LABOGENE
Scandinavian by Design

INSTRUCTION MANUAL

DOMINIQUE DUTSCHER SAS



CoolSafe Touch

Item No. 700636
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Symbols used in this manual

	**Note**
	Used to direct attention to a special item.

	**Warning**
	Used in case of danger of a serious accident or lethal injury.

	**Caution**
	Used in case of danger of medium or minor injuries or physical damage.

This document is the original instruction manual in accordance with the current Machinery Directive. This document is the reference for any translation of this instruction manual. In case of doubts or uncertainties the text in the original instruction manual is the valid.

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1 Introduction

This manual covers the CoolSafe models using the touch control system. The models are:

CoolSafe Touch 55-4, 55-9, 55-15, CoolSafe Touch 95-15, CoolSafe Touch 100-9 and CoolSafe Touch 110-4.

CoolSafe 4-15 l is an outstanding and versatile range of advanced bench-top freeze dryers. They are the product of more than 40 years' experience and expertise, and are the ideal choice for research, process development and small-scale production.

All come with a choice of condenser temperatures and a wide range of high-quality chambers and accessories. All models offer both simplicity of operation and the highest performance characteristics to meet the demands of today's research and development laboratories.

- Lowest condenser temperatures of -55°C, -95°C, -100°C or -110°C.
- Seamless stainless steel condenser with external cooling coils, heavily insulated to conserve energy and increase performance Easy removal of water via drain valve.
- Easy draining with built-in valve, allowing removal of water after a completed freeze-drying session.
- Easy operation with a built-in vacuum valve connecting the condenser and vacuum pump and allowing the condenser to cool down and the vacuum pump to warm up separately, ensuring an efficient start-up sequence.
- New touch screen controller with regulation of temperature, pressure and time.
- Freeze-drying with programming and storage of protocols for full research and method development.
- Wide choice of manifolds, chambers with heated shelves and accessories to suit your sample requirements.
- Available with 4-litre condenser capacity and temperature options of -55°C or -110°C and condenser ice capacity of 2.5 kg/24 hours - max. 3 kg in total.
- Available with 9-litre condenser capacity and temperature options of -55°C or -100°C and condenser ice capacity of 4 kg/24 hours - max. 7 kg in total.
- Available with 15-litre condenser capacity and temperature options of -55°C or -95°C and condenser ice capacity of 6 kg/24 hours - max. 10 kg in total.

If you are not familiar with the freeze-drying process, please read the section "The freeze-drying process", which outlines the freeze-drying process.

2 Safety precautions

2.1 General information

Please read this entire manual to fully understand the safe and effective use of this product. Should you have any comments about this manual we will be pleased to receive them.

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☞	**Note**
	If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

2.2 Safety

All CoolSafe models are electrically protected with an over current circuit breaker.

All CoolSafe models utilize low temperature refrigeration to -55°C, -95°C, -100°C or -110 °C and under no circumstances should the cold surfaces of the condenser be touched whilst switched on, in operation or in the de-icing process.

Do not handle, move or service the vacuum pump whilst in operation or if it is switched off, until it has cooled down to ambient temperature. (See paragraph 7.2 regarding maintenance & changing of oil in the vacuum pump).

It is advisable that safety glasses and personal protective garments are worn by all users of the equipment.

CoolSafe Touch models 95-15 and 100-9 are fitted with castors, the front pair being lockable. Once located in the position conducive to both the safety of the laboratory environment and personnel, it is advised that the castors be in the locked position.

The safety system is designed according to safety requirements for electric equipment, control and laboratory use (EN 61010-1), which assumes that two separate faults do not occur simultaneously.

3 Installation

3.1 Installation of CoolSafe

- Make sure that the mains supply is according to the specifications on the type label placed on the rear panel.

- It is important that free air circulation is available at the air inlet and outlet grills. If the CoolSafe is positioned against a wall, there must be at least 100 mm free space at the rear of the unit.

- The CoolSafe Touch 95/55-15 and the CoolSafe Touch 100-9 are both floor standing units fitted with castors, the front pair being lockable. Before operating the system insure that the castors are in the locked position.

3.2 Installation of vacuum pump

A two stage vacuum pump (with 2-5 m^3/h capacity or greater) must be connected to the CoolSafe Touch via the connection on the rear of the CoolSafe Touch cabinet in order to allow cryo pumping.

On the floor standing models the vacuum pump can be installed on the rear of the CoolSafe on a shelf support delivered with the equipment. On table models the vacuum pump must be placed near to the freeze dryer.

LaboGene recommends the VacuuBrand RZ2.5 rotary vane pump for which a variety of protection accessories, against aggressive materials are available. The vacuum pump outlet/exhaust is fitted with an oil mist filter as standard.

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- Check that the mains supply for the pump is according to the specifications on the type label.
- Connect the vacuum hose to the suction side of the pump.
- Connect the pump to the vacuum connection pipe on the rear panel of the CoolSafe.
- Check the oil level on the pump and fill it if necessary. The oil level sight glass should be 1/2 - 3/4 full.

LaboGene recommends that when the pump is running the gas ballast valve is in the open position.

3.3 Installation of accessories

The CoolSafe Touch is a basic unit and must be equipped with the necessary accessories in order to run a specific freeze-drying process. Select from the wide range of accessories listed in the accessories section.

Make sure to mount the correct manifold, chamber and shelf arrangements and always check that all connections are tight.

4 Functional description

The CoolSafe Touch including a vacuum pump and a chamber or manifold is a standalone unit that is setup, controlled and monitored via the user interface placed on the front of the cabinet.

The control system lets the user take complete control of the system and makes it easy to set up the system and run the freeze-drying process manually or automatically.

All the temperature, pressure and time parameters needed for the freeze drying process can easily be controlled via the control panel or user interface.

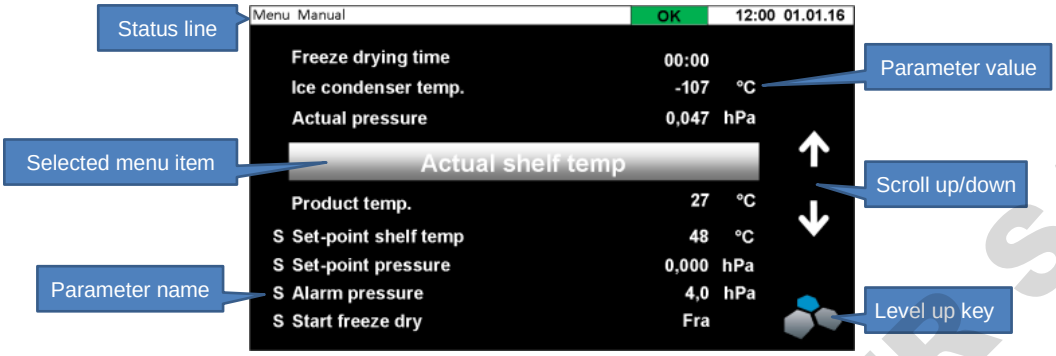
4.1 Control panel

The control panel is placed on the upper front of the cabinet at an angle for easy reading and use. The control panel, a 4,3” resistive colour touch screen, acts as input device for setup of the CoolSafe, programming of freeze drying processes, monitoring device for the freeze drying process and

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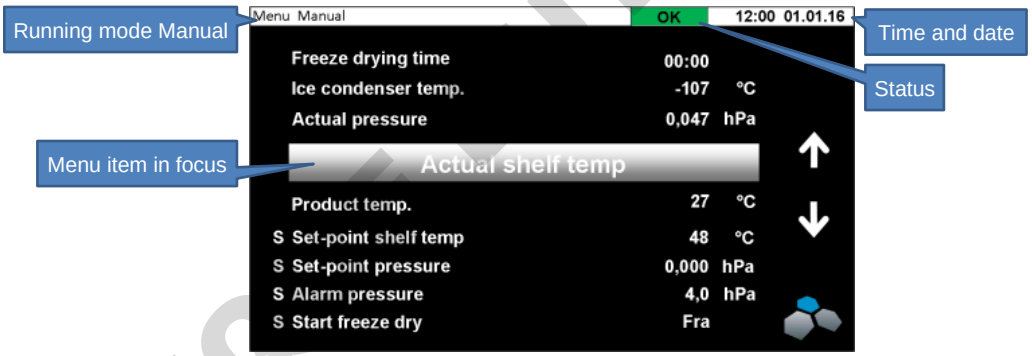
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information panel for status and alarm messages. Navigation is easy. To enter menu items just press lightly on the touch panel. If the menu holds more items than can be shown in one screen, use the UP and DOWN arrows on the right side of the display to scroll through the menu items.



Navigation is easy. To enter menu items just press lightly on the touch panel. If the menu holds more items than can be shown in one screen, use the UP and DOWN arrows on the right side of the display to scroll through the menu items. To return to the previous menu press the LaboGene logo placed in the lower right hand corner of the screen.

When a menu item is selected or in focus, the text is magnified. The text will be either yellow, indicating that the menu item is information only or the text is white, indicating that more details can be displayed by pressing the menu item selected.



