Operating Instructions

Personal Synthesis Workstation

OptiMax 1001

METTLER TOLEDO

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1 Introduction

The METTLER TOLEDO OptiMax™ 1001 is a reactor system for performing synthesis with a 250-mL, a 500-mL, or a 1000-mL glass reactor. The instrument is operated via the touchscreen.

- The reactor can be heated or cooled and its content stirred and refluxed.
- The temperature of the reactor content can be measured using a Pt100 sensor.
- The integrated pH measurement system, when equipped with the appropriate electrode allows you to measure the pH value of the reactor content.
- You can export the acquired data to another program for further processing.

1.1 Scope of Delivery

The following items are included in the OptiMax 1001™ thermostat set:

Order number		Description	Quantity
		OptiMax 1001 thermostat	1
51161883		TFT touchscreen 7″, 1 m cable	1
11132570		Protective cover for touchscreen	1
30260369		Emergency button	1
51191125		PVC hose, soft, for reflux condenser	1
51161187		PVC industrial hose for coolant, 15 bar	2
51192239		PVC industrial hose for purge gas, 18 bar	1
51161186		PVC hose for purge gas	1
51191373		Y-piece for gas tubing	4
51191916		Reducing connector for purge gas tubing	3

51190324		Quick connect coupling for purge gas inlet	5
51192126		Hose clamp for PVC tube	4
51191915		Flow indicator for coolant	1
51191914		Knurled screw, M6 x 10 mm	4
51191235		Identification clips for adhesive labels	10
51162860		Reactor block plug for bottom drain valve opening	1
51192209		O-ring for 51162860 plug, Ø 50.39 mm x 3.53 mm	1
51161782		Bubble counter	1
51161603		Magnetic bubble counter holder	1

51162886		Accessories holder set	1
51192208		Glass adapter ST19/26-GL14	2
51190317		Screw cap GL14, with aperture	2
51103947		Silicone rubber sealing ring for screw cap GL14, aperture 6 mm	2
51191945		Purge gas regulation valve	1
51161099		Lab bar, 600 mm x 14 mm	4
51162690		Overhead stirrer drive complete	1
30356209		USB Stick RXE/CSS with documents	1
		User Manual	1

If an item is missing, please contact your local support.

1.2 Check on arrival

Check the following conditions once the package has arrived:

- The package is in good condition.
- The content shows no signs of damage (e.g. broken covers, scratches etc.)
- The content is complete (see [Scope of Delivery ▶ Page 3]).

If one condition is not fulfilled, please contact your local support.

2 Safety Information

This thermostat has been tested for the intended purposes described in this document. However, this does not absolve you from the responsibility of performing your own tests of the product supplied by us regarding its suitability for the methods and purposes you intend to use it for. You should therefore observe the following safety measures.

We, Mettler-Toledo GmbH, accept no liability whatsoever if you do not observe the following rules and safety notes for safe operation of the thermostat.

2.1 Definition of signal warnings and symbols

Safety notes are marked with signal words and warning symbols. These show safety issues and warnings. Ignoring the safety notes may lead to personal injury, damage to the instrument, malfunctions and false results.

WARNING A hazardous situation with medium risk, possibly resulting in death or severe injury if not avoided.

CAUTION A hazardous situation with low risk, resulting in minor or moderate injury if not avoided.

NOTICE A hazardous situation with low risk, resulting in damage to the instrument, other material damage, malfunctions and erroneous results, or loss of data.

Note (no symbol)
for useful information about the product.

Meaning of safety symbols

	Electrical Hazard		Explosion		Burns / Hot Surface
	Rotating parts		Heavy load		General note

2.2 Intended use

The METTLER TOLEDO OptiMax™ 1001 is a reactor system for performing synthesis with reactor volumes up to 1000 mL.

Always operate and use your device in accordance with the instructions contained in this manual, only use it together with equipment specified in this documentation.

Any other type of use and operation beyond the limits of technical specifications without the written consent from Mettler-Toledo GmbH, is considered as not intended.

2.3 Product-specific safety

⚠ WARNING

Risk of electric shock

1 Make sure to plug the power cable supplied into a power supply outlet that is grounded. A technical fault could otherwise result in serious injury or death.

2 Only use the METTLER TOLEDO power supply cable and AC power adapter designed for your instrument.

⚠ WARNING

Power failure

A power failure can lead to explosion with possibly fatal consequences.

– Implement appropriate measures like an uninterruptible power supply (UPS).

⚠ WARNING

Risk of explosion with critical reactions

Performing critical reactions could lead to explosions.

– Perform a safety analysis before starting an experiment with high hazardous potential for example by using a Differential Scanning Calorimeter.

⚠ WARNING

Electrostatic discharges through stirring the reaction mass

The following conditions can form electrostatic charge:

- High flow rates (high stirrer speed) of nonpolar liquids with a high resistivity (>10^8 Ohmmeter).
- Two-phase systems with suspended solids (e.g. after crystallization processes in nonconductive solvents or immiscible liquids.)

– Work under an inert gas (nitrogen or argon).

⚠ WARNING

Risk of explosion due to damaged reactors

Explosion of a reactor could cause serious injury.

– Check the reactor before each use for damage (scratches, formation of cracks).

⚠ CAUTION

Hot parts when working above 50 °C

Touching hot parts can cause burns.

– Do not touch the cover plate of the device, the fixing ring, the reactor covers, attachments of the reactor or the overhead stirrer if you work above 50 °C.

⚠ CAUTION

Rotating parts of stirrer

Touching rotating parts of a running stirrer may lead to injuries.

– Do not touch rotating parts of a stirrer.

⚠ CAUTION

Risk of injury due to heavy load

You can injure yourself by carrying the instrument alone.

– Never try to carry the instrument alone. At least two people are needed to carry the instrument.

NOTICE

Wrong connection or disconnection of cables

A wrong connection or disconnection of cables during operation could lead to instrument damage.

1 Before switching on the device connect the cables of stirrers and sensors to their respective inputs and outputs.

2 Do not disconnect the cables while the instrument is operating.

NOTICE

Condensation of atmospheric moisture

The condensation of atmospheric moisture can cause corrosion of the instrument.

– To prevent this, purge the instrument with dry air, nitrogen or argon.

NOTICE

Wrong coolant used

High chloride concentration in the coolant can lead to corrosion of the thermostat.

– Do not use solutions of NaCl or $CaCl_2$

NOTICE

Thermal shock

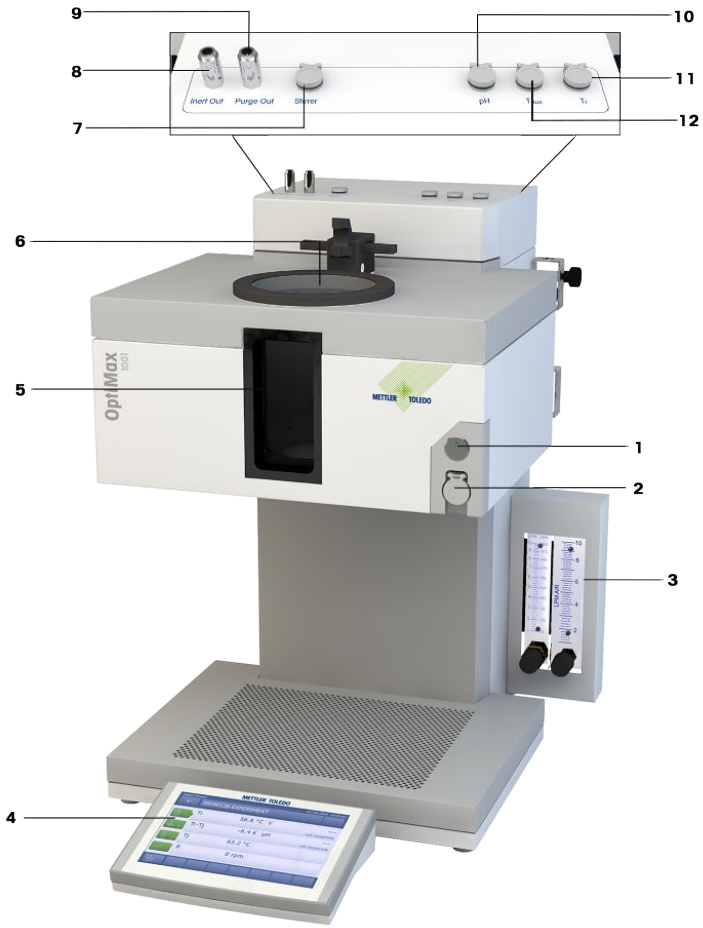
Glass parts of the instrument or the reactor could get damaged.

– Do not fill cold liquids into hot glassware and vice versa.

3 Design and Function

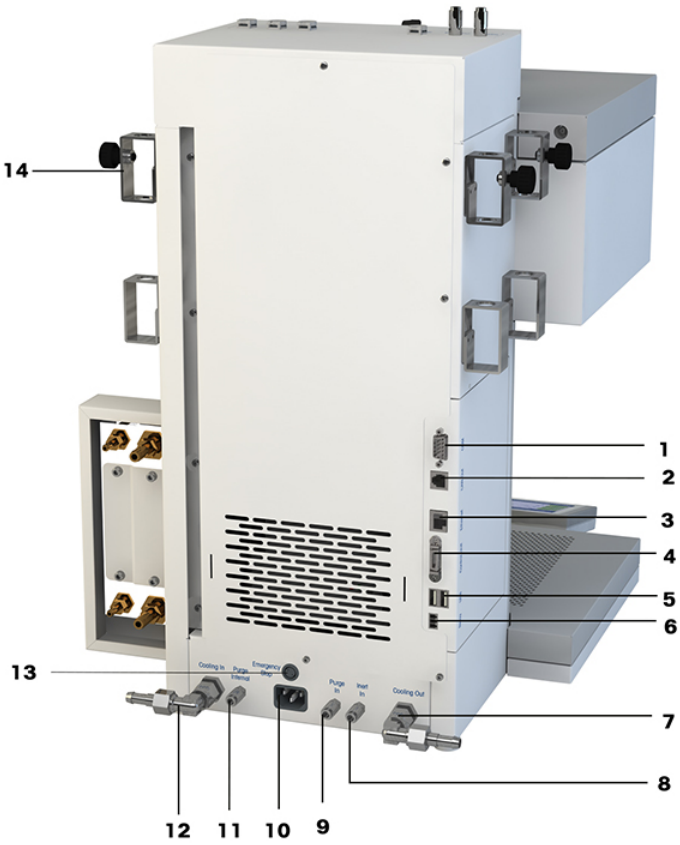
3.1 Overview

Front view



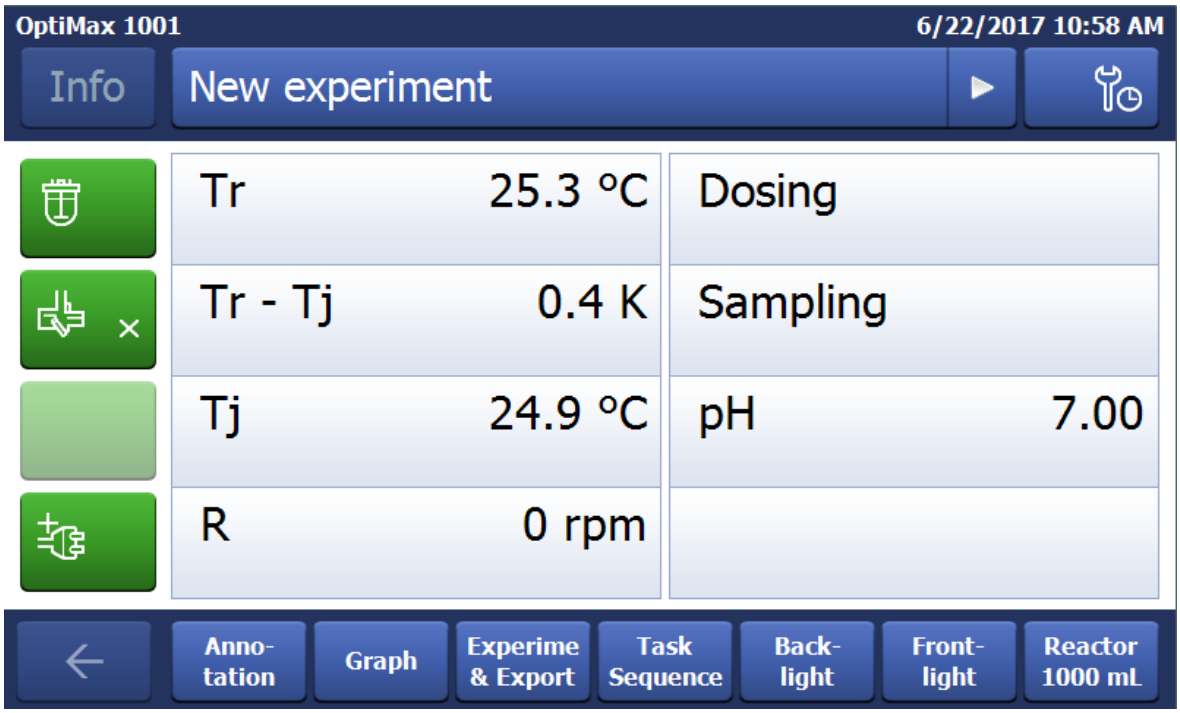
1	Power Button	**2**	USB
3	Flow indicators	**4**	Touchscreen
5	Reactor window (with back- and frontlight)	**6**	Opening for reactors
7	Stirrer connection	**8**	Inert out connection
9	Purge out connection	**10**	pH connection
11	Tr connection	**12**	T_{aux} connection

