill
value	temp. 0 °C	time 5 sec
control	active	
∏N2	0.00 ln/min	🔽 vac. valve
		N2 fill 🔽 vac. pump 🔽 botheat
		🔽 cooling 🔽 HV gate
		🖵 air-cool 🛛 🗍 HV. pump
		program name HV-T+300C
		step 05/9 name gate-close
sele	ct program and save	
pro	gram 02 HV-T+3	300C 💽 👗 🗐 🕋 💼

Figure 26: Program step for switching off HV pump



Step 6 uses the "fill" trigger to purge the process chamber with nitrogen gas up to a set pressure of 5.0×10^{-1} hPa. It should be noted that depending on the location of the pressure sensor with respect to the process gas inlet the reached pressure can exceed the pressure value specified in field "vacuum". Note that in present case the step name has been name "fill-3mbar" in order to take this inertia into account.

WinVNC		
😭 🗈 😔 😏	🔊 🍂 Ctri Alt 🗞 🖳 🔒	X
trigger	temp.	ramp 🗖 time 🔽 vacuum 🔽 fill
value	temp. 0 °C	vacuum 5.0 x10 ⁻¹ hPa
control	active	
▼ N2	0.10 In/min	🔽 vac. valve
		🔽 N2 fill 🛛 🔽 vac. pump 🔽 botheat
		Cooling HV gate
		🖵 air-cool 🛛 🗌 HV. pump
		program name HV-T+300C
		step 06/9 name fill-3mbar
sele	ct program and save	
program 02 HV-T+300C 🔽 👗 🖆 🏠		

Figure 27: Program step for purging a process chamber up to a trigger pressure

Step 7 uses a "time" trigger for water cooling of the heating plate for a time of 300 sec. After this time step 8 continues.

WinVNC		
🖆 🗈 😔 😔 📾 🌉 Ctri. Att 🗈 🖳	×	
trigger temp.	ramp 🔽 time 🔽 vacuum 🖵 fill	
value temp. 0 °C	time 300 sec	
control 🔽 active		
N2 0.00 In/min	🔽 vac. valve	
	🔽 N2 fill 🛛 🔽 vac. pump 🔽 botheat	
	🔽 cooling 🛛 🕅 HV gate	
	air-cool 🔲 HV. pump	
	program name HV-T+300C	
	step 07/9 name cool	
select program and save		
program 02 HV-T+3	300C 💽 👗 🗐 🌨 💼	

Figure 28: Program step for time based water cooling of heating plate

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Step 8 activates a flow of nitrogen gas (2 ln/min) in the process chamber in order to increase the cooling rate.

WinVNC		
🖀 🗈 🚱 😔 🕬 🌉 Ctri Att 🖻 🖳	X	
trigger temp.	ramp 🔽 time 🔽 vacuum 🖵 fill	
value temp. 0 °C	time 900 sec	
control 🔽 active		
N2 2.00 In/min	Vac. valve	
	🔽 N2 fill 🛛 🔽 vac. pump 🔽 botheat	
	🔽 cooling 🛛 🗍 HV gate	
	🔽 air-cool 🛛 🗍 HV. pump	
	program name HV-T+300C	
	step 08/9 name cool+fill	
select program and save program 02 HV-T+300C V		

Figure 29: Program step for water cooling and nitrogen assisted cooling using "time" trigger

The last step 9 switches off the water cooling of the heating plate and uses nitrogen gas to cool down the process chamber.

🔉 WinVNC				
🖀 🗈 🔂 🔂 🚳 🌉 Ctri /	Alt 🖻 🖳 🔛 🗙			
trigger [ter	mp. 🦵 ramp	Time	Vacuum	🖵 fill
value temp. [0 °C		time	150 sec
control 🕅 ac	tive			
№ N2 2.00) In/min	Г	vac. valve	
		N2 fill 🛛 🗍	vac. pump	🔽 botheat
		cooling [HV gate	
		air-cool 🛛	HV. pump	
	progra	am name	HV-T+300C	
	step	09/9 name	final-purge	
select program	n and save			
program 02	2 HV-T+300C	•		

Figure 30: Program step for nitrogen assisted cooling using "time" trigger



2. Configuration and manual operation of vacuum process system

2.1 Config menu

The Config menu shows the hardware configuration of the respective vacuum process system. It contains the tabs

2.1.1 Gas

This tab shows up to four process gas lines with respective gas type and the maximum flow of the MFC (mass flow controller) and the presence of cool and purge gas lines. The push button "readout" next to "MFC" can be pushed in order to show the current gas flow of the respective process gas line.