The status line at the top of the display shows the running mode of the freeze dryer, i.e. Manual or Auto running freeze drying process, the actual stage of the freeze drying process, i.e. standby, pre-freezing, primary drying and secondary drying. Next the status of the freeze dryer or the current freeze drying process is displayed in a colour coded area, green for OK, yellow for OK but not ready to proceed and red for error or alarm situation. At the end time and date is shown.

4.2 Valves and connections

The CoolSafe is equipped with a number of valves and connections that makes the freeze dryer function and operate correctly. Each must be set correctly and plugged in correctly to make the CoolSafe operational.

4.2.1 Power supply and ON/OFF switch

The CoolSafe is designed to be plugged into a standard wall socket with build in earth and minimum 10 A fuse.

The CoolSafe is delivered with a country specific power cable, which is connected to the unit on the lower left hand side on the back panel. The main ON/OFF switch is placed on the front panel of the unit. When switched on the switch is illuminated green.

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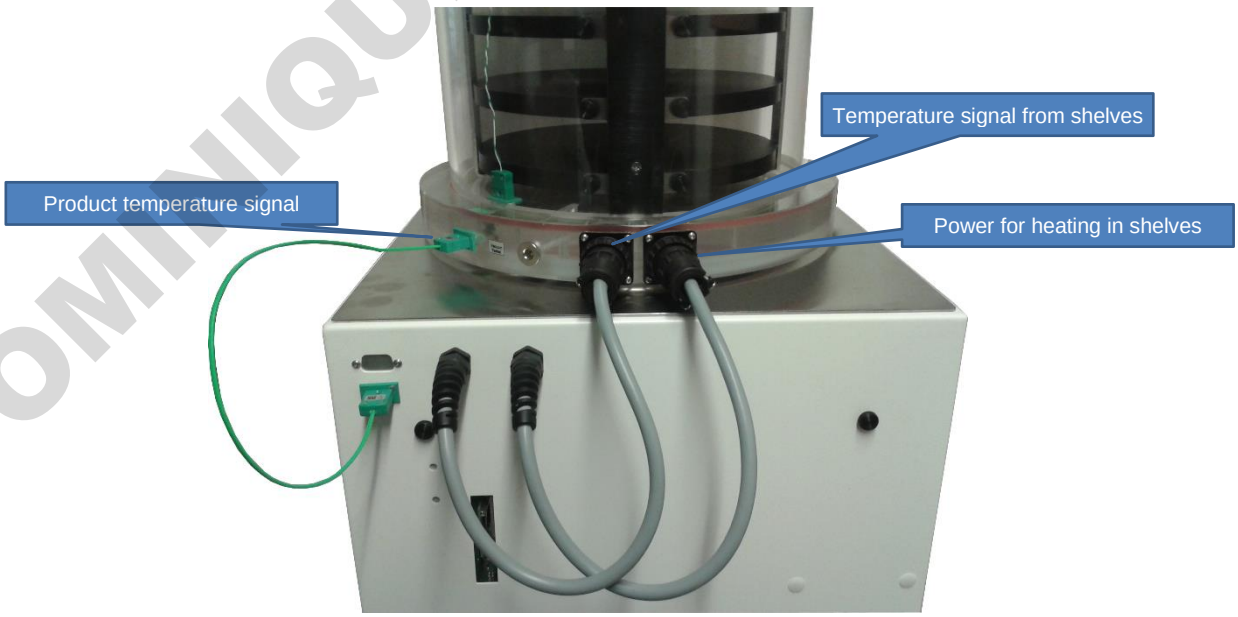
4.2.2 Vacuum pump connection

The connection for the vacuum pump is placed on the back of the cabinet. The connection between the vacuum pump and the freeze dryer is a vacuum hose, which is clamped to the nozzles on the vacuum pump and the freeze dryer with the delivered clamps.



4.2.3 Power supply for heating of and temperature signals from shelves (option)

The rack and shelves placed on top of the condenser is connected to the control system through two cables placed on the back of the cabinet.



For temperature regulation purposes, the temperature in each shelf is measured using a PT 100 temperature sensor. The signals from these sensors regulate the heating wire build into each shelf.

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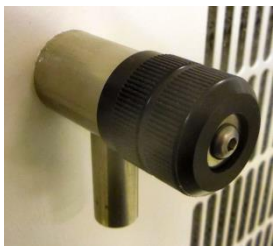
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4.2.4 Product temperature (option)

The temperature in the product being dried is measured using a thermocouple.

4.2.5 Drain valve

The drain valve is placed on the front of the cabinet. After de-icing or cleaning of the ice condenser it can be drained through the drain valve.



A hose may be attached to the nozzle to minimize spillage. Remember to close the drain valve after use.

4.2.6 Pressure regulation valve (option)

The pressure regulation valve is placed on the front of the cabinet. It is a needle valve that is used for fine-tuning the flow of air or inert gas into the ice condenser. It is used to reduce the hysteresis on the pressure regulation.



Never close a needle valve too hard – there is a risk of the needle welding to the valve seat due to the very tight fit.

4.2.6.1 Using the pressure regulation

The pressure regulation works from the display of the controller. Here a set point of the pressure during the freeze drying is defined.

If a set point of e.g. 1 hPa is entered, the controller will try to maintain the pressure of 1 hPa during the freeze drying process.

So when the vacuum valve is open and the vacuum pump reduce the pressure to 1 hPa, then the pressure regulation valve will open, in order to inject air or inert gas to the freeze dryer chamber. However, when the regulation valve open, then the pressure will increase very fast and with no control. To enable a controlled pressure increase, a needle valve is built in, enabling fine tuning of the flow into the chamber.

This will prevent an over-shoot in the chamber pressure, and enabling the control of the pressure during the process.

In order to get the best result of the pressure regulation and the needle valve, it is necessary to make a fine tuning of the needle valve. Same applies in case the set point pressure is changed.

So whenever the set point is changed, the needle valve must be fine-tuned.

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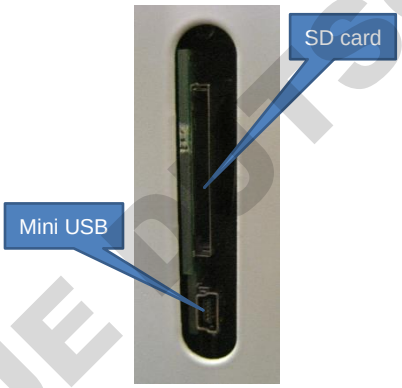
If the needle valve is closed too much, then the pressure will still decrease, in which case the needle valve must be opened more, or if the pressure increases too fast, the needle valve must be closed more.

4.3 Interface, data acquisition and control

On the back of the CoolSafe cabinet, to the right of the name plate, slot for a SD card and a mini USB connection is placed.

During freeze drying all time, pressure and temperature data is stored on the SD card at one minute intervals. The data saved on the SD card is formatted for use in the LaboGene freeze drying software package. From the software the data can be formatted and saved in an Excel compatible format. The software package is included in the delivery.

Under the SD card slot a mini USB connection is available. This is used for connecting a computer, running the LaboGene freeze drying software, from which the freeze dryer can be controlled. The software offers a graphical user interface showing the complete freeze dryer system and the status of all installed components. Further a screen makes it possible to see the time, pressure and temperature of the system in real-time. This mode of operation is described in a separate manual for this option.



5 Operation

The touch control system is designed and developed for running the CoolSafe freeze dryers specifically. All the build in facilities are designed to facilitate easy control of the freeze dryer and the freeze drying process in either manual or automatic running mode.

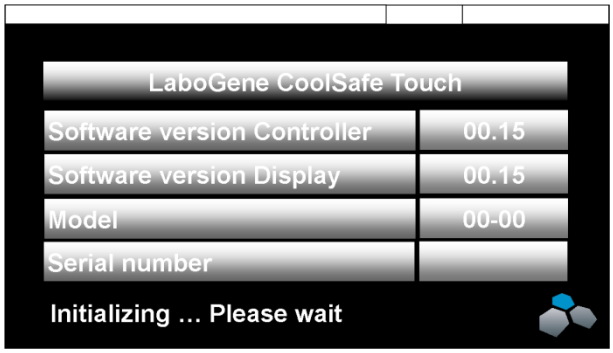
The touch control system is based on a simple structured menu structure for easy and logical setup and control of the freeze dryer and freeze drying process. Navigation is done using a light touch of a finger and all the menu items have been named to facilitate an intuitive and logical approach for the user.

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6 User interface

On start up the screen below will be showing until the control system is up and running.