Back view



1	RS232	**2**	CAN out
3	Ethernet	**4**	Control unit (Touchscreen) connection
5	USB (2x)	**6**	Safety relay
7	Coolant out	**8**	Inert in connection
9	Purge in connection	**10**	Power supply
11	Purge internal connection	**12**	Coolant in
13	Emergency Stop connection	**14**	Holder for lab bars

3.1.1 Touchscreen overview



Info	Displays error messages and warnings
New experiment ▶	Enables you to start, stop and pause a running experiment
	Brings you to the device managment screen, where you can: • Prepare connected dosing units • Configure the ECB outputs On the bottom left you can get to the system settings: • Network Settings • Time Settings • Language Settings • System information
	Displays main screen or brings you back to main screen
	Switches stirrer on and off. Stirrer on controls the stirrer to 100 rpm
00:00:00	Only available when an experiment is running. Used to set time back to zero
Anno-tation	Lets you enter an annotation

	Switches view to the trend graph viewer
	Allows you to start an experiment or export already finished experiments
	Allows you to create a sequence with up to 6 tasks
	Illuminates reactor
	Allows you to access the safety settings and change reactor types

3.2 Operating Principle

The device consists of four modules:

- Electronic control unit
- Thermostat
- Measurement system
- Touchscreen

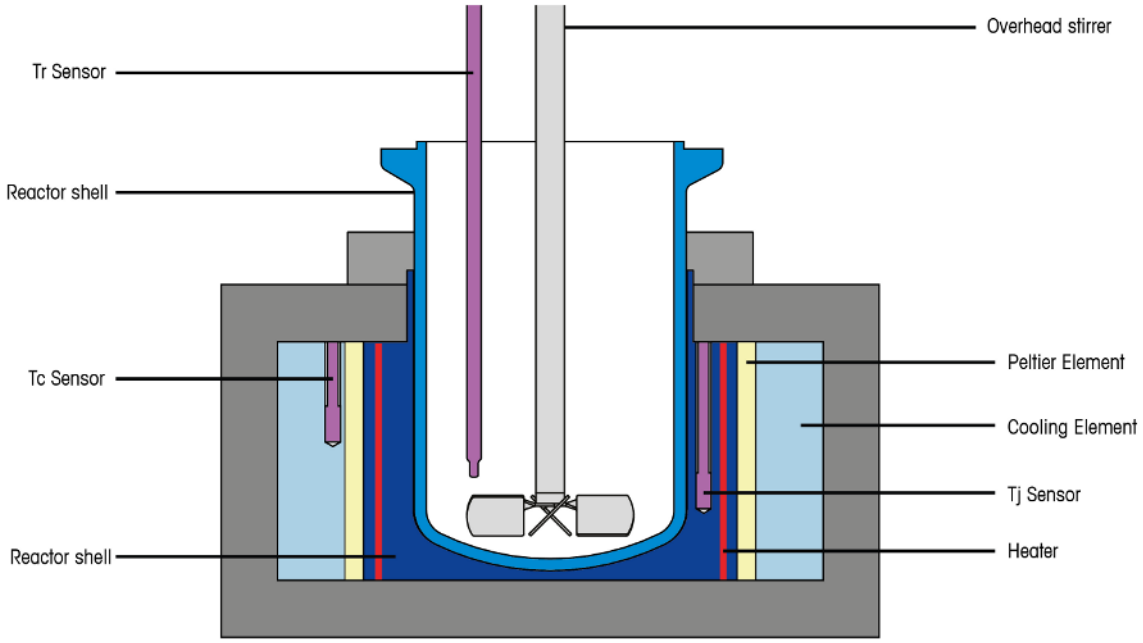
The touchscreen is used to control the device, perform experiments and managing data (storage and export of data).

For the following values the measurement system acquires the set and actual value every 2 seconds:

- Temperature of the reaction mass (Tr)
- Temperature of the thermostat (Tj)
- Temperature of coolant (Tc)
- Stirrer speed
- T_{aux}
- pH

These values are used for controlling the instrument and to trigger warnings and emergency programs.

3.2.1 Thermostat



- The Tr sensor measures the temperature of the reactor contents.
- The Tj sensor measures the temperature of the reactor shell.
- The Tc sensor measures the temperature of the cooling element.

3.3 Temperature Modes

3.3.1 Tr Mode

The temperature of the reactor contents is controlled. Thereby Tr is held constant or changed with a ramp. Deviations of the temperature of the reactor contents from the set value (through heat of reaction) are compensated by appropriate correction of the thermostat temperature, i.e. the heat generated is dissipated.

3.3.2 Tj Mode

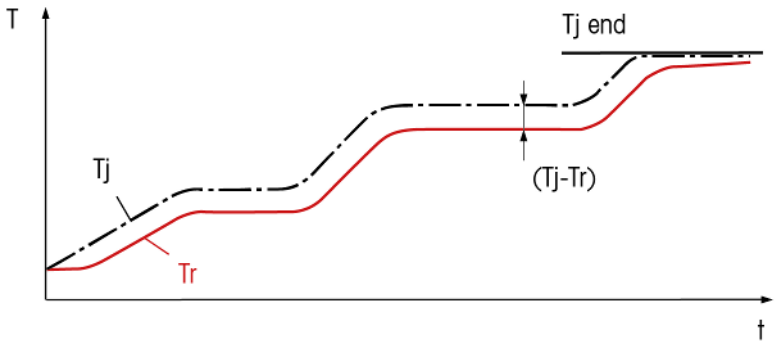
The temperature of the thermostat is controlled. Tj is held at a specific value or changed with a temperature ramp.

3.3.3 Reflux / Distillation Mode (Tj-Tr)

The value entered for the desired temperature difference between the thermostat and the reactor contents (Tj - Tr) is added to the measured temperature of the reactor contents and gives the set value for the control of Tj. For this mode, you have to enter

- the desired temperature difference, Tj - Tr,
- the upper limit of the jacket temperature, Tj end.

As a result, during the time in which no solvent is distilled, the temperature of the reactor contents, Tr, rises in accordance with the value entered for Tj - Tr. During the actual distillation, Tr and hence also Tj remain approximately constant. As soon as Tj end is reached, the final (end) temperature is held.



3.4 Safety System

3.4.1 Chemical Safety

The safety with chemical reactions is assured by monitoring the limit values of the temperatures, the stirrer speed and the measured values of the sensors.

You as the user bear full responsibility for selection of the safety limit values and the reaction control. In the case of chemical reactions with a virtually unknown profile, you are responsible for preventing the reactor reaching a hazardous condition long before the limit values of the intrinsic safety are reached and would respond. You must define the limit values for each new application after careful consideration of all criteria.

Measures to ensure chemical safety

- Limitation of the Tj set value to Tj end in the distillation or reflux mode.
- Monitoring the limit values for Tr, Tj and Rmax defined by you; triggering emergency programs if limit values are exceeded.
- The safety temperature Tsafe you have defined is used as set temperature for emergency program E
- Monitoring of the plausibility of your entries (prevention of typing errors that could have serious consequences).
- Implementation of additional measures with the safety relay, e.g. an external alarm system with visual and/or audio signals or the activation of additional safety functions such as electromagnetic valves. (You have to implement the measures.)
- Manual triggering of an emergency cooling by pressing the emergency button.

3.4.2 Intrinsic Safety

Safe operation is assured by monitoring the instrument functioning.

For every instrument configuration, you are responsible for ensuring that the entire system is safe in case of a power-failure. Ensure that any reaction in progress can not run away.

Measures to ensure intrinsic safety

Electronics

- Monitoring the microprocessor for breakdown (watchdog).
- Monitoring of the stirrer motor.

Software

- Self-test of the microprocessor system after switching on.
- Monitoring all measured values for plausibility and failure.
- Restriction of the temperature difference "Tj-Tr" to maximum 60 K in the Tr and distillation / reflux mode to avoid glass breakage.
- Error recognition and triggering of emergency programs.

3.4.3 Emergency program A

As long as emergency program A is active, errors which trigger this program cannot be reset, i.e. you have to switch off the instrument and rectify the error. An exception is the emergency program "Tc higher than Tc max".

Error causes and measures

Error causes	Measures to take
No connection	Switch off the instrument and restart it.
A/D converter defective	Call METTLER TOLEDO Service.
Power PIC error	Call METTLER TOLEDO Service.
Tj sensor defective	Call METTLER TOLEDO Service.
Tc sensor defective	Call METTLER TOLEDO Service
Tc > Tc max (The temperature of the coolant, Tc, is higher than the defined safety limit value ,Tc max)	Check the flow rate of the coolant. Press Reset, when Tc is lower than Tc max again and continue the interrupted experiment.

3.4.4 Emergency program E

Errors which trigger emergency program E can be reset, i.e. you can continue the experiment when you have rectified the error.

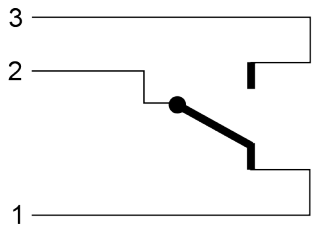
Error causes and measures

Error causes	Measures to take
Tr sensor defective or not connected	Connect the Tr sensor or connect a new one.
Tr > Tr max (The temperature of the reactor contents, Tr, is higher than the defined safety limit value Tr max)	1 Tap **Reset**. 2 Wait until Tr < Tr max. 3 Continue the experiment.
Tr < Tr min (The temperature of the reactor contents, Tr, is lower than the defined safety limit value Tr min)	1 Tap **Reset**. 2 Wait until Tr > Tr min. 3 Continue the experiment.
Tj > Tj max (The temperature of the thermostat, Tj, is higher than the defined safety limit value Tj max)	1 Tap **Reset**. 2 Wait until Tj < Tj max 3 Continue the experiment.
Tj < Tj min (The temperature of the thermostat, Tj, is lower than the defined safety limit value Tj min)	1 Tap **Reset**. 2 Wait until Tj > Tj min. 3 Continue the experiment.
The emergency button is pressed during an active ramp	1 Release the emergency button. 2 Continue the experiment.
The stirrer motor cannot reach the set speed for more than 3 minutes	1 Reduce the speed. 2 Check the viscosity. 3 Continue the experiment.

3.5 Safety Relay

The emergency relay is thought for connecting an optical or visual alarm. In case no emergency program is triggered, pins 1 and 2 are connected. As soon as an emergency program is triggered, the relay switches and pins 2 and 3 are connected.

Relay switched off: contact between pin 1 and pin 2



Relay switched on: contact between pin 2 and pin 3 (Meaning an emergency program has been triggered.)

4 Installation

4.1 Installation requirements

- Make sure there is enough space (about 10 cm) between the ventilation slots at the back side of the instrument and any other object or the wall.
- Make sure you install the device in accordance with the [technical data ▸ Page 62].