2.1.2 Heat

This tab is showing the values of maximum and minimum temperature, maximum ramp up and maximum cool down rate as well as quantity of IR lamps, lamp power, lamp voltage and lamp packets. When the check box "enabled" is set, a lamp test will be performed after switch on of the vacuum process system.

2.1.3 Vacuum

This tab is showing the type of vacuum pump, vacuum valve, pressure gauge and ultimate pressure. The check box "vacuum enabled" needs to be set (checked).









2.1.4 Cooling

Inside the box with red lines the type of chiller, the type of water flow sensor and the type of temperature sensor is set. Below this box several values can be set: "on >=" is the threshold value of the chassis temperature above which the chiller is activated. The value at "alarm flow" provides a trigger value for alarm (i.e. when the flow of cooling water should



be below this value, an alarm is triggered). The value at "alarm temp" provides a trigger value for alarm (i.e. when the chassis temperature exceeds this value, an alarm will be triggered). The values in purple color indicate ei-

ther a range or a maximum or minimum value.

2.1.5 Options

In case of additional features ("options") this field shows these options. Examples for options are oxygen sensor and interlock.

home	contig	PID Control	manual control pr	ogram logg	data Enguagi er languagi
gas	heat	vacuum	cool	options	info
- 02-sen ena liftpin ena addition	bled bled nal TC	interlock	> active = 110.0 °C = 100.0 °C > hotplate ter 0 °C	Interlock 50°c until 200,0° 20° until 110.0 with cooling > max.coolin	C °C g temperature

2.1.6 Info

This tab provides a counter for operating time (in hours, minutes and seconds), allows setting the time. When logged in as "admin", hitting the button "user control" allows to administer users (see)

home	contig	PID Control	manual control	program	dit logg	data er languag
gas	heat	vacuum	coolir	ng i	options	info
operating current t total time - Text	y hours coun i 12 29	ter h 59 min h 37 min	8	type serial r power	eter no.	150 × 0 0 KW
display_t	time 28/0	3/2014 13:49:36	5	voltage curren		
S ,	user control		port e	1	parameter	r management

The content inside the box with red line cannot be modified (even with "admin" level) as it is part of the vacuum process (e.g. RTP) system.



2.2 PID control menu

The PID control menu shows the current PID parameters of the process control and offers the chance to improve these parameters by a new tuning. In order to modify the PID parameters, you need to be logged in "control" or "admin" user level.

In the following picture, the PID parameters of the first IR lamp field (zone 1 field) are shown. The value "P" represents the proportional factor, value "I" the integral factor and "D" the derivative factor.

WinVNC		Ν	
1 1 🔂 😏	🛛 🖅 🗿 Ctrl 🗛 🗄	1 🖬 🗶 🦷	
home	contig	PID manual regler manual control progr	edit am logger language
PID	option	limit first_tune	fine_tune
Zone 1 fi	eld ———	zone 2 frame front back	zone 3 frame left right
	enabled	enabled	enabled
Р	0.210		
I	6.909		
D	1.752		
t	0.15 sec		

Figure 31: Screen showing the PID parameters of IR lamp control

The tap "option" allows entering other PID relevant factors, e.g. PWM (pulse width modulation) and quantifiers for P (proportional) and D (differential).

WinVNC	ß				
1 1 🔂 🔂 🚳	🖪 Ctrl 🗛 🗎 🖺		2014		
home		PID regler	manual control pro] edit gram logg	data Jer language
PID	option	limit	first_tune	fine_tune	
PWM on PWM off	0.0 sec. 0.0 sec.	zone 2 fra	me vh ———	zone 3 fr	ame Ir
quantifier P quantifier D factor D power	0.10 0.25 0.00 100.0 %				



Figure 32: PID option tab allowing entering of other PID relevant factors

The submenu

"limit" shows the settings of the respective vacuum process system. The values "max. temperature" and "min. temperature" define the operating temperature range. Exceeding the value stated in "max. warning" or underrunning the value stated in "min. warning" will lead to a warning message. This warning message has to be prompted by checking a check box.