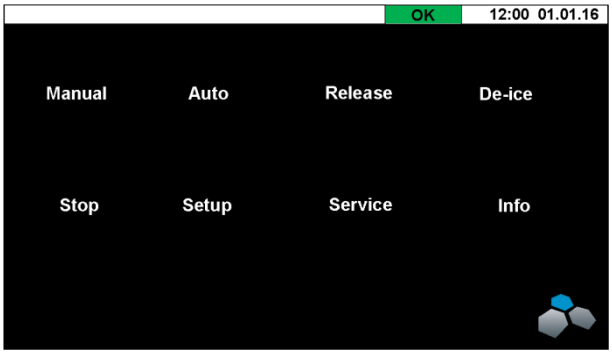


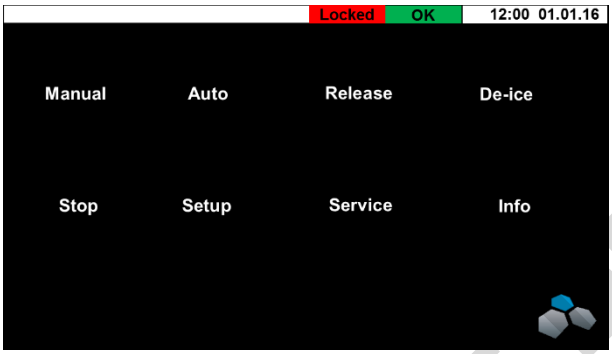
When the system is fully loaded and initialized the main menu will be displayed on the touch screen.

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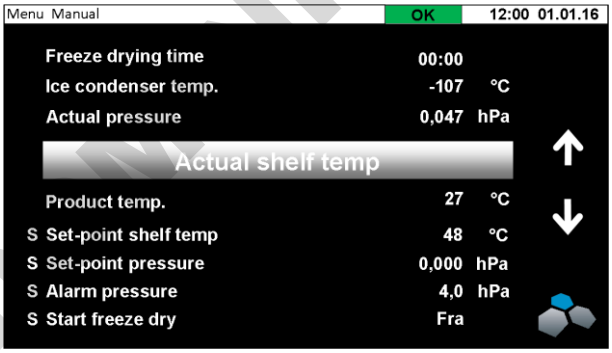
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6.1 Main menu

Touch screen – as opened	Menu	Action
	Manual	Opens the manual menu.
	Auto	Opens the program selection menu or the automatic operation menu.
	Release	Opens the release menu.
	De-ice	Opens the de-ice menu.
	Stop	Stops the ongoing process.
	Setup	Opens the setup menu.
	Service	Opens the service menu.
	Info	Opens the information screen.
		Press the LaboGene logo for 2-3 seconds to lock the display for input. Unlock press again.

Touch screen - locked	Menu	Action
		Press the LaboGene logo for 2-3 seconds to lock the display for input. Unlock press again. It is possible to lock and unlock the touch screen from any menu or screen.

6.2 Manual menu

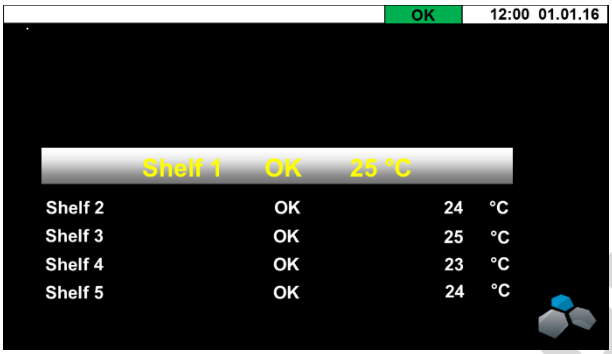
Touch screen – as opened	Item	Action
	Freeze drying time	Time elapsed since start of freeze drying.
	Ice condenser temp.	The current temperature in the ice condenser.
	Actual pressure	The current pressure in the freeze dryer.
	Actual shelf temp	The current shelf temperature – press to open a list of the temperature on each shelf.
	Product temp.	The current product temperature – one product temperature sensor available.
	Set-point shelf temp	Press to set shelf temperature.
	Set-point pressure	Press to set system pressure.
	Alarm pressure	Press to set the alarm pressure.
	Start freeze dry	Press to start manual freeze drying process.
Scroll up and down, using the arrows to the right, to select the menu item you want to see or change.	Reset error	Scroll down to see this menu item.
		Press the LaboGene logo to return to the main menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

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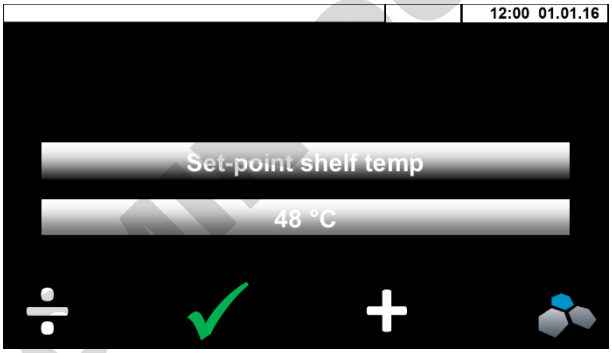
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Touch screen – scrolled down	Item	Action
	Product temp	The current product temperature – one product temperature sensor available.
	Set-point shelf temp	Press to set shelf temperature.
	Set-point pressure	Press to set system pressure.
	Alarm pressure	Press to set the alarm pressure.
	Start freeze dry	Press to start manual freeze drying process.
	Reset error	Scroll down to highlight menu item, press to reset error counter.
		Press the LaboGene logo to return to the main menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.2.1 Current shelf temperatures

Touch screen – as opened	Item	Action
		Press the LaboGene logo to return to the manual menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

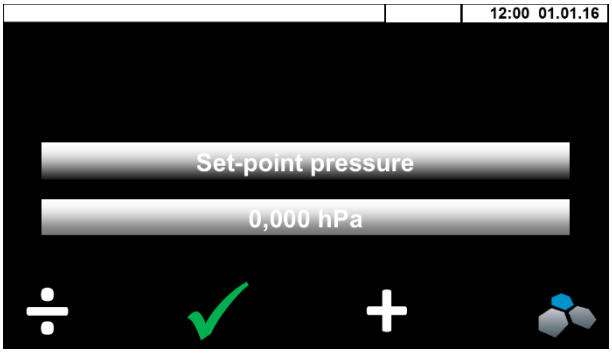
6.2.2 Set-point shelf temperature

Touch screen – as opened	Item	Action
	÷	Decrease set-point by 1 °C/°F.
	✔	Accept change in set-point.
	+	Increase set-point by 1 °C/°F.
		Press the LaboGene logo to return to the manual menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

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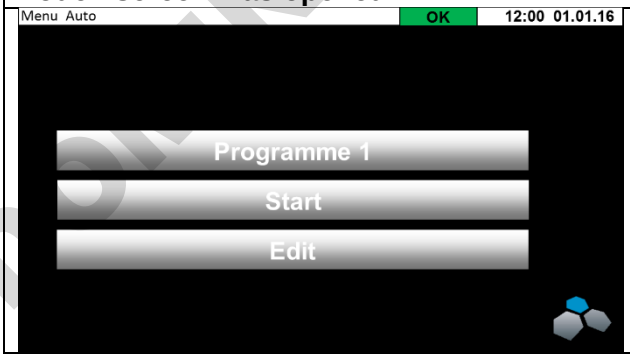
6.2.3 Set-point pressure

Touch screen – as opened	Item	Action
	÷	Decrease set-point by 0,001 hPa/Torr.
	✔	Accept change in set-point.
	+	Increase set-point by 0,001 hPa/Torr.
		Press the LaboGene logo to return to the manual menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.2.4 Alarm pressure

Touch screen – as opened	Item	Action
The alarm pressure is a limiting parameter that ensures that the shelf heating is not turned on before this pressure is reached. If the pressure raise above this pressure, during operation, the shelf heating will be turned off to protect the product being freeze dryed. 	÷	Decrease set-point by 0,1 hPa/Torr.
	✔	Accept change in set-point.
	+	Increase set-point by 0,1 hPa/Torr.
		Press the LaboGene logo to return to the manual menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

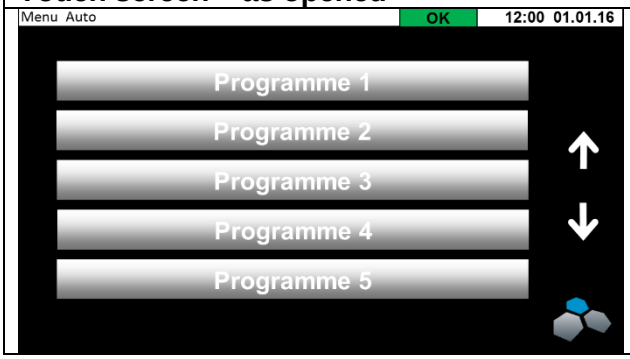
6.3 Auto menu

Touch screen – as opened	Item	Action
	Programme 1	Active programme, press to select programme from list.
	Start	Start active programme.
	Edit	Edit active programme.
		Press the LaboGene logo to return to the main menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