Site requirements

The instrument has been developed for indoor operation in a well-ventilated area. Avoid the following environmental influences:

- Conditions outside of the ambient conditions specified in the technical data
- Powerful vibrations
- Direct sunlight
- Corrosive gas atmosphere
- Explosive atmosphere of gases, steam, fog, dust and flammable dust
- Powerful electric or magnetic fields

4.2 Connecting power to the device

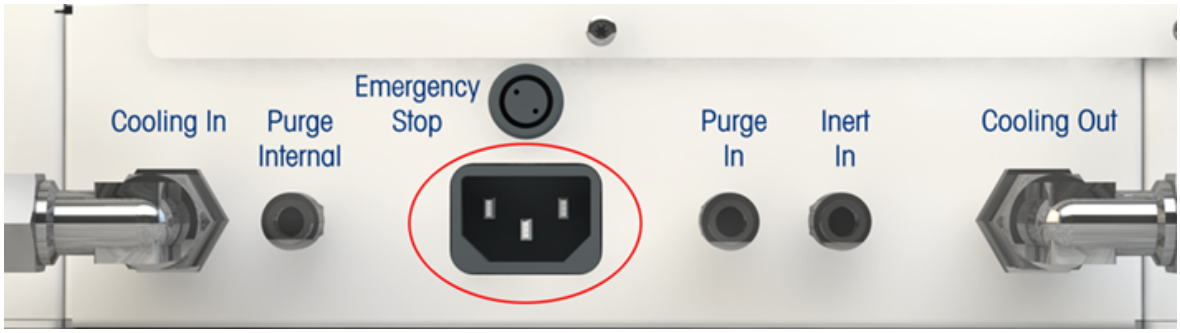
⚠ WARNING

Risk of electric shock

1 Make sure to plug the power cable supplied into a power supply outlet that is grounded. A technical fault could otherwise result in serious injury or death.

2 Only use the METTLER TOLEDO power supply cable and AC power adapter designed for your instrument.

1 The power supply connection is on the back side of the device.

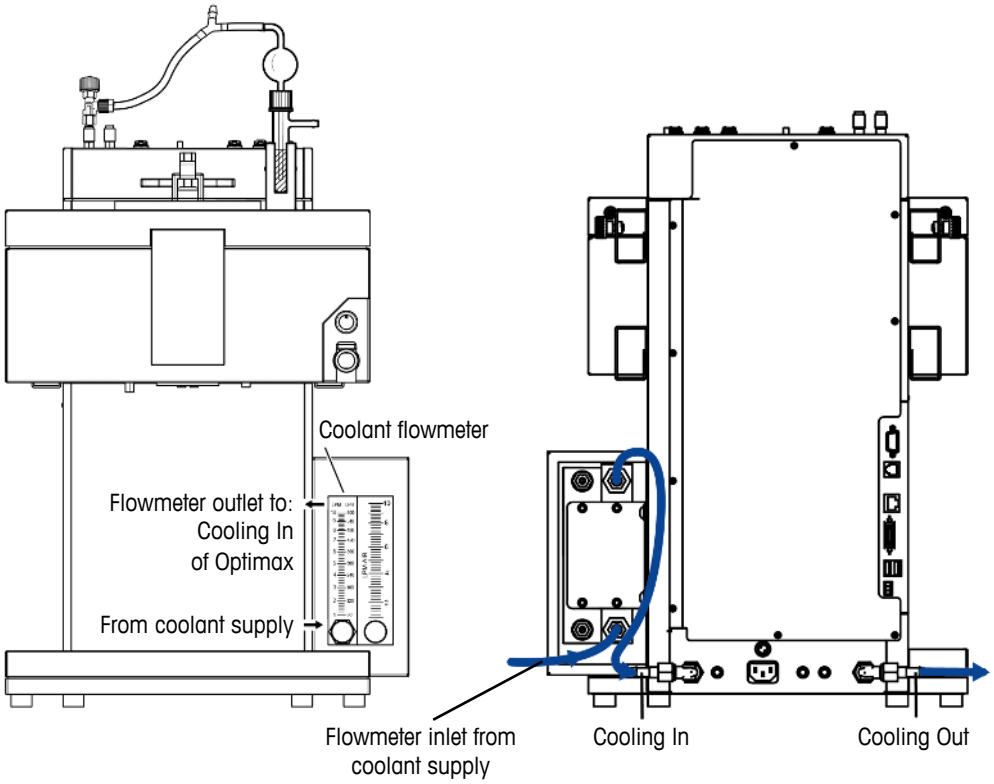


2 Connect the instrument to the power supply using the included country-specific cable.

3 Insert the plug of the power cable in a grounded power outlet that is easily accessible.

4.3 Connecting water cooling

The installation via the flowmeter requires three pieces of tubing, in the box you will find two. You can cut away a piece of appropriate length (it has to cover the connection from the flowmeter to the cooling in on the back side of the instrument) from one of the two delivered tubes.



1 Push one piece of the PVC industrial hose (51161187) over the cooling inlet of the coolant flowmeter.
2 Secure it with a hose clamp.
3 Connect the other end to the coolant supply.
4 Connect the cut piece to the coolant flowmeter outlet and secure with hose clamp.
5 Connect the other end to the **Cooling In** of the device and secure with hose clamp.
6 Push the second piece of the PVC tube over the elbow coupling of the **Cooling Out** on the back side of the instrument.
7 Secure it with a hose clamp.
8 Connect the other end to the waste water system.

4.4 Connecting cryostat cooling

NOTICE

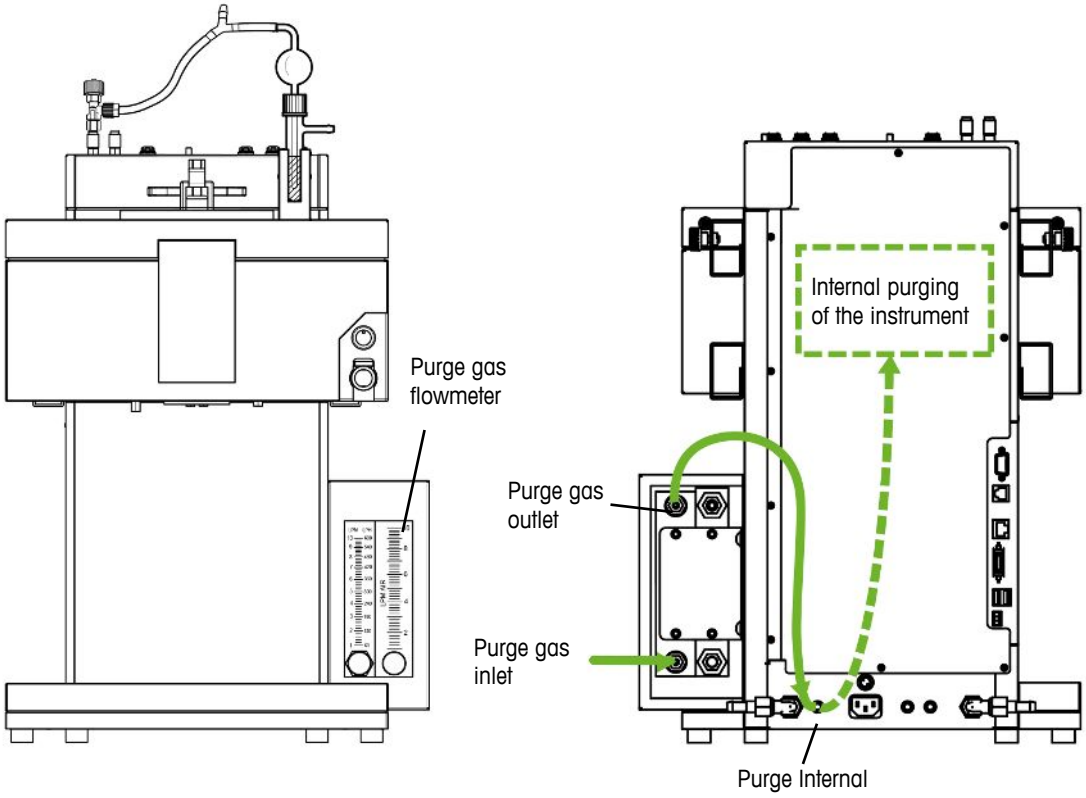
Damage of Flowmeter

The flowmeter is not resistant against any other liquids than water! Do not use it with other coolants.

1 Screw the insulated connection tube over the **Cooling In** on the back of the instrument.
2 Use a wrench to tighten the connection to the instrument.
3 Screw the second insulated connection tube over the **Cooling Out** on the back of the instrument.
4 Use a wrench to tighten the connection to the instrument.

4.5 Connecting instrument purge gas

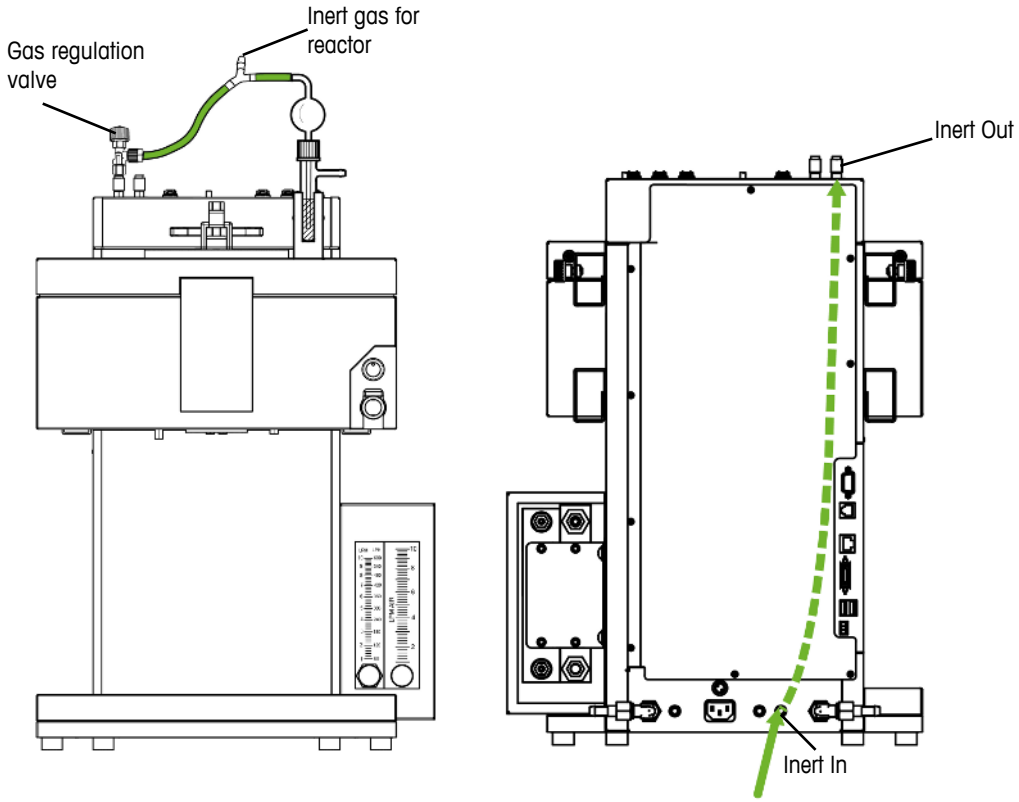
To prevent corrosion by condensed atmospheric moisture in the instrument, the instrument must be purged with a dry gas, e.g. dry air, dry nitrogen or dry argon.



1 Push one piece of PVC industrial hose for purge gas (51192239, ø 4/10 mm) on the purge gas Inlet of the purge gas flowmeter.
2 Secure it with a hose clamp.
3 Connect the other end to the purge gas supply.
4 Push a second piece of PVC industrial hose for purge gas over the purge gas outlet of the flowmeter.
5 Secure it with a hose clamp.
6 Push the other end of the second piece over the **Purge Internal** quick connect coupling connection on the back side of the device.
7 Secure it with a hose clamp.