In case the value stated in "max. error" is exceeded or the value stated in "min. error" is underrun, an error will be triggered. As this error could have some quite severe root causes, it leads to the abortion of program.



Figure 33: Settings of temperature limits



The submenu "first_tune" allows a rough tuning of PID parameters.

The desired temperature (in degrees centigrade, °C) and lamp power (in percent) have to be entered in the fields with light background color. After pushing the "start" button, the rough tuning of PID parameters starts with respect to the entered temperature and IR lamp power. The rough tuning usually takes about 20 seconds but can be interrupted by pushing the "stop" button.



The submenu "fine tune" allows a finer tuning of PID parameters.

📡 WinVNC							
🖀 🗈 🐼 😔 🛛	🔊 🇊 Ctrl Alt 🗎 🗎	B 🖌 🗙					
home	contig	PID regler manual prog		ingram logger	language		
PID	option	limit	first_tune	fine tune			
temp. 0 power 100	ld +12.5 ° 0.0 0.0 %	C add powe	ont back er of e lamp s	frameleft right add power of frame lam	frameleft right add power of frame lamps		
TIR error warning status start	+0 0001 0000 inaktiv	0-20%	0 %	0-20% 0	%		

UniTemp GmbH • Sepetelder Str. 9 • D-85276 Ptattenhoten • +49 (0) 8441 78 76 63 • www unitemp.de • info@unitemp.de Figure 35: Menu for fine tuning of PID parameters Page 26 of 35



2.3 Manual control

The manual control menu allows the interactive (i.e. not automated) operation of the vacuum process system. In order to use this option, you need to be logged in either as "admin" or as "control" user level.

There are four submenus (tabs) which refer to "gas", "temperature", "vacuum" and "logger".

The submenu "gas" allows the manual control of inlet gas lines. This control covers opening of process gas, cooling or purging gas lines as well as of chamber valve, setting of process gas flow and checking of the MFC status.

	WinVNC	Ν		
	🖀 🗈 🐼 🗲 🛷 鑈 Ctri Ait	🖻 🖷 🖬 🗙		
	home contig	PID h	and and program	iogger language
			:hamber	temp. 13.5 °C
	gas tempera	ture vacuum	logger	
	gas1 -N2	gas2	gas3	gas4
Open process gas line	→ On/off	on/off	on/off	on/off
Set process	set > 0.00 In/min	set 0.00 ln/min	set 0.00 ln/min	set 0.00 ln/min
gas flow	flow 0.00 In/min	flow 0.00 ln/min	flow 0.00 ln/min	flow 0.00 ln/min
Check MFC	ME info	MFC info	MFC info	MFC info
Open cooling	N2-cool	N2-purge	air-cool —	chamber-valve
gas line	→ On/off	on/off		on/off
Open purge				I
gas line -				

Figure 36: Submenu for manual control of inlet gas lines



The submenu "temperature" allows to manually switch on the IR lamps of the respective vacuum process system.

WinVNC			N		
🖀 🗈 🔂 😎 🦉	🔊 🏭 Ctrl 🛛 Alt 🛛 🖺	🖲 🖬 🗙	Ц3		
home	config	PID Control	hand control mes	ssages logge	ata 💦 👘
		1		chamber temp	23.4 ºC 24.1 ºC
gas	temperature	vacuum	logger	cool water	0.0 l/min
- temperat	ure				[100
temp.	0 °C	600-			-80
ramp [+0.00 K/s				
Set 🗌	+0.0 °C	400-			
ті Г	24.9 °C	-			-40
т2 Г		200-			-20
тз Г					
т4 Г		-100 -80	-60 -40 -2	żo ó żo 4 eat	
power	0.0 %	start/stop	bottomh	eat	



2.4 Data logger

The data logger option allows storing of process data as csv (comma separated values) data on external storage media.

2.4.1 Setting of storage path

The process data can be stored either

- i) On SD card (located in the rear side of the touch panel)
- ii) On USB 2.0 memory stick (located in the top cover of the vacuum process oven), and
- iii) On network folder.