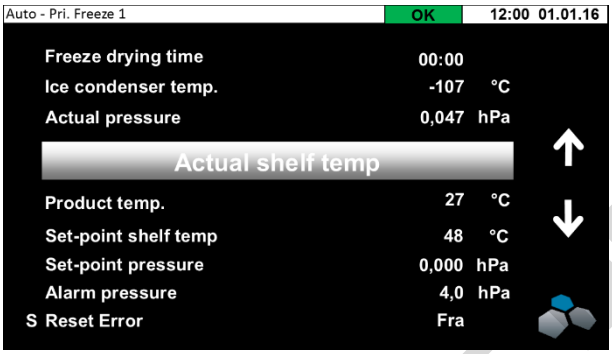
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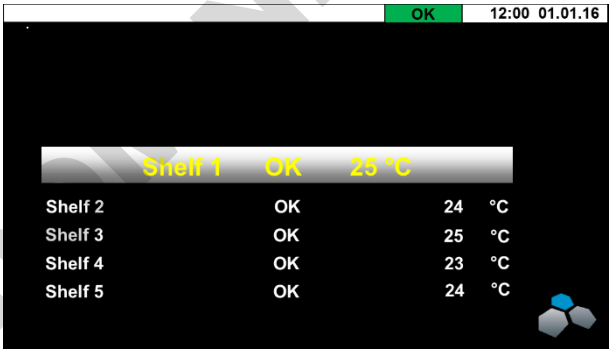
6.3.1 Programme list

Touch screen – as opened	Item	Action
		List of programmes 1 to 10. Press the desired programme to activate.
		Press the LaboGene logo to return to the auto menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.3.2 Start

Touch screen – as opened	Item	Action
	Freeze drying time	The time period the freeze dryer has run the current programme.
	Ice condenser temp.	View the current ice condenser temperature.
	Actual pressure	View the current pressure in the ice condenser.
	Actual shelf temp	Press to see list of Current shelf temperatures.
	Product temp.	View the current product temperature.
	Set-point shelf temp	View the shelf temperature set-point
	Set-point pressure	View the current ice condenser pressure set-point.
	Alarm pressure	Press to set the alarm pressure.
	Reset Error	Press to reset counter.
		Press the LaboGene logo to return to the main menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.3.2.1 Current shelf temperature

Touch screen – as opened	Item	Action
		Press the LaboGene logo to return to the auto menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

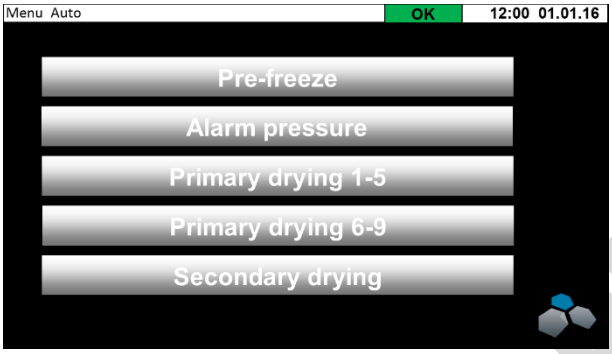
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6.3.2.2 Alarm pressure

Touch screen – as opened	Item	Action
	÷	Decrease set-point by 0,1 hPa/Torr.
	✔	Accept change in set-point.
	+	Increase set-point by 0,1 hPa/Torr.
		Press the LaboGene logo to return to the auto menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.3.3 Edit programme

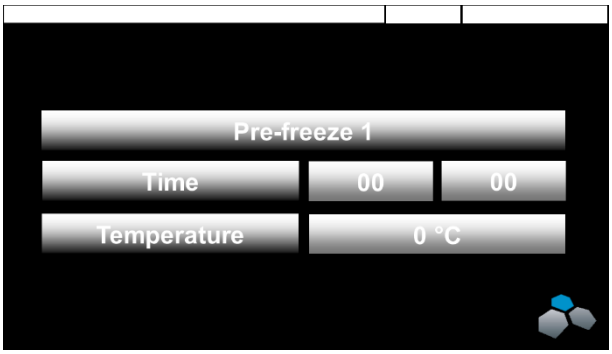
Touch screen – as opened	Item	Action
	Pre-freeze	Press to edit pre-freeze process.
	Alarm pressure	Press to set alarm pressure
	Primary drying 1-5	Press to edit primary drying process.
	Primary drying 6-9	Press to edit primary drying process.
	Secondary drying	Press to edit secondary drying process.
		Press the LaboGene logo to return to the edit menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.3.3.1 Pre-freeze

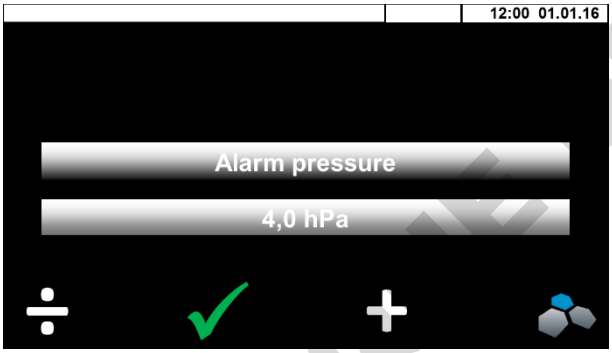
Touch screen – as opened	Item	Action
	Pre-freeze 1-5	Edit one or more pre-freeze sequences.
		Press the LaboGene logo to return to the edit menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

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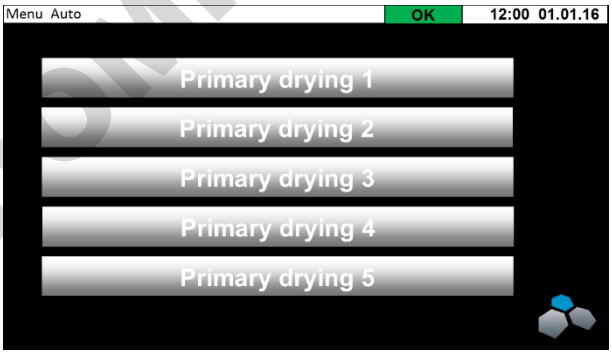
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Touch screen – as opened	Item	Action
 When activating a numerical box the the input bottons shown below appears. Use ÷ and + to adjust the values and the ✔ to accept the change. 	Pre-freeze 1 - 5	Press the individual numerical boxes to change the values.
		Press the LaboGene logo to return to the pre-freeze menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.3.3.2 Alarm pressure

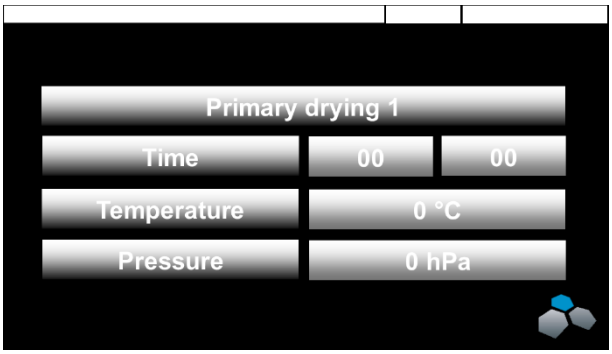
Touch screen – as opened	Item	Action
	÷	Decrease set-point by 0,1 hPa/Torr.
	✔	Accept change in set-point.
	+	Increase set-point by 0,1 hPa/Torr.
		Press the LaboGene logo to return to the edit menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.3.3.3 Primary drying 1-5 and 6-9

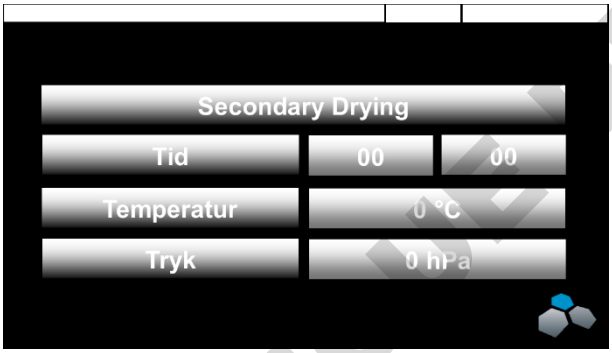
Touch screen – as opened	Item	Action
	Pre-freeze 1-5	Edit one or more pre-freeze sequences.
		Press the LaboGene logo to return to the edit menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

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Touch screen – as opened	Item	Action
 When activating a numerical box the the input bottons shown below appears. Use ÷ and + to adjust the values and the ✔ to accept the change. 	Pre-freeze 1 - 5	Press the individual numerical boxes to change the values.
		Press the LaboGene logo to return to the primary drying menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.3.3.4 Secondary drying

Touch screen – as opened	Item	Action
 When activating a numerical box the the input bottons shown below appears. Use ÷ and + to adjust the values and the ✔ to accept the change. 	Pre-freeze 1 - 5	Press the individual numerical boxes to change the values.
		Press the LaboGene logo to return to the edit auto menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

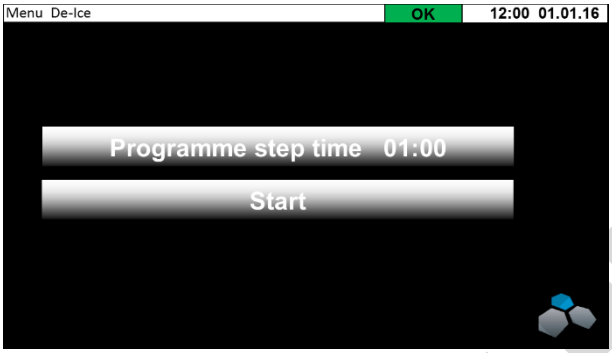
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6.4 Release