4.6 Purging the reactor with inert gas

To perform reactions under nitrogen (or any other inert gas) you have to install the purge tubing according to the following instructions:



1 Install a quick connect coupling (51190324, ø 4/6 mm, red) with the PVC tube (51161186) on the **Inert In** connector on the back side of the instrument and secure it with a hose clamp.

2 Connect the other end of the PVC tube to the gas supply.

3 Install a quick connect coupling on the **Inert Out** connector on top of the instrument and push a piece of the PVC tube over the quick connect coupling.

4 Integrate a bubble counter with a gas regulation valve (51161802, optional available as set) and the Y-piece (51191373) into the tubing as shown in the drawing. Proceed, depending on the type of the used reactor. (The use of the Y-piece guarantees an uncritical pressure for the reactor while the gas flow can be monitored with the bubble counter.)

5 Always leave a small opening in the reactor to allow a flow of the purge gas.

4.7 Connecting touchscreen to OptiMax

NOTICE

Touchscreen connection / disconnection

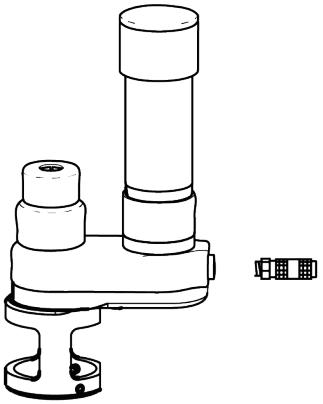
The instrument may be seriously damaged if the touchscreen is connected or disconnected when the instrument is switched on.

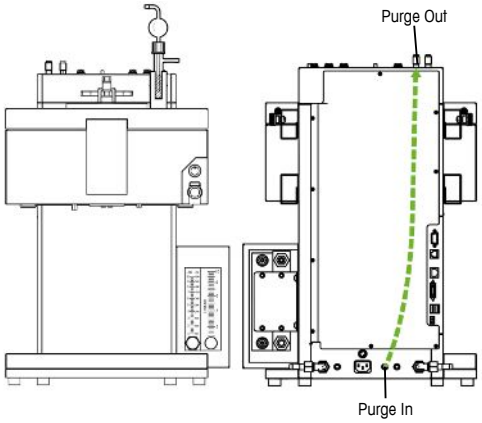
– Do only connect or disconnect the touchscreen when the instrument is switched off.

1 The touchscreen connection is on the back side of the instrument (see picture).
2 Connect the touchscreen cable to the socket.

4.8 Connecting stirrer purge gas

1 Remove the nut on the stirrer with a hexagonal wrench (4 mm).
2 Remove the Swagelok fitting from metal connector.
3 Screw the metal connector onto the purge connector on the stirrer.
4 Do not tighten it completely it should stick out at least 2,5 cm from the stirrer.
5 Cut the tubing to an appropriate length.
6 Connect the quick connectors on either side of the tubing.
7 Connect the quick connectors to the metal connector mounted on the stirrer.
8 Connect the tubing to the **Purge In** on the back side of the instrument.





4.9 Connecting emergency button to OptiMax

– Connect the emergency button to the **Emergency Stop** connector on the rear side of the instrument.

4.10 Assembling the Stirrer

Step 1 and 2 are not needed when the device is installed for the first time as the adapter part comes already assembled.

The assembly of the stirrer adapter (30451755) into the stirrer housing can be a bit tight in the beginning and will improve over time.

1 Install the PTFE cord (**6**) in the adapter (**7**).

2 Reinstall the pressure screw (**5**) and lightly tighten.

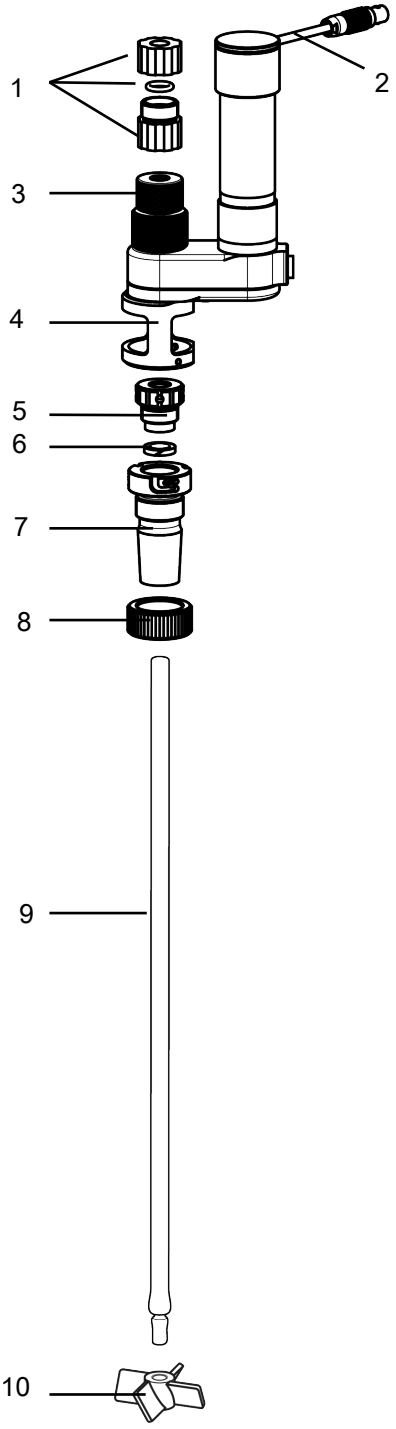
3 Screw the pitched-blade element (**10**) onto the stirrer shaft (**9**).

4 Push the stirrer shaft (**9**) from below through the central opening of the reactor cover.

5 Push the adapter loosening nut (**8**) over the stirrer shaft (**9**) and screw to the adapter (**7**).

6 Insert the adapter (**7**) into the central opening of the cover.

7 Push the stirrer shaft (**9**) through the hole in the stirrer assembly.



8 Tighten the pressure screw (**5**). Increasing the tightness will minimize solvent loss (or retention of vacuum).

9 Align the slits in the adapter (**7**) with the pins of the lower housing (**4**).

10 Turn the stirrer adapter (**7**) until you hear a click and the adapter is locked in the lower aluminum housing (**4**).

11 If necessary adapt the height of the stirrer shaft and the pitched-blade element with the reactor for an applicable immersion depth.

12 Fix the stirrer shaft by tightening the chuck (**3**) and secure it with the locking device (**1**) on top of the chuck (**3**). (The locking device prevents the stirrer shaft from falling into the reactor in case the chuck is loosened carelessly or by mistake.)

13 Connect the stirrer cable (**2**) to the connector on top of the instrument housing.

To change the immersion depth of the stirrer shaft:

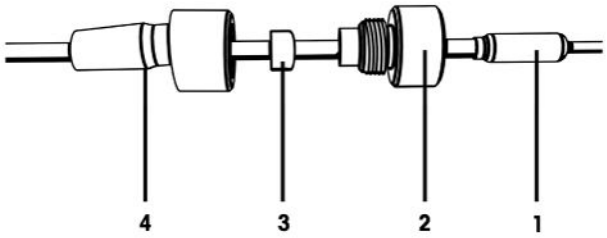
1 Release the chuck (**3**) while holding the stirrer shaft.

2 Release the locking device (**1**) and adapt the immersion depth.

3 Tighten the chuck (**3**) and secure it with the locking device (**1**).

4.11 Installing a Tr sensor

Note The Tr sensor must be immersed in the reaction solution to a depth of at least 1.5 cm to give correct measurement values.



1 Unscrew the pressing screw (**2**) from the adapter and push it over the sensor (**1**).

2 Push the sealing ring (**3**) over the Tr sensor with the round side pointing to the screw (**2**).

3 Push the lower part of the adapter (**4**) over the Tr sensor.

4 Screw the adapter (**3** & **2**) lightly together.

5 Install the Tr sensor (**1**) on the reactor cover (in an appropriate port).

6 Connect the Tr sensor to the Tr connection on the instrument.

4.12 Installing a baffle

The baffle is inserted in one of the ST 19 openings of the reactor. Using the eccentric PTFE adapter (51104154) and due to the fact that the baffle itself is angular, fit the baffle in a way that it does not collide with the stirrer, the Tr sensor or any other insert of the reactor.

Baffle available on:

- 500 mL (51162638)
- 1000 mL (51162637)

4.13 Installing a 1000 mL two-piece reactor

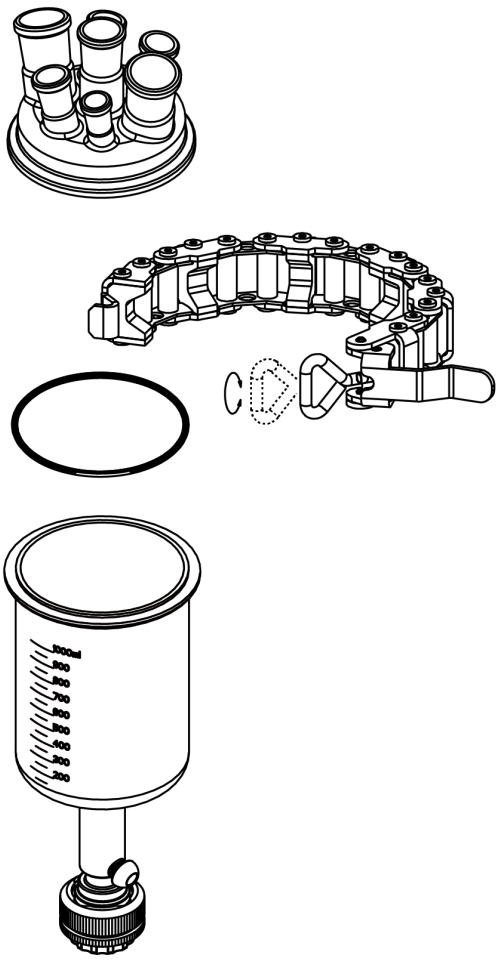
Before you place the reactor in the thermostat, we recommend that you install the Tr sensor and other inserts in order to check their distance from the stirrer or the bottom of the reactor. We also recommend that you add the reagents and solvent for the starting volume and possibly check the fill level of the first fill.

1 Push the glass stirrer or the stirrer shaft with anchor or pitched-blade element through the central opening of the reactor cover before you place the cover onto the reactor.
2 Connect the stirrer shaft to the stirrer motor.
3 Fix the reactor holder (51162782) to one of the lab bars and place the reactor in the reactor holder.

4 Place the O-ring on the cover rim and place the cover on the reactor.

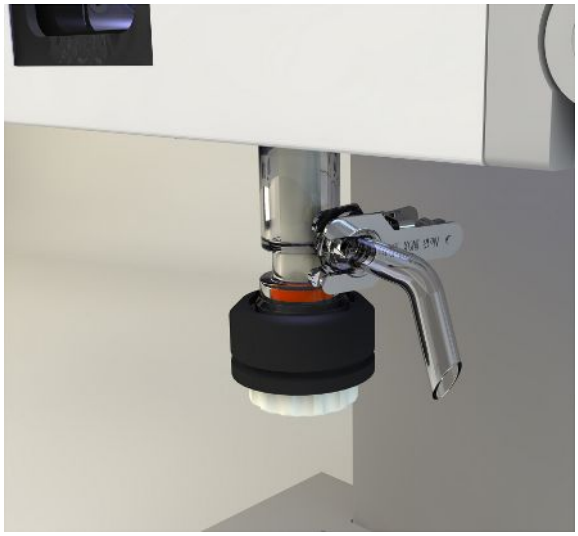
5 Place the clamp chain carefully around the cover and the reactor flanges.