If the storage path is set for the first time or if it has been changed (1.), the new storage path has to be confirmed by tapping the "test" button (2.). Then the new (and current) storage path is shown in the respective field right to the "test" button (3.).

WinVNC	Ν	
🖀 🗈 🔂 🗲 🕫 觸 Ctri Att 🖻		
home config	PID k manual control control messages	logger language
storage		additional data
path to sd card	\Storage Card SD\	Vacuum
path to usb stick	\Storage Card USB\	gas1
path to network	N	gas3
2.	3.	gas4
test	Storage Card USB	☐ N2 cool
	Tistolage card 0501	N2 purge
mode	sample	
	1 sample{sec]	
start automatic	0 archiv number	

Figure 37: Data logger menu with order of setting storage path



In case that the selected storage path is not available (e.g. missing connection to computer network), there will be a red bar in the field right to "test" button.

	N		
a 🖺 🔒 🗙	14		
PID ama control	nual itrol messages	logger	language
		additior	nal data 🦳
\Storage C	ard SD\	🛛 🕅 vacuu	um
Storage C	ard LISB\	🗌 🗌 gas1	
Totorage e	10.000/	gas2	
N		gas3	
		gas4	
		│	lool
		🗌 🗌 Ν2 pι	urge
sample	a.		
	1 sample{sec]		
	0 archiv number		
	o archiv humber		
	PID control mar control cor Storage Ca Storage Ca Sample	PID control messages Storage Card SD Storage Card USB N Sample ample amp	PID control manual control messages data logger addition \Storage Card SD\ \storage Card USB\ gas2 \storage Card USB\ gas2 \storage addition Qas2 \storage Card USB\ Qas2 \storage addition Qas2 \storage Card USB\ Qas2 \storage addition Qas2 \storage Card USB\ Qas2 \storage addition Qas2 \storage addition \storage a

Figure 38: Data logger menu with unavailable storage path

2.4.2 Selection of process data

Typically the process data cover time, set temperature, actual temperature, power, temperature of cooling water, flow of cooling water, pressure inside of process chamber.

TIME[sec]	SET[°C]	TEMP[°C]	Power[%]	Water [°C]	Water [l/mi	Pressure[hi	V_valve	V_pump	Gas1	Flow1[l/min	N2_cool	N2_purge	Error	Warning	Init 🛛	
0	20,6715	20,6	2,10E-02	15,06438	0	1000	False	False	True	0,180484	False	False	C	0) (0
1	20,78851	20,6	6,43E-02	15,18012	0	1000	False	False	True	0,3859565	False	False	C	0) (0
2	20,91201	20,6	0,1174808	15,19459	0	1000	False	False	True	0,4717351	False	False	C	0) (0
3	21,04852	20,6	0,1851521	15,24523	0	1000	False	False	True	0,4962643	False	False	C	0) (0
4	21,17202	20,6	0,2544425	15,1982	0	1000	False	False	True	0,5065982	False	False	C	0) (0

If required, flags indicating the status vacuum valve, of vacuum pump and of process gas flow, the value of process gas flow, flags for the flow of cooling and of purging gas as well as codes for errors, warnings and initialization can be shown in the process data.



In order to have additional values and flags logged in the process data file, the respective check boxes need to be checked (see Figure 39).

WinVNC	
🖀 🗈 🐼 😏 🛷 綱 ctri Att 🖻	Ň 🖬 🗙
home contig	PID control manual control manual program edit logger language
storage	additional data
path to sd card	\Storage Card SD\
path to usb stick	\Storage Card USB\ ☐ gas1
path to network	M gas3
	gas4
test	N2 cool
	sample N2 purge
start automatic	1 sample{sec]
	19 archiv number

Figure 39: Checked boxes in frame "additional data"



2.5 Export and import of programs

All programs stored on the touch panel can be exported to different storage media. By pushing the button "im-export" on the start screen (see Figure 40) the import/export menu is selected.



Figure 40: Location of push button "im-export" on start screen

The import/export menu (see Figure 41) clearly defines the steps required for importing programs from external storage media or for exporting programs to external storage media.