Touch screen – as opened	Item	Action
	Start Release	Press to start the pressure release process. During release the compressors are off, the vacuum valve is closed and the release valve is opened. The progress of the pressure release can be followed on the moving bar graph at the top of the screen.
		Press the LaboGene logo to return to the main menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.5 De-ice

Touch screen – as opened	Item	Action
	Programme step time	Press to open
	Start	Start the de-icing process. Heating elements in the condenser will start melting the ice on the condenser wall. Can either melt it completely or just enough to free the ice block from the condenser wall. The block can then be removed from the condenser. Remaining water is drained through the drain valve.
		Press the LaboGene logo to return to the main menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

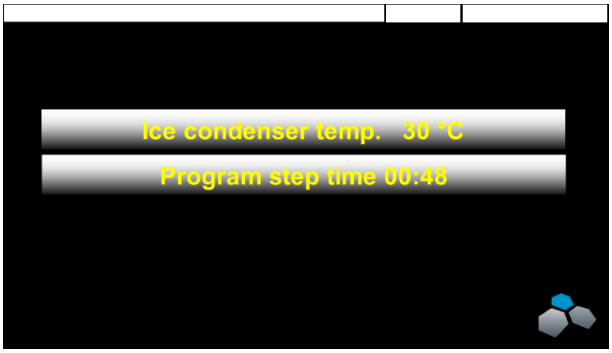
6.5.1 Set programme step time

Touch screen – as opened	Item	Action
 When activating a numerical box the the input bottons shown below appears. Use ÷ and + to adjust the values and the ✔ to accept the change. 	Programme step time	Press the individual numerical boxes to change the values.
		Press the LaboGene logo to return to the de-ice menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

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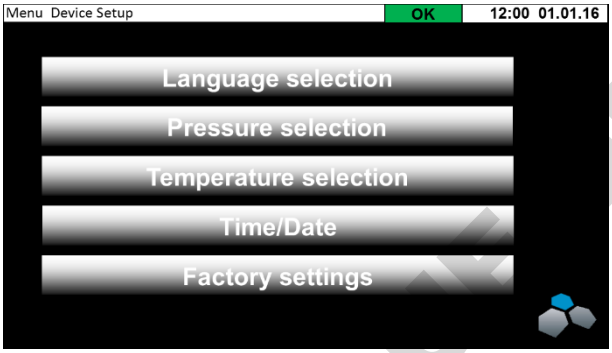
6.5.2 Status for de-icing process

Touch screen – as opened	Item	Action
	Ice condenser temp.	Displays the current ice condenser temperature.
	Programme step time	Displays the remaining time of the de-ice process.
		Press the LaboGene logo to return to the de-ice menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.6 Stop

Pressing the stop button will stop any ongoing process. Compressors will be turned off, the vacuum valve will be closed and the release valve will be closed.

6.7 Setup

Touch screen – as opened	Item	Action
	Language selection	Press to select the language displayed in the control system.
	Pressure selection	Press to select the pressure unit to be displayed.
	Temperature selection	Press to select the temperature unit to be displayed.
	Time/date	Press to set time and date.
	Factory settings	Restricted menu – protected by password.
		Press the LaboGene logo to return to the main menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

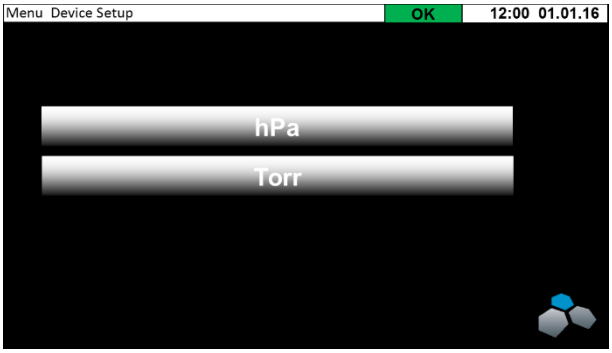
6.7.1 Language selection

Touch screen – as opened	Item	Action
	-	Press the preferred language
		Press the LaboGene logo to return to the setup menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

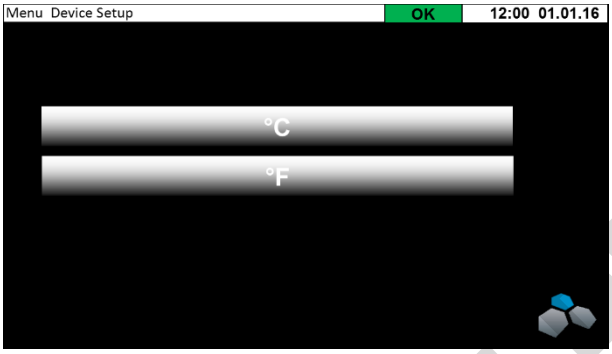
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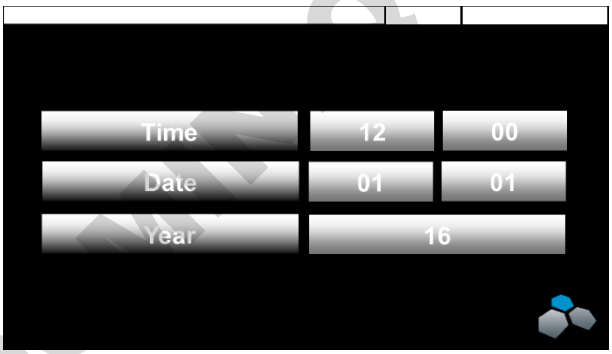
6.7.2 Pressure selection

Touch screen – as opened	Item	Action
	-	Press the preferred pressure unit.
		Press the LaboGene logo to return to the setup menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.7.3 Temperature selection

Touch screen – as opened	Item	Action
	-	Press the preferred temperature unit.
		Press the LaboGene logo to return to the setup menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

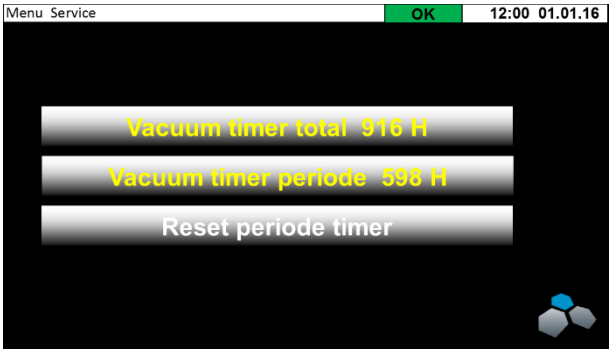
6.7.4 Set time/date

Touch screen – as opened	Item	Action
	Time	Press the individual numerical boxes to change the values.
	Date	Press the individual numerical boxes to change the values.
	Year	Press the numerical box to change the value.
When activating a numerical box the the input bottons shown below appears. Use ÷ and + to adjust the values and the ✔ to accept the change. 		Press the LaboGene logo to return to the setup menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

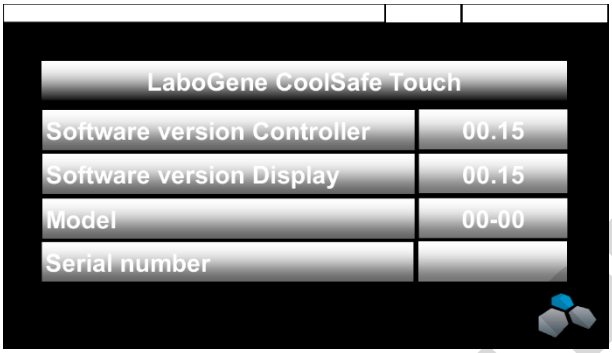
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6.8 Service

Touch screen – as opened	Item	Action
	Reset period timer	Press to reset period timer. Can be used for monitoring time since last service. The timer is active when the vacuum pump is running.
		Press the LaboGene logo to return to the main menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

6.9 Info

Touch screen – as opened	Item	Action
	Software version controller	The current software version installed on the freeze dryer.
	Software version display	The current software version installed on the freeze dryer.
	Model	The LaboGene model designation.
	Serial number	The freeze dryers LaboGene serial number.
		Press the LaboGene logo to return to the main menu. Press the LaboGene log for 2-3 seconds to lock the display for input. Unlock press again.

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7 Error situations, status and error codes

7.1 Power failure

If the freeze dryer is running in manual or auto mode during a short period of power failure – less than 10 minutes, the freeze dryer will start up in the same mode and continue the ongoing process, using the same parameters, in manual mode, and continue running the active programme if in auto mode.

If the freeze dryer is running in manual or auto mode during a short period of power failure – longer than 10 minutes, the freeze dryer will start up in the same mode and continue the ongoing process, using the same parameters, in manual mode, and continue running the active programme if in auto mode. If the pressure has increased, the freeze dryer will enter Cool only mode until the pressure is below the alarm point, and then continue with the active programme.