6 Screw the hook in or out so that the buckle can be easily closed (with one finger).

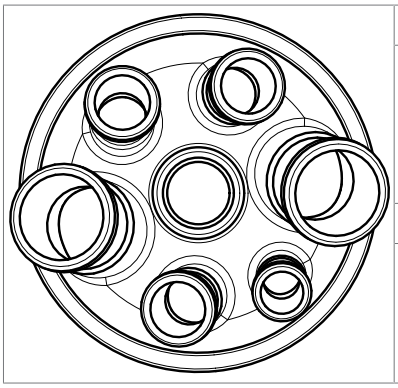


7 Remove the assembled reactor from the reactor holder and insert it into the thermostat.

8 Attach the drain union (51162685) to the bottom drain valve and fasten it with the pinch clamp.



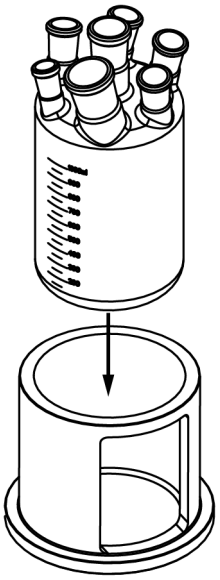
4.13.1 Openings of the 1000 / 500 mL two-piece reactor cover



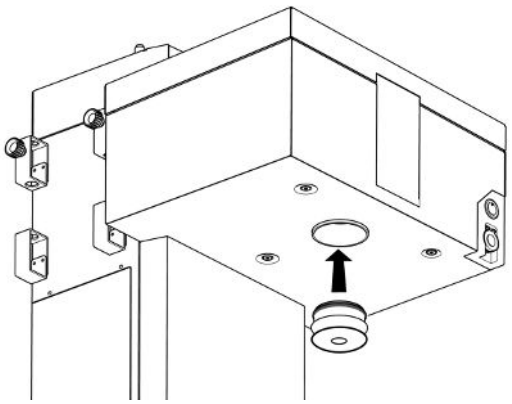
Center ST24/29	Stirrer
ST19/26 (3x)	• pH electrode • Baffle • EasySampler • FBRM S/G400 long
ST 14/23 (1x)	Tr sensor or EasySampler
ST 29/32 (2x)	

4.14 Installing a 1000 mL one-piece reactor

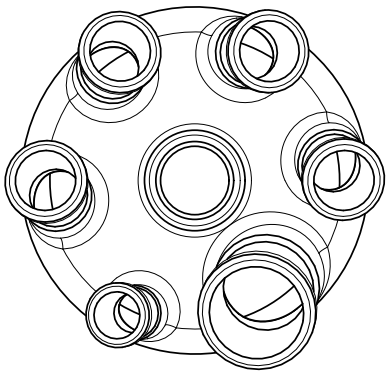
1 Place the reactor in the reactor stand (51162760).
2 Install the stirrer with a half-moon blade in the central opening.
3 Install the Tr sensor.
4 Check that the stirrer does not touch inserts.
5 Add the liquids for the first fill.
6 Check that Tr sensor is immersed.



7 Insert the plug (51162860 with sealing 51192209) from below into the lower opening of the thermostat. This will eliminate any disturbing stack-effect from the thermostat.
8 Place the reactor in the reactor opening of the thermostat.
9 Connect stirrer and Tr sensor to the device.



4.14.1 Openings of the 1000 mL one-piece reactor cover



	Central ST24/29	Stirrer
	ST29/32 (1x)	
	ST14/23 (1x)	Tr sensor and EasySampler
	ST19/26 (4x)	• pH electrode • Baffle • EasySampler

4.15 Using the rotation lock

Only applicable for two-piece reactors.

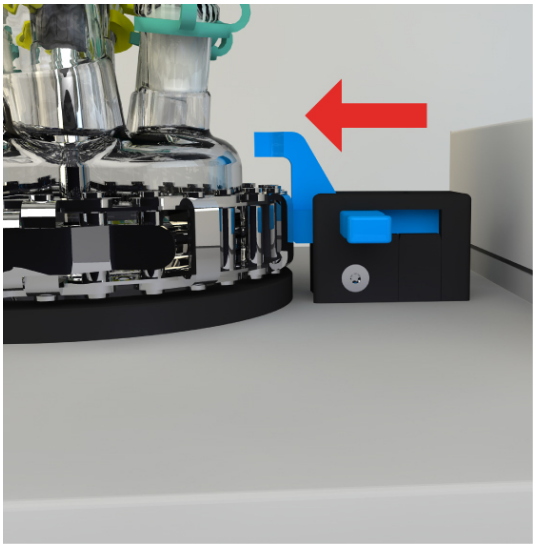
Using the rotation lock to fix reactor

Always lock the reactor using the rotation lock this prevents the reactor from rotating concurrently while you open or close the bottom drain valve.

1 Insert the reactor into the thermostat.

2 Push the blue rotation lock towards the reactor.

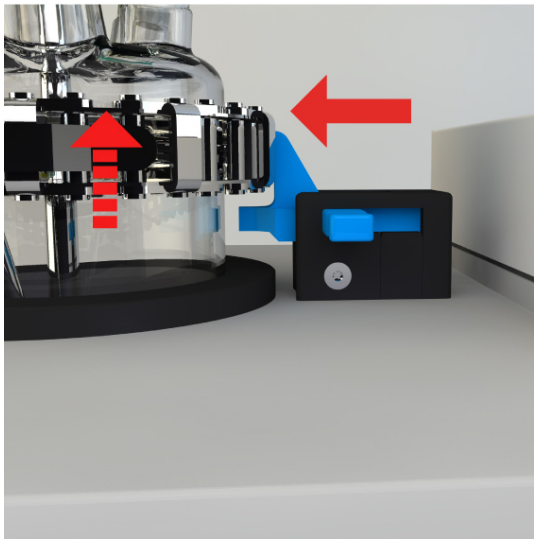
3 Make sure the lower pin fits into the chain and holds it in place.



Using the rotation lock to uplift the reactor

– Uplift the reactor and lock it with the upper pin of the rotation lock.

⇨ You can observe the bottom of the reactor through the reactor window.



4.16 Installing smaller two-piece reactors

For OptiMax also 500 mL and 250 mL reactors are available. The installation procedure is very similar to the 1000 mL reactor.

The only difference are the order numbers for reactor size specific items and the installation of a receptacle into the thermostat

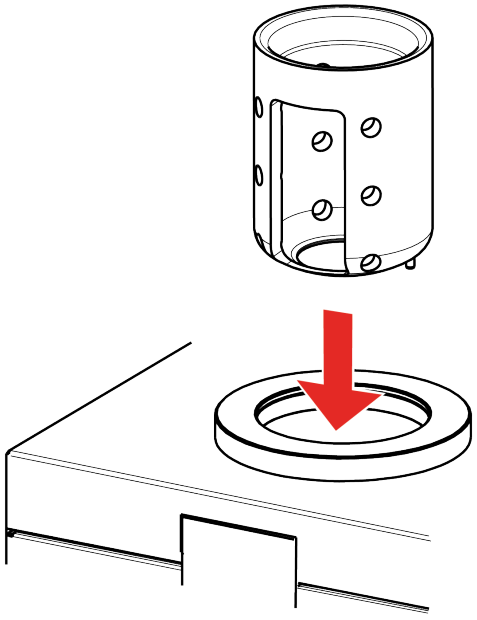
1 Install and prepare the reactor as described in the chapter [Installing a 1000 mL two-piece reactor ▸ Page 25].

2 Before placing the assembled reactor into the thermostat, install the receptacle.

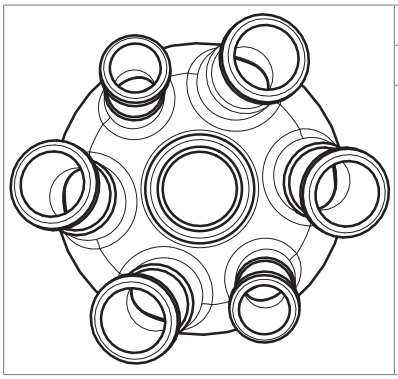
3 Insert the receptacle into the thermostat with the window heading forward. Make sure the locking pin on the side snaps into place.

4 Remove the assembled reactor from the reactor holder and insert it into the receptacle in the thermostat.

5 Attach the drain union (51162685) to the bottom drain valve and fasten it with the pinch clamp.



4.16.1 Openings of the 250 mL two-piece reactor cover



Central ST 24	Stirrer
ST 14/23 (2x)	Tr Sensor and EasySampler
ST 19/26 (4x)	• pH electrode • EasySampler

4.17 Installing smaller one-piece reactors

For OptiMax also 500 mL and 250 mL reactors are available. The installation procedure is very similar to the 1000 mL reactor.

The only difference are the order numbers for reactor size specific items and the installation of a receptacle into the thermostat.

Instead of the reactor holder, the reactor stand (51162759 for 500 mL reactor and 51162758 for 250 mL reactor) is used to store and prepare the reactor.

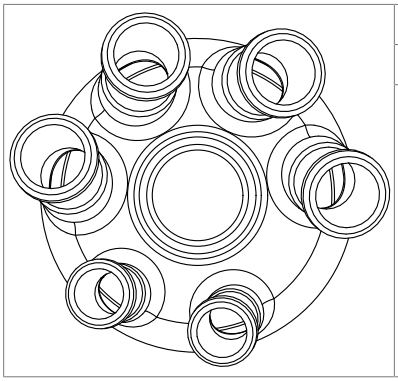
1 Before placing the assembled reactor into the thermostat, install the receptacle.

2 Insert the receptacle into the thermostat with the window heading forward. Make sure the locking pin on the side snaps into place.

3 Insert the plug (51162860 with sealing 51192209) from below into the lower opening of the thermostat. (This will eliminate any disturbing stack-effect from the thermostat.)

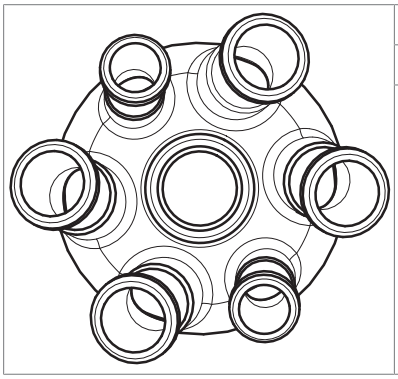
4 Remove the assembled reactor from the reactor stand and insert it into the receptacle in the thermostat.

4.17.1 Openings of the 500 mL one-piece reactor



Central ST 24/23	Stirrer
ST 14/29 (2x)	Tr Sensor and EasySampler
ST 19/26 (4x)	• pH electrode • EasySampler

4.17.2 Openings of the 250 mL one-piece reactor



Central ST 24/29	Stirrer
ST 14/23 (2x)	Tr Sensor and EasySampler
ST 19/26 (4x)	• pH electrode • EasySampler

4.18 Turn on Device

- Power is connected.
- Cooling is connected.
- Purging of instrument is connected.
- Touchscreen is connected

– Press the ON/OFF button on the front side of the instrument.
  ⇨ The touchscreen shows a splash screen during start up phase.

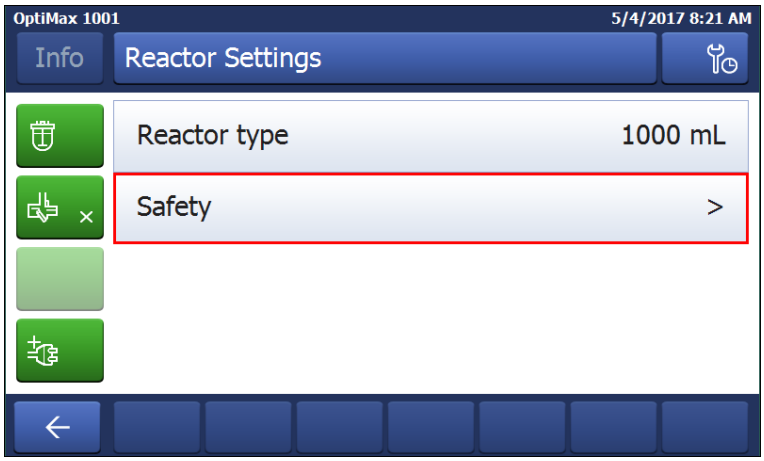
⇨ You can use the device as soon as the reactor view appears on the screen.