WinVNC	L.	
🖀 🗈 🐼 🔂 as 😹 Ctri Att 🖻 🖷 🖬 🗙		
import export programs		IE IC
select program		0 53
1		
2	ns in 4 steps	4
import select programspace in	control unit	save
program 02	
export program	ns in 3 steps	3 1
select storage space		
2		
	50 1 SE ES	0 50 EE EC

Figure 41: Import/Export menu

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The three steps for export of a program to external storage media is explained in the next figures:

First the program to be exported has to be selected through the pull down menu.



Figure 42: Selection of program to be exported through pull down menu

As next step the storage destination has to be chosen (see Figure 43). In the present case the USB memory stick shall be selected. After selecting the destination "Storage Card USB" the "OK" button has to be entered.

WinVNC	
🖆 🗈 🚱 😏 🕸 😹 Crri Att 🔤 🖳 🗶	
import export programs	
select program 0 0 50 +1	0 53
1 Select path	
2 🚣 🔶 📂 🗟 🕠 к х	4 💾
import 3 w Computer	save
Network Starage Card SD 📂 My Docume	export
Application Data 📂 Program File	
coloct storage card USB Control Panel.Ink 📂 Temp	3
2	
Name: My Computer	0 50
Type: ES	EE EC

Figure 43: Selection of destination path for program export

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The selected path appears in the line "select storage space" (see Figure 44).

WinVNC		
📸 🗈 🚱 😏 🎯 🏨 Citi, Ait 🛍 🖺 📕 🗙		
import export programs PS SS select program 0 0	SI IS 50 +1	IE IC 0 53
1 2 import programs in 4 step	s	4 💾
import 3 program 02 1 export programs in 3 step	• –	save
select storage space		
	50 1 SE ES	0 50 EE EC

Figure 44: Confirmation of destination path for export

The process of program export is started by pushing the "export" button.

WinVNC		
🖀 🗈 🐼 🗲 🕫 🍂 ctrl. Att 🖻 🖳 🗙		
program		
	vacuum pump	
active steps 1	vacuum vaive	
	vacuum control	
	vacuum hv pump	0
trigger 0	Vacuum hv gate	
1.230 I -		
gas1 0 Text 0	process control	0 time 10 temp 10
gas2 0 Text 0	process error	O Top heat O
gas3 0 Text 0	cool water valve	0 bottom heat
gas4 0 Text 0	air cool valve	
	chiller	0 sound 0
ramp rate +0	N2 purge valve	0 lamp 0
	N2 cool valve	0 reserve 1 0
	N2 fill up	n reserve 2 n
program 02		Tout D Tout
program oz		Text S Text

Figure 45: Operation of program export

The progress of program export might take some time (it cannot be shortened). At the end of program export, the import/export menu reappears. By pushing the home button the start screen can be reached.

As the import of programs is similar to the export of programs it will not be described in further detail.

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2.6 Access management

There are five user levels which define the available user rights. The following matrix shows the available rights of each user level:

Available	Start of	Selection	Edition of	Manual	Change of	Admini-
Rights	process	of recipe	recipes	control	PID parame-	stration of
	-	-			ters and con-	users
Login					trol process	
name: 🔪					settings	
admin	Х	Х	Х	Х	Х	Х
control	Х	Х	Х	Х	Х	
edit	Х	Х	Х	Х		
select	Х	Х				
start	Х					

The login requirement for the four lowest levels (select, start, edit, control) can be waived by the system administrator (login: "admin"). In Figure 46 the login requirements for user levels "start", "select" and "edit" have been waived (the respective check boxes are unchecked).

	(WinVNC		
		Image: Control of the second secon	PID manual control control	messages logger
		gas hea	at vacuum cooli	ng options info
		operating hours o	ounter	parameter
		current time 1	h 43 min 5	type VPO 🔽
Unchecked		total time 94	ł h 9 min 22	serial no. 0
boxes, i.e.		login —	time	power 42 KW
waived log-		🛛 🔽 login start	11/04/2014 15:22:13	voltage 6x 230V
in require-	4	login select	- user administration	curren 6x32A
ments for user levels start, select	L	login edit		parameter management
and edit				и

Figure 46: Configuration information screen with waived login requirements

Each login (for all five user levels) expires after a certain time (which can be set by system administrator).