7.2 Compressor start-up, 2 stage cooling systems

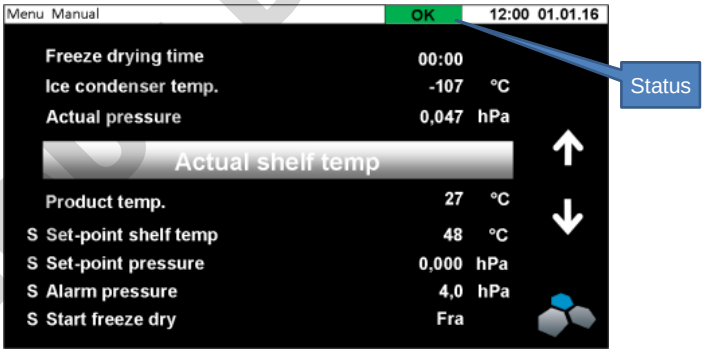
On CoolSafe models using two cooling stages (-95 °C, -100 °C and – 110 °C) each operated by a separate compressor.

The system is set up to start the two stages with a time delay of 6 minutes. At start up stage 1 is running for 6 minutes before stage 2 is started up. This is to ensure that pressure in the stage 2 system is keep within the allowable pressure limits.

In case the ice condenser temperature is below -70 °C (for instance after a short power failure) the time delay is set to 10 seconds.

7.3 Status codes

A number of different codes gives information on the current status of the freeze dryer:



Displayed code	Description	-55 °C	-95 °C & -100 °C	-110 °C
OK	The ice condenser temperature is near or at reachable temperature. The ice condenser is ready for the freeze drying process. The freeze dryer will be in Await-state until these temperatures are reached for the first time after power up. Ice condenser ready.	-40 °C	-85 °C	-90 °C
Await	Will be shown while the ice condenser is cooling down. Change to OK-state when the ice condenser reaches this temperature for the first time. Ice condenser not ready.	-30 °C	-75 °C	-70 °C
Await	If the temperature in the ice condenser increase to over this temperature, during the freeze drying process, the Await-state is invoked until the ice condenser reaches this temperature again, where OK-state is returned. Ice condenser overloaded.	-30 °C	-75 °C	-70 °C
Alarm	If the temperature in the ice condenser increase to over this temperature, during the freeze drying process, the Alarm-state is invoked until the ice condenser reaches this temperature again, where Await-state is returned.	-20 °C	-65 °C	-50 °C

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7.4 Error codes

The following situations will invoke an alarm that will be shown in the status line on the touch screen:

Displayed code	Description	-55 °C	-95 °C & -100 °C	-110 °C
E01	Temperature sensor error – PT-100 connection broken or sensor not attached to the system.	✔	✔	✔
Alarm	Temperature under freeze drying exceeds this temperature.	-20 °C	-65 °C	-50 °C
E03	Temperature sensor error – PT-100 shorted or outside range.	✔	✔	✔
E04	Pressure sensor error - Pirani connection broken or sensor not attached to the system.	✔	✔	✔
Cool only	The pressure in the ice condenser is exceeding the alarm pressure.	✔	✔	✔
Power out	A power out has occurred.	✔	✔	✔
E08	Pressure sensor error - Pirani shorted or outside range.	✔	✔	✔
E09	The safety pressure sensor on stage 1 is active. Restart compressors on stage 1 and stage 2 by manual resetting of the safety pressure sensor.	N/A	✔	✔
E10	The safety pressure sensor on stage 2 is active. Restart of compressor 2 is performed automatically be the auto-reset function. If the safety pressure sensor is activated 3 times in a 20-minute period, it must be reset by powering the compressor down and turning it on again.	N/A	✔	✔

8 Preparations

Check that the CoolSafe ice condenser is free from ice and water, and that all valves i.e. the drain valve is closed. Check that there is no water in the drain valve.

☞	**Note**
	Do not use any tools to close valves, as they will easily be damaged.

- Check that the gas ballast valve on the vacuum pump is open at all times.
- Check the oil level in the pump and the oil mist filter. The filter should have only a maximum 10 mm oil level (preferably it should be empty).
- Switch on the CoolSafe and the vacuum pump.
- The lowest temperature (-100 °C on the CoolSafe 100-9 Touch Superior XS and -95 °C with CoolSafe 95-15 Touch Superior XL) should be achieved within 60 minutes.
- The vacuum pump should now be allowed to run for at least 30 minutes to achieve the lowest vacuum performance. In this “warm up” phase the gas ballast control ideally should be open but closed during the primary and secondary drying phases. Please note that vacuum will not be applied to the condenser at this juncture. The electronic vacuum valve

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remains closed until you enter the freeze drying modes (either opened via the touch screen in manual mode or via programme sequence in automatic mode).

8.1 Freeze drying

The CoolSafe Touch will allow freeze drying in 10 steps without any further manipulations.

However, if manual mode is used, then all values and time transitions for the freeze drying must be input manually via the touch screen.

- Enter the values for freeze drying, time, shelf temperature and maximum pressure, in 10 steps. If you do not need all 10 steps enter 0.00 for time BUT keep the temperature values the same. All 10 steps must have values entered.

- Pressure regulation (optional) allows programming and regulation of the vacuum to set values in each of the 10 freeze drying steps. Entering a zero value for pressure, no regulation is applied. This can be used in the secondary drying phase of the cycle or if no regulation is required. Possible in the last 4-5 steps of the freeze drying sequence.

8.2 De-ice

The CoolSafe freeze dryers are equipped with electric de-icing. This facility gently warms the wall of the condenser and facilitates the release and easy removal of the “ice-plug” in the ice condenser.



	Caution
	Always wear cryo-protective gloves when carrying out this procedure.

If the electric de-icing option is not fitted:

1. Ensure the CoolSafe is switched off and the vacuum has been released.

2. Leave the condenser open to the atmosphere, introduce warm water into the condenser until it is released from the walls of the condenser.

3. Then remove the ice.

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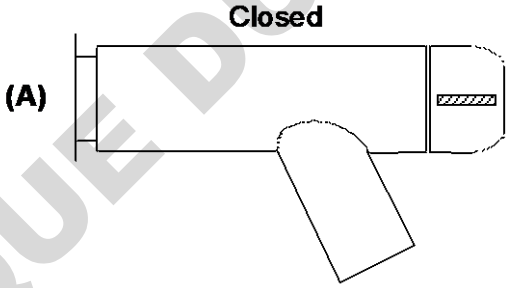
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In both cases, with or without electric de-icing, once the ice has been removed, open the drain valve to remove any remaining water. Thoroughly dry the condenser using disposable tissues, spray with alcohol and wipe dry, ensuring there is no retention of any liquid in the drain.

8.3 Freeze drying using manifolds

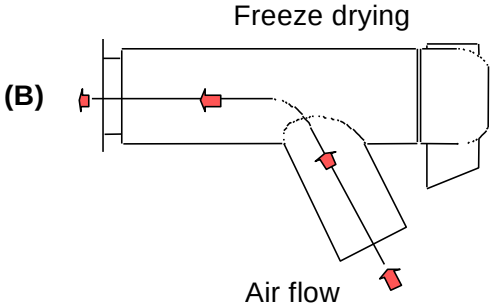


1. The manifold is connected to the conus in the lid. Make sure this connection is tight. Check that all rubber valves are closed **(A)** or in vacuum-release position **(C)**, and that the flange and lid are tight.



2. Start the creation of vacuum by opening the vacuum valve and check that the AWO-Indicator stays green indicating OK for freeze-drying.

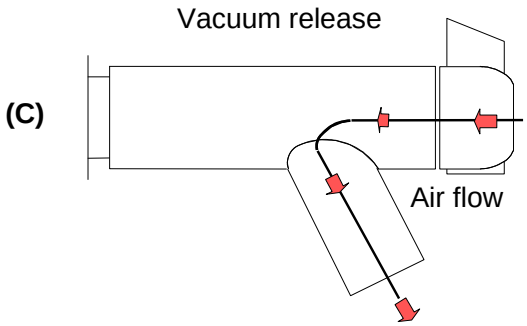
3. Connect a flask to an appropriate cone on the rubber valve. Turn the rubber valve to position **(B)**. The AWO-Indicator should always be green prior to connecting the next flask. The freeze-drying process is now in progress.



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4. To stop the freeze-drying process, turn the rubber valve handle 180° to position **(C)** to equalise the pressure in the flask, and remove the flask from the cone.



5. Close the vacuum valve after removal of the last flask.

6. To allow the system to equalise the vacuum in condenser, use the release function.

8.4 Freeze drying using chambers



Warm shelves



Cold shelves

1. Make sure that the vacuum valve is closed.

2. Mount the chamber and shelf arrangement. Check that all connections are tight and the chamber is closed. If heated shelves are to be used, refer to the controller manual.

3. Open the chamber place the frozen material on the shelves in the chamber. Close the chamber.

☞	**Note**
	Make sure that both drain valve and release valve are closed.

4. Open the vacuum valve. The freeze-drying process is now in progress.

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5. To stop the freeze-drying process, close the vacuum valve and equalise the pressure by opening the release valve at the back.