5 Operation

5.1 Change Safety Settings

1 Tap the Reactor button.

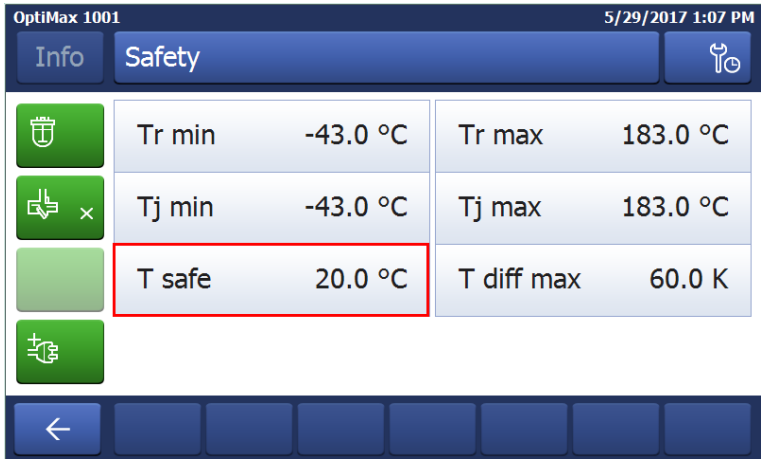
2 Tap on the **Safety** field.



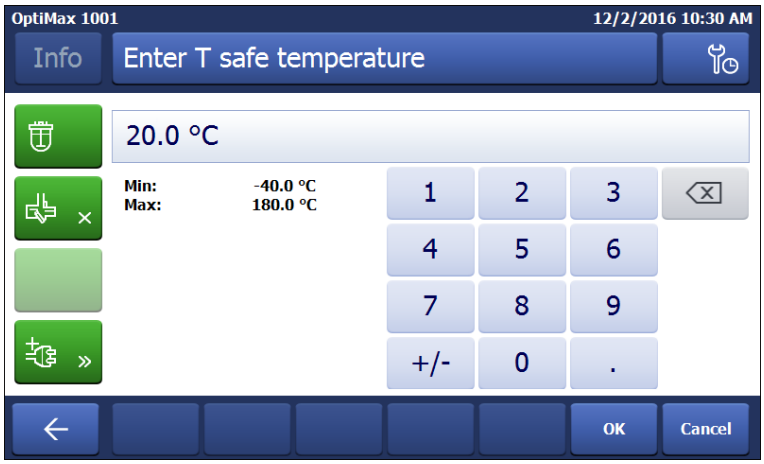
3 Change the necessary parameters according to your experiment and setup.

5.1.1 Change Safety Temperature (T safe)

1 Tap on **T safe**.



2 Enter a value for **T safe** that is valid for your experiment.

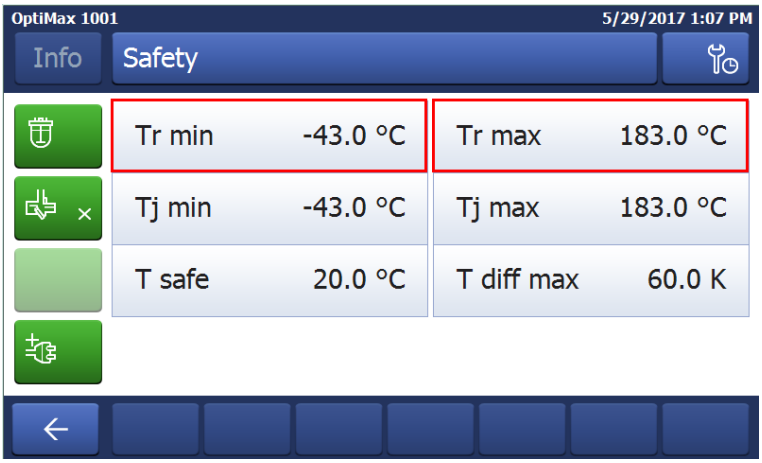


3 Tap **OK**.

Parameter	Description	Values
Tsafe	Defines the temperature to which the reaction will be cooled in case of an emergency program E.	According to your chemistry

5.1.2 Change Reaction Temperature limits (Tr)

1 Tap on **Tr max** or / and **Tr min**.



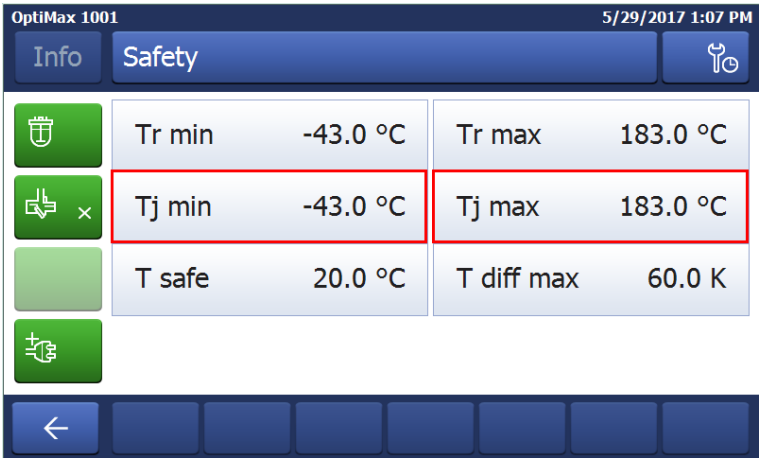
2 Enter a value for **Tr max** and **Tr min** that is valid for your experiment.

3 Tap **OK**.

Parameter	Description	Values
Trmin	Defines the minimum temperature the Tr value can reach during an experiment and the user can enter in the Reactor view. If the temperature falls below that value the Emergency program E is triggered.	-43…17 °C
Trmax	Defines the maximum temperature Tr value can reach during an experiment and the user can enter in the Reactor view. If the temperature rises above that value the Emergency program E is triggered	23…183 °C

5.1.3 Change Range of Jacket Temperature (Tj)

1 Tap on **Tj min** or / and **Tj max**.



2 Enter a value for **Tj min** and **Tj max** that is valid for your experiment.

3 Tap **OK**.

5.1.4 Change T diff max

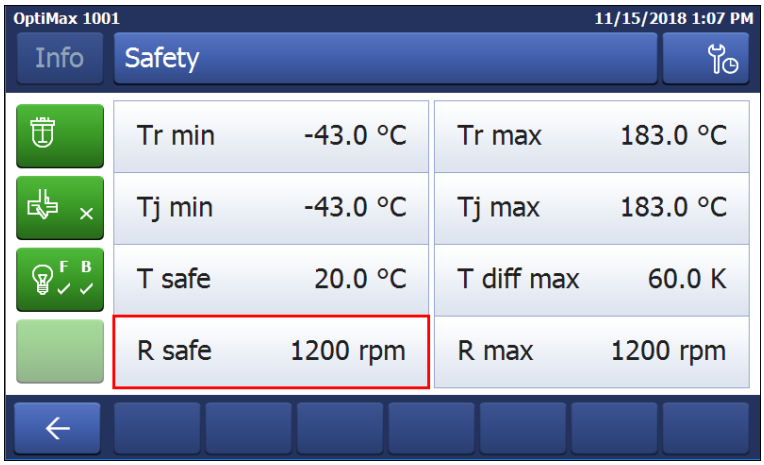
1 Tap on **T diff max**.

2 Enter a value for **T diff max** that is valid for your experiment.

3 Tap **OK**.

5.1.5 Change Rsafe

1 Tap on **Rsafe**.

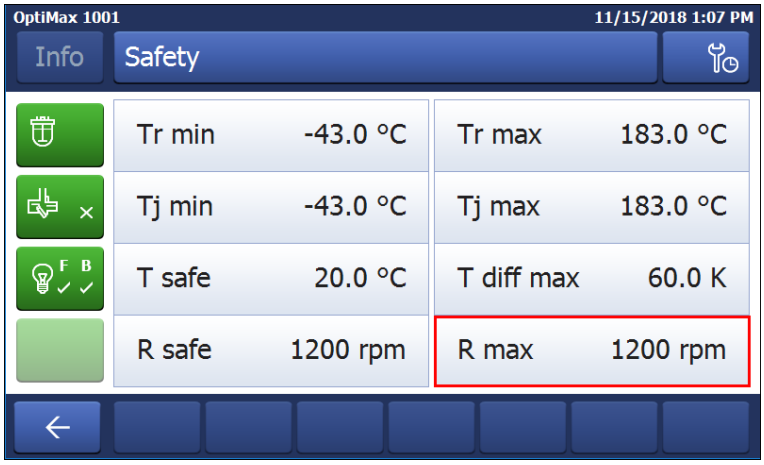


2 Enter a value for **Rsafe** that is valid for your experiment.

3 Tap **OK**.

5.1.6 Change Rmax

1 Tap on **Rmax**.



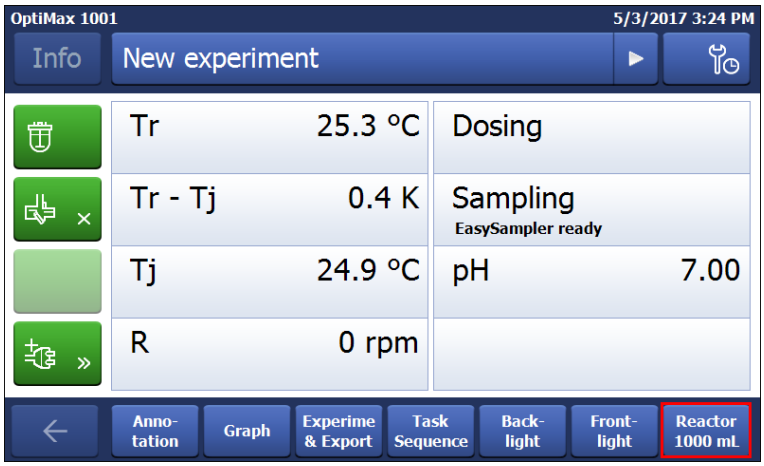
2 Enter a value for **Rmax** that is valid for your experiments.

3 Tap **OK**.

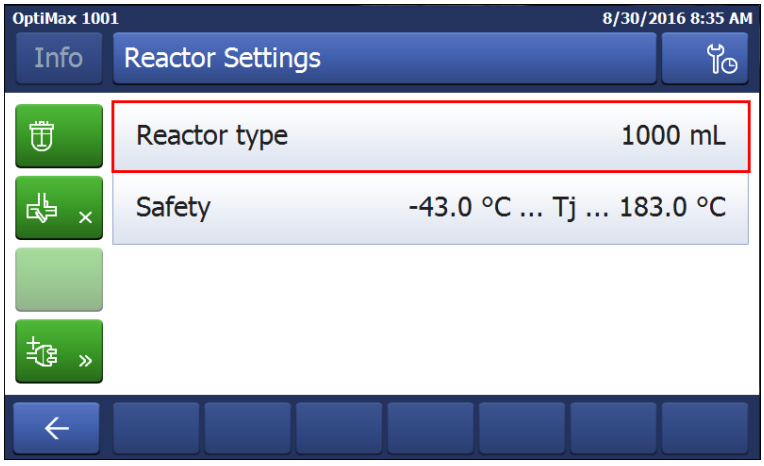
5.2 Experiment

5.2.1 Select Reactor type

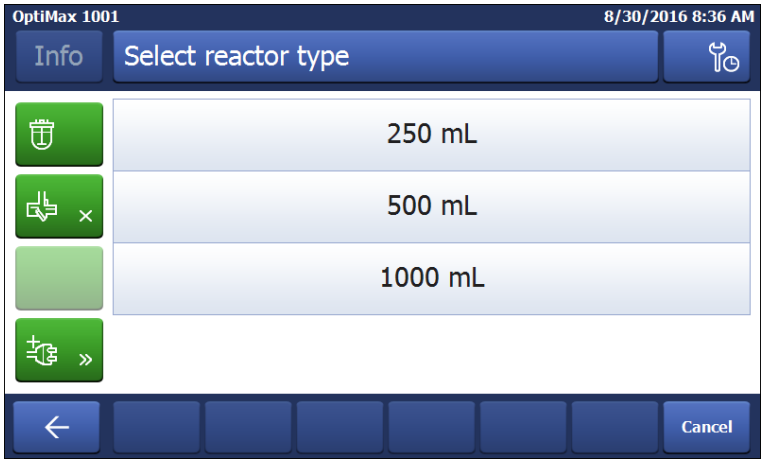
1 Tap the icon Reactor 1000 mL.