6. Remove the material from the shelves.

8.5 Stopping the vacuum pump

☞	**Note**
	Keeping the pump at operation temperature and with open gas ballast valve minimises the risk for harmful condensation of vapours in the pump.

⚠	**Caution**
	Do not stop the vacuum pump during the freeze drying process!

Close the vacuum valve and let the pump run for a minimum of 45 minutes after the freeze-drying has ended. This is to avoid any possible condenses remaining in the pump oil.

If the freeze dryer is used regularly during the week, it is recommended that the vacuum pump run constantly with open gas ballast valve and closed vacuum valve.

8.6 Hints, tips and reminders

- The selection of the appropriate sample container is important to ensure samples are dried efficiently. Freeze drying emanates from the surface area of the sample, so the larger the surface area in respect to its depth/thickness is a determining factor in the speed of the drying cycle. “Never let the depth of sample exceeds its diameter” especially in vials, flasks trays etc.

- Maintain the vacuum pump regularly, oil changes must be made as per manufacturer’s instructions. Poor vacuum performance could mean contaminated oil.

- Ensure all seals and surfaces are clean and properly seated to avoid vacuum leaks. Always start the freeze dryer and the vacuum pump 30-40 minutes before use.

- Keep the freeze dryer operational if you expect to use it more than once during the day.

9 Maintenance

9.1 CoolSafe freeze dryer

The air-cooled condenser must be cleaned minimum once a year. Use a vacuum cleaner and remove any dust in the cooling ribs on the front.

Rubber valves, black O-rings and valves on the manifold and black O-rings on chambers should be greased with an ultra-thin layer of vacuum grease and wiped off with a soft cloth every 3-4 months. The rubber must appear shiny, smooth and without cracks. All silicone gaskets need only dust removal (do not use any vacuum grease).

9.2 Vacuum pump

See the vacuum pump instruction manual for maintenance according to supplier’s recommendation. Maintenance for a vacuum pump in general will be to:

- Check the oil volume and colour conditions regularly. The oil should be changed every 400-500 working hours, more often if aggressive vapours have been pumped. Keep a Log book

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- Drain the oil mist filter if the oil level is more than 10 mm.
- Drain, clean and eventually change the filter insert if smoke comes from the oil mist filter.

9.3 Cleaning

☞	**NOTE** When using strong materials such as strong acids or bases, radioactive substances and volatile organic solvents it must be handled carefully and promptly cleaned up if spilled.

If a sample is spilled in the concentrator chamber, it must be cleaned up immediately.

- Cleaning of acrylic components use only mild detergents solutions NEVER solvents.
- Wipe stainless steel surfaces with alcohol and then dry, do not use abrasives.
- The condenser of the CoolSafe once drained, wipe dry and then lightly cleaned with alcohol, ensure that the drain valve is open. Do not forget to close the valve once the condenser has dried.

9.4 Checking for Leaks on the CoolSafe freezer dryer

Always start from the vacuum pump and work forwards towards the chamber.

1. Check vacuum hose connection to the pump. If the pump is fitted with a nozzle and if this is held in place with a clamp, check that there is a centring ring with seal fitted between the flange on the pump and the nozzle. Make sure the clamp is tight and that the hose is pushed well onto the nozzle, and that the clip on the hose is tight.

2. Check the other end of the vacuum hose where it connects to the CoolSafe, make sure the clip is tight.

3. The drain valve on the front of the Cool Safe also has to be checked for leaks. First unscrew the drain valve (with black knob) all the way until its loose and then pull towards you. The barrel of the valve then comes away from the body. On the end of the barrel there is a white Teflon plug, make sure this is clean and without any scratches, also wipe the inside of the valve body. Replace the valve barrel into the body of the valve, push in and then screw the valve completely to the fully closed position. When vacuum is applied check that there is no leak from the drain-this can be done placing a finger over the drain spigot, you will feel if there is a leak.

4. Check the seal on the acrylic plate of the chamber that interfaces with the top stainless steel part of the CoolSafe. This can be done by squirting or brushing some frothy soap solution all around, if there is a leak this will be sucked in towards the condenser.

5. If leak(s) are found on the seals, clean both the surface of the s/steel and the seal, using a clean tissue slightly wetted with alcohol.

6. Check that the lid of the chamber is located correctly, again check that the seal is OK as previous.

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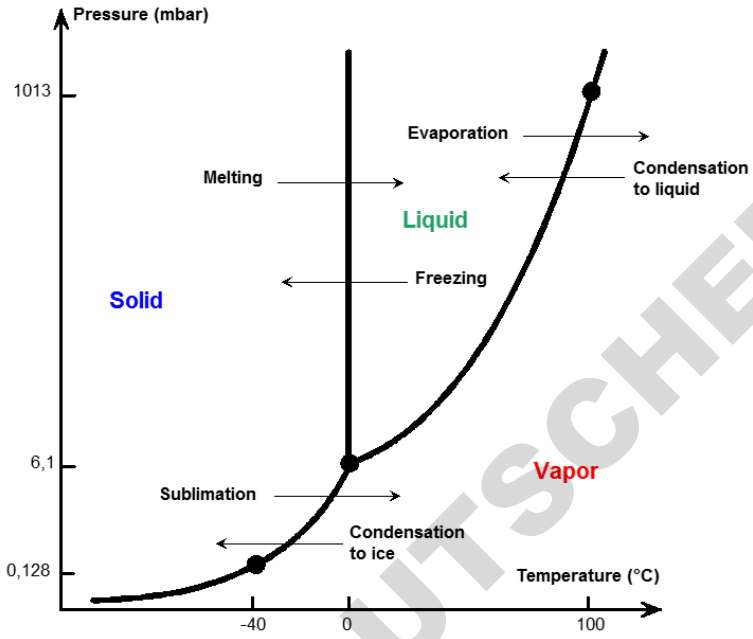
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10 The Freeze-drying process

To understand the freeze-drying process, this section describes the theory for the process in short.

For more detailed information about freeze-drying please consult available literature.

All material in free form will exist in one of three states: Vapour, liquid or solid.



As shown in the diagram for water, the physical state is dependent on the surrounding pressure and the temperature. The point where all three phases of water co-exist is called the triple point.

Freeze-drying is basically a change in state and properties of the material, (water), that is to be removed. In principle the process is very simple, but in reality it also can be very complex as the product can consist of many components, which interact with each other.

Moving from one state to another requires the supply or removal of energy to or from the product. This energy flux will have an impact on the structure of the material being dried.

Freeze-drying is achieved using equipment that controls temperature and pressure in the environment of the product and is a 3-step process.

- In the first step, the product is frozen solid so that the water present in the material is converted to ice (pre-freeze).
- In the second step, the ice formed in pre-freezing is removed from the product by direct conversion from solid to vapour. This process is called sublimation. In order to start removing moisture in the sublimation process, the pressure surrounding the material has to be brought down to a value below that of the triple point, whilst keeping the temperature of the product below its freezing point. The condenser surface temperature must also be down to a temperature lower than the temperature of the material handled. When the product is heated it will theoretically place itself somewhere on the transition line between the solid and vapour states. The heating will initiate sublimation of the moisture from the product to the surrounding environment. The vapour will move to the condenser surface because of the lower vapour pressure in the condenser.

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- In the third step, water that is strongly bound to the solids of the sample (called sobbed water) is converted to vapour and removed from the product, this process being referred to as de-sorption. Removing moisture in the de-sorption phase or secondary drying phase, is done at a higher product temperature and at the lowest possible pressure

11 Technical Specifications

11.1 CoolSafe -55 °C

CoolSafe Touch 55-4	Unit	Part no: 700047
Digital read-out of temperature		Yes
Digital read-out of pressure		Yes
Ultimate temperature at 20°C room temperature	°C	-55
Power requirements	V/Hz	230/50-60
Power consumption	W	800
Insulation	mm	90
Condenser capacity	kg	3
Condenser capacity per 24 hours	kg	2,5
Total volume of Condenser	L	4
Weight net	kg	40
Cabinet dimensions (DxWxH)	mm	500x400x520
Cabinet material		Polyester coated steel
Condenser material		Stainless steel AISI 316
Cooling media		R 507
Vacuum Valve		Electric
Drain tap		Yes
Touch screen for control options		Yes
USB port for LaboGene software/SD card for data		Yes

CoolSafe Touch 55-9	Unit	Part no: 700051
Digital read-out of temperature		Yes
Digital read-out of pressure		Yes
Ultimate temperature at 20°C room temperature	°C	-55
Power requirements	V/Hz	230/50-60
Power consumption	W	800
Insulation	mm	50
Condenser capacity	kg	7
Condenser capacity per 24 hours	kg	4
Total volume of Condenser	L	9
Weight net	kg	45
Cabinet dimensions (DxWxH)	mm	500x400x520
Cabinet material		Polyester coated steel
Condenser material		Stainless steel AISI 316
Cooling media		R 507
Vacuum Valve		Electric
Drain tap		Yes
Touch screen for control options		Yes
USB port for LaboGene software/SD card for data		Yes