2 Tap the **Reactor type** field.



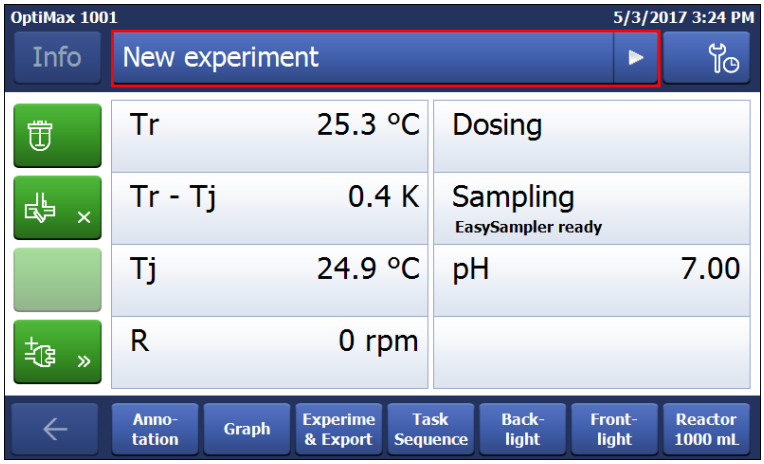
3 Select the reactor type that is installed.



⇨ Make sure the safety settings for the reactor are still within the range.

5.2.2 Start an Experiment

1 Tap the experiment button on the main screen.



2 Enter an **experiment name**.

3 Tap **Start** to start the experiment.

⇨ All tasks that are executed will be saved under the experiment and available for export.

5.2.3 Add a Time Marker

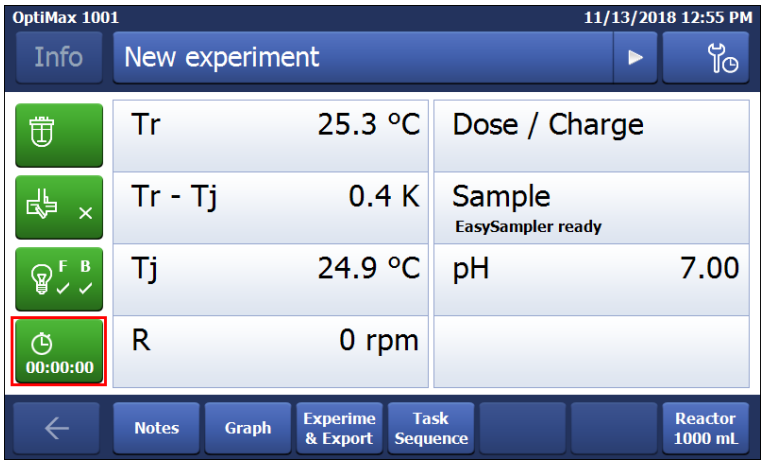
The time marker is only active if an experiment is running.

Time markers can be added on the touchscreen with two possibilities:

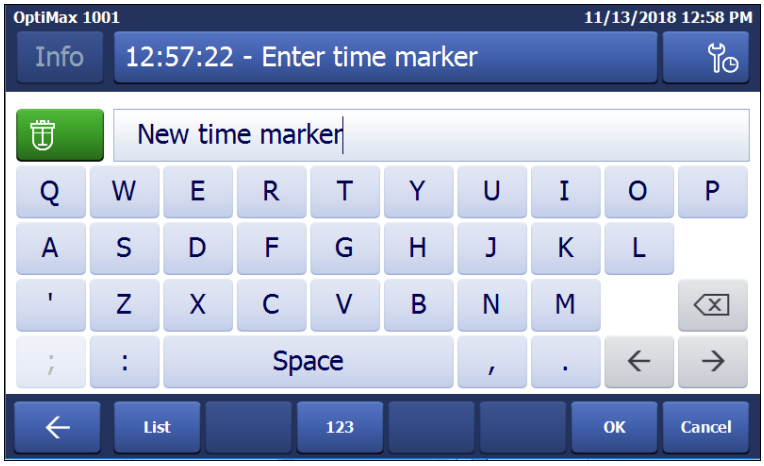
- Action button in green on the left side of main screen.
- In the Trend graph viewer by tapping on the trend graph.

Add time marker on main screen

1 Tap on the time marker symbol on the main screen.



2 Enter a name for the time marker.



3 Tap **OK** to add the time marker to the experiment.

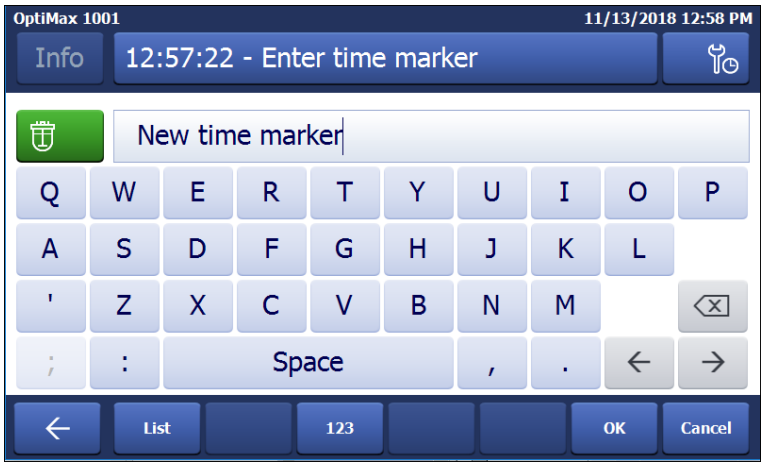
Add time marker in the trend graph

1 Tap on the **Graph** button.

2 Tap in the graph area where you would like to set a time marker.

3 Choose time marker from the options.

4 Enter a name for the time marker.



5 Tap **OK** to add the time marker to the experiment.

5.2.4 Manual Sampling

- No EasySampler is connected.

1 Tap on **Sampling** on the mainscreen.
2 Change the name of the sample or use the default name.
3 Tap **OK**.

Check manual samples

1 Tap on **Sampling** on the mainscreen.
2 Tap on **List** on the bottom left of the screen.
⇨ All taken samples are shown with name and time stamp.

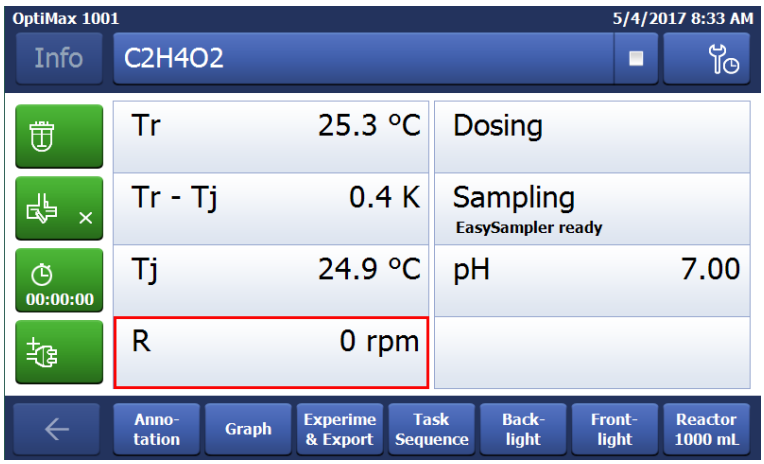
5.2.5 Stirring

5.2.5.1 Change Stirrer Speed

Note The value cannot be higher than the safety limit value.

- A stirrer is connected.
- The touchscreen is connected.

1 Tap on the **R** field.



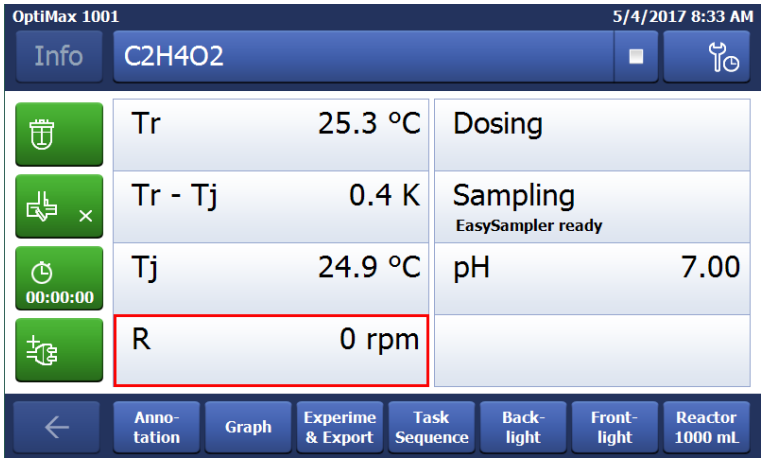
2 Enter the desired value.

3 Tap **Start**.
⇨ The stirrer will immediately start stirring.

5.2.5.2 Create a Stirrer Speed Ramp

- A stirrer is connected.
- The touchscreen is connected.

1 Tap on the **R** field.



2 Tap **Advanced**.

3 Enter a stirrer end speed (R end).

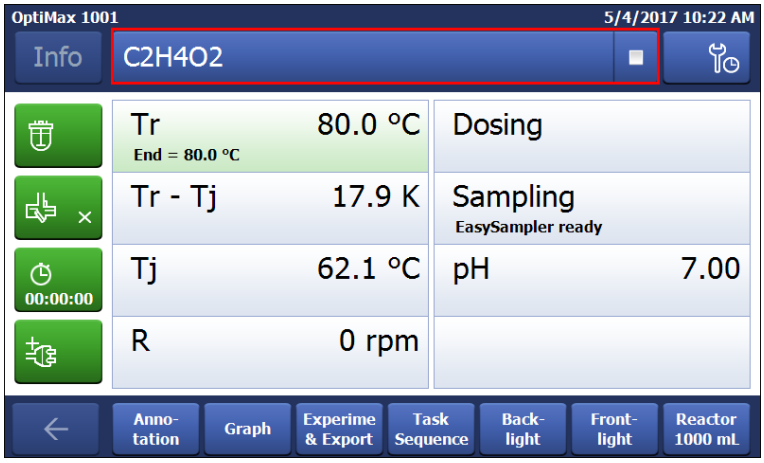
4 Enter the duration of the ramp.

5 Tap **Start**.

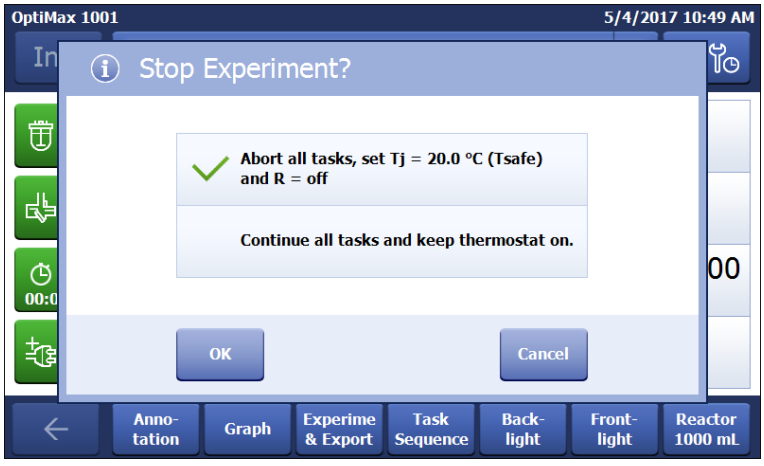
⇨ The stirrer will immediately start stirring.

5.2.6 End an Experiment

1 Tap on the Stop button on the mainscreen.



2 Select your preferred option for experiment end conditions.



3 Tap **OK**.

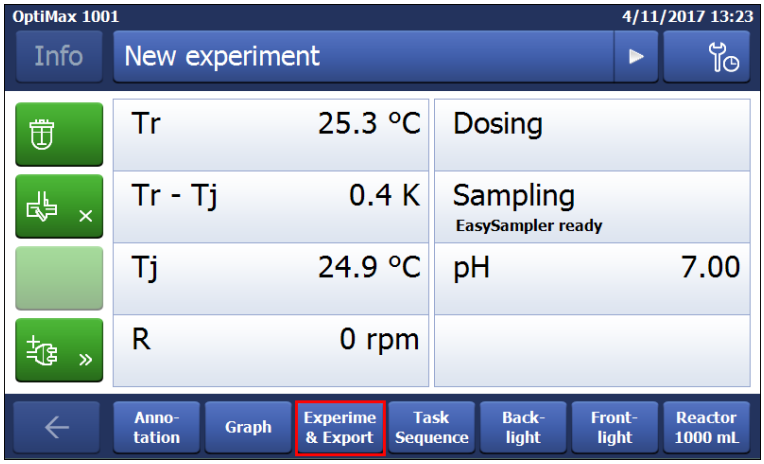
⇨ Your experiment is stored on the device and can be exported.