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CoolSafe Touch 55-15	Unit	Part no: 700055
Digital read-out of temperature		Yes
Digital read-out of pressure		Yes
Ultimate temperature at 20°C room temperature	°C	-55
Power requirements	V/Hz	230/50-60
Power consumption	W	800
Insulation	mm	90
Condenser capacity	kg	10
Condenser capacity per 24 hours	kg	6
Total volume of Condenser	L	15
Weight net	kg	70
Cabinet dimensions (DxWxH)	mm	620x495x745
Cabinet material		Polyester coated steel
Condenser material		Stainless steel AISI 316
Cooling media		R 507
Vacuum Valve		Electric
Drain tap		Yes
Touch screen for control options		Yes
USB port for LaboGene software/SD card for data		Yes

11.2 CoolSafe -95 °C and -100 °C

CoolSafe Touch 95-15	Unit	Part no: 700057
Digital read-out of temperature		Yes
Digital read-out of pressure		Yes
Ultimate temperature at 20°C room temperature	°C	-95
Power requirements	V/Hz	230/50-60
Power consumption	W	1400
Insulation	mm	90
Condenser capacity	kg	10
Condenser capacity per 24 hours	kg	6
Total volume of Condenser	L	15
Weight net	kg	85
Cabinet dimensions (DxWxH)	mm	620x495x745
Cabinet material		Polyester coated steel
Condenser material		Stainless steel AISI 316
Cooling media		R 507/R170
Vacuum Valve		Electric
Drain tap		Yes
Touch screen for control options		Yes
USB port for LaboGene software/SD card for data		Yes

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CoolSafe Touch 100-9	Unit	Part no: 700053
Digital read-out of temperature		Yes
Digital read-out of pressure		Yes
Ultimate temperature at 20°C room temperature	°C	-100
Power requirements	V/Hz	230/50-60
Power consumption	W	1300
Insulation	mm	90
Condenser capacity	kg	7
Condenser capacity per 24 hours	kg	4
Total volume of Condenser	L	9
Weight net	kg	75
Cabinet dimensions (DxWxH)	mm	620x495x745
Cabinet material		Polyester coated steel
Condenser material		Stainless steel AISI 316
Cooling media		R 507/R170
Vacuum Valve		Electric
Drain tap		Yes
Touch screen for control options		Yes
USB port for LaboGene software/SD card for data		Yes

11.3 CoolSafe -110 °C

CoolSafe Touch 110-4	Unit	Part no: 700049
Digital read-out of temperature		Yes
Digital read-out of pressure		Yes
Ultimate temperature at 20°C room temperature	°C	-110
Power requirements	V/Hz	230/50-60
Power consumption	W	1300
Insulation	mm	90
Condenser capacity	kg	3
Condenser capacity per 24 hours	kg	2,5
Total volume of Condenser	L	4
Weight net	kg	55
Cabinet dimensions (DxWxH)	mm	500x400x520
Cabinet material		Polyester coated steel
Condenser material		Stainless steel AISI 316
Cooling media		R 507/R1150
Vacuum Valve		Electric
Drain tap		Yes
Touch screen for control options		Yes
USB port for LaboGene software/SD card for data		Yes

12 Accessories

For accessories please contact your local LaboGene distributor or visit LaboGene's web site www.labogene.com where brochures are available.

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13 Declaration of conformity

Declaration of conformity

We declare under our responsibility, that the following product:

Product: CoolSafe Basic, Pro & Touch
Models: 55-4, 55-9, 55-15, 95-15, 100-9 and 110-4

to which this declaration relates is in conformity with the following standard(s), directives or other normative document(s):

In compliance with:

EN 61010-1 - Safety requirements for electrical equipment for measurement, control and laboratory use - General requirements

EN 61326-1 - Electrical equipment for measurement, control and laboratory use - EMC requirement - General requirements.

EN 378-1 - Refrigerating system and heat pumps - Safety and environmental requirements - Basic requirements, definitions, classification and selection criteria.

EN 378-2 - Refrigerating systems and heat pumps - Safety and environmental requirements - Design, construction, testing, marking and documentation.

Following the provisions of:

2006/42/EC - Machinery Directive, as amended

2006/95/EC - Low Voltage Directive, as amended

2004/108/EC - EMC Directive, as amended

97/23/EC - Pressure equipment, as amended

2011/65/EU - RoHS Directive

2012/19/EU - WEEE Directive

Allerød, November 2018

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14 Annex - Pressure of Aqueous Vapor

Temperature	Pressure	Temperature	Pressure	Temperature	Pressure	Temperature	Pressure
0,0	6,103	-9,2	2,789	-18,4	1,204	-27,6	0,488
-0,2	6,003	-9,4	2,741	-18,6	1,182	-27,8	0,479
-0,4	5,906	-9,6	2,693	-18,8	1,159	**-28,0**	**0,468**
-0,6	5,810	-9,8	2,645	-19,0	1,138	-28,2	0,459
-0,8	5,714	-10,0	2,599	-19,2	1,116	-28,4	0,449
-1,0	**5,620**	-10,2	2,553	-19,4	1,095	-28,6	0,439
-1,2	5,527	-10,4	2,509	-19,6	1,074	-28,8	0,431
-1,4	5,436	-10,6	2,464	-19,8	1,054	**-29,0**	**0,422**
-1,6	5,347	-10,8	2,421	**-20,0**	**1,034**	-29,2	0,414
-1,8	5,259	**-11,0**	**2,379**	-20,2	1,014	-29,4	0,405
-2,0	**5,171**	-11,2	2,336	-20,4	0,995	-29,6	0,397
-2,2	5,086	-11,4	2,295	-20,6	0,977	-29,8	0,389
-2,4	5,002	-11,6	2,253	-20,8	0,958	**-30,0**	**0,381076**
-2,6	4,919	-11,8	2,213	**-21,0**	**0,939**	-32,0	0,308966
-2,8	4,838	-12,0	2,175	-21,2	0,921	-34,0	0,249652
-3,0	**4,755**	-12,2	2,135	-21,4	0,903	-36,0	0,200868
-3,2	4,677	-12,4	2,097	-21,6	0,883	-38,0	0,161147
-3,4	4,599	-12,6	2,060	-21,8	0,869	**-40,0**	**0,128758**
-3,6	4,522	-12,8	2,023	**-22,0**	**0,853**	-42,0	0,102366
-3,8	4,446	**-13,0**	**1,986**	-22,2	0,835	-44,0	0,081173
-4,0	**4,371**	-13,2	1,951	-22,4	0,819	-46,0	0,064112
-4,2	4,298	-13,4	1,915	-22,6	0,803	-48,0	0,050383
-4,4	4,226	-13,6	1,880	-22,8	0,789	**-50,0**	**0,039387**
-4,6	4,154	-13,8	1,847	**-23,0**	**0,773**	-52,0	0,030656
-4,8	4,085	**-14,0**	**1,814**	-23,2	0,758	-54,0	0,023725
-5,0	**4,016**	-14,2	1,780	-23,4	0,743	-56,0	0,018394
-5,2	3,948	-14,4	1,748	-23,6	0,729	-58,0	0,014128
-5,4	3,881	-14,6	1,716	-23,8	0,714	**-60,0**	**0,010769**
-5,6	3,814	-14,8	1,684	**-24,0**	**0,701**	-62,0	0,008184
-5,8	3,749	**-15,0**	**1,654**	-24,2	0,686	-64,0	0,006184
-6,0	**3,685**	-15,2	1,624	-24,4	0,673	-66,0	0,004651
-6,2	3,622	-15,4	1,594	-24,6	0,659	-68,0	0,003478
-6,4	3,561	-15,6	1,566	-24,8	0,647	**-70,0**	**0,002585**
-6,6	3,500	-15,8	1,536	**-25,0**	**0,634**	-72,0	0,001906
-6,8	3,440	**-16,0**	**1,508**	-25,2	0,622	-74,0	0,001399
-7,0	**3,381**	-16,2	1,480	-25,4	0,609	-76,0	0,001026
-7,2	3,322	-16,4	1,454	-25,6	0,597	-78,0	0,000746
-7,4	3,265	-16,6	1,426	-25,8	0,585	**-80,0**	**0,000533**
-7,6	3,209	-16,8	1,400	**-26,0**	**0,573**	-82,0	0,000386
-7,8	3,154	**-17,0**	**1,374**	-26,2	0,562	-84,0	0,000266
-8,0	**3,100**	-17,2	1,348	-26,4	0,551	-86,0	0,000186
-8,2	3,045	-17,4	1,323	-26,6	0,540	-88,0	0,000133
-8,4	2,993	-17,6	1,299	-26,8	0,529	**-90,0**	**0,000093**
-8,6	2,941	-17,8	1,274	**-27,0**	**0,518**	-92,0	0,000064
-8,8	2,889	**-18,0**	**1,251**	-27,2	0,508	-94,0	0,000044
-9,0	**2,840**	-18,2	1,227	-27,4	0,499	-96,0	0,000029
						-98,0	0,000020

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