5.2.7 Export Data from a Defined Time Frame

This is good for exporting data from a series of experiments.

- An USB stick is inserted in the USB port.

1 Tap on **Experiment & Export**.



2 Choose **Export time period**.

3 You can change the time period by tapping on Time period start / Time period end.

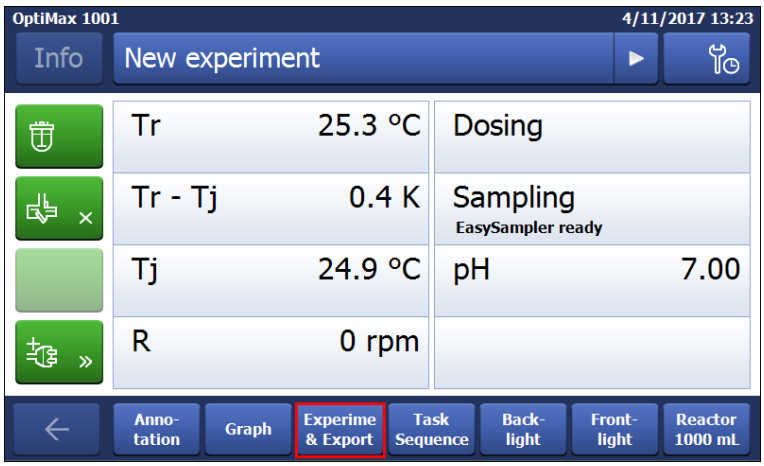
4 Tap on **Start Export**.

⇨ The touchscreen will show a message when export is finished and successful.

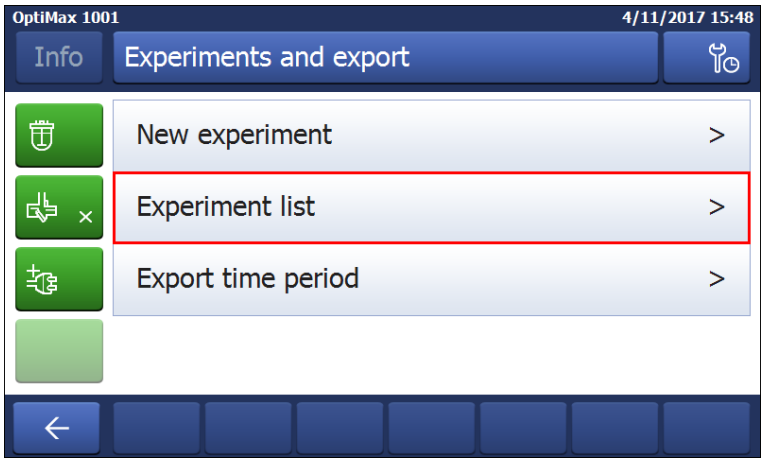
5.2.8 Export Single Experiments

- An USB stick is inserted in the USB port.

1 Tap on **Experiment & Export**.



2 Choose **Experiment List**.



3 From the **Experiment List** choose the experiment you want to export.

4 Tap on **Start Export**.

⇨ The touchscreen will show a message when export is finished and successful.

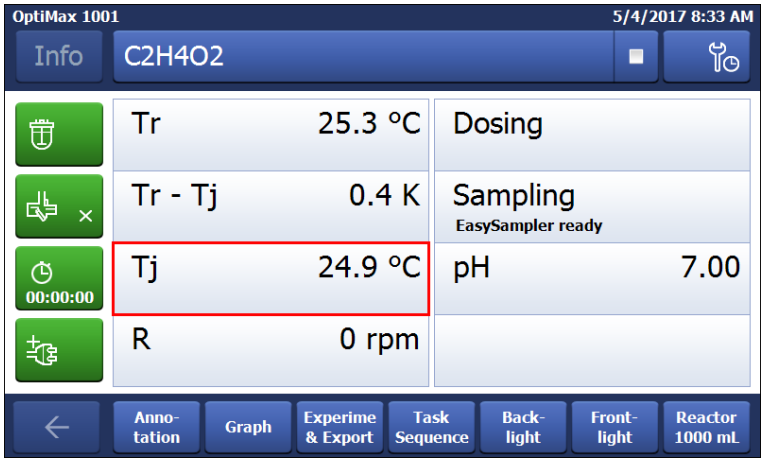
Interval time can be changed in order to minimize data volume and time for export.

5.3 Heating and Cooling

5.3.1 Change Tj

Note The value cannot be higher than the safety limit value.

1 Tap the **Tj** value field on the main screen.



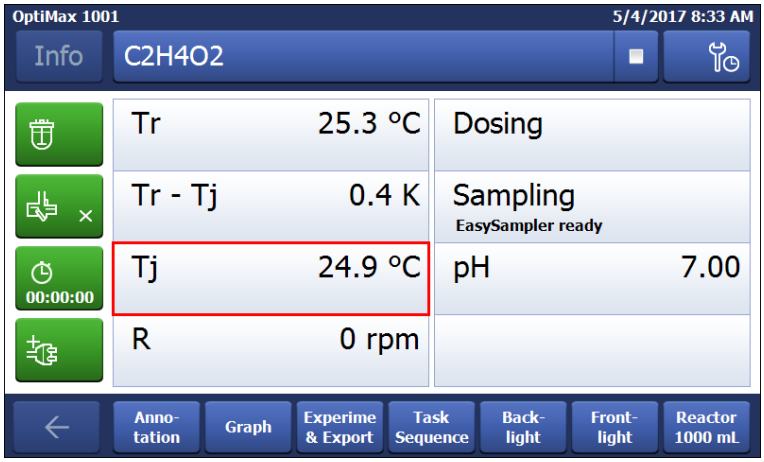
2 Enter the end temperature for **Tj**.

3 Tap **Start** to initiate the task.

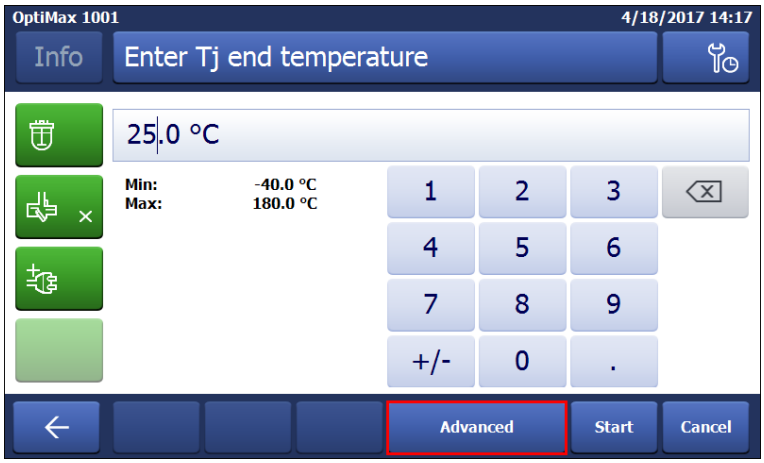
⇨ The task will start immediately.

5.3.2 Create a Tj Ramp

1 Tap the **Tj** value field on the main screen.



2 Tap **Advanced** to enter the ramp settings.



3 Enter the end temperature for **Tj**.

4 You can chose between **Duration** or **Rate**.

5 Tap **Start** to initiate the task.

⇨ The Tj ramp will start immediately.

Using the task sequence, you can also have your ramp starting at a certain point in the reaction.

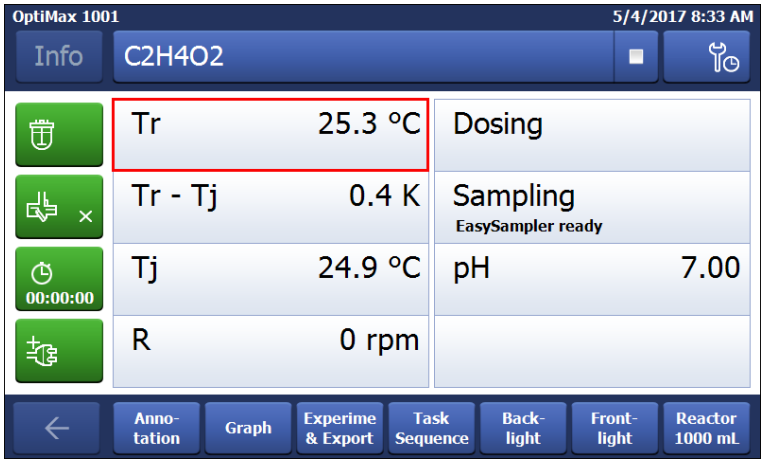
Parameter	Description	Values
Tj ramp	Defines heating or cooling the reactor jacket over a certain duration or by rate.	-
Duration	Defines the end temperature at the end of the timespan you have entered.	-
Rate	Defines the end temperature is reached through the centigrade per minute you have defined.	-

5.3.3 Change Tr

Note The value cannot be higher than the safety limit value.

- A Tr sensor is connected to the thermostat.

1 Tap the **Tr** value field on the main screen.



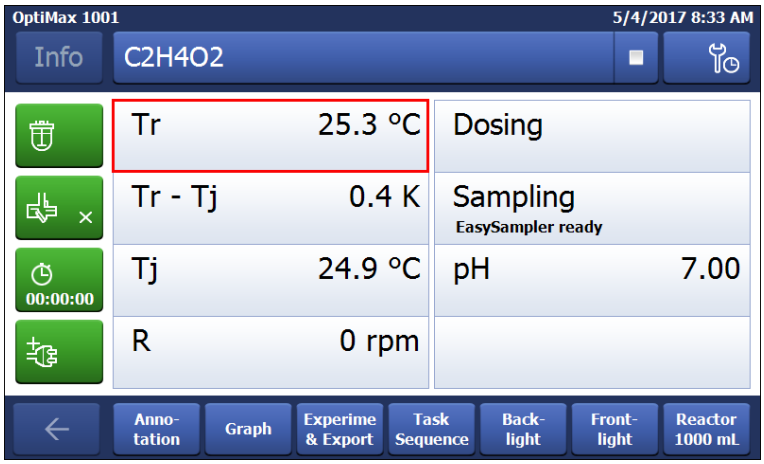
2 Enter the end temperature for Tr.

3 Tap **Start** to initiate the task.

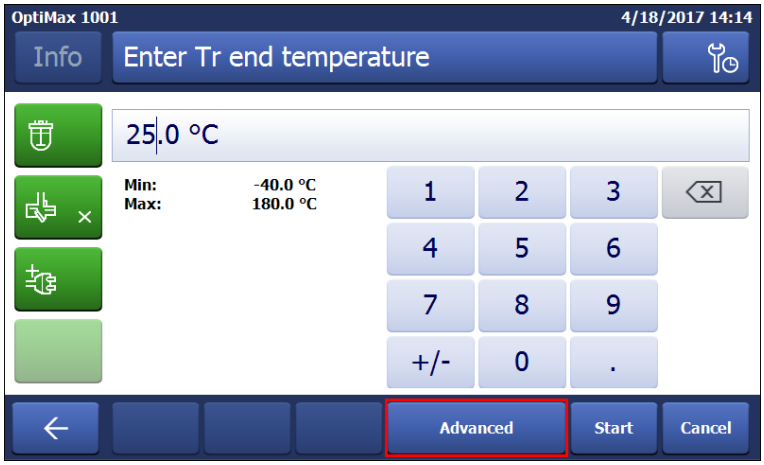
5.3.4 Create a Tr Ramp

- A Tr sensor is available.

1 Tap the **Tr** value field on the main screen.



2 Tap **Advanced** to enter the ramp settings.



3 Enter the end temperature for Tr.

4 You can chose between **Duration** or **Rate**.

5 Tap **Start** to initiate the task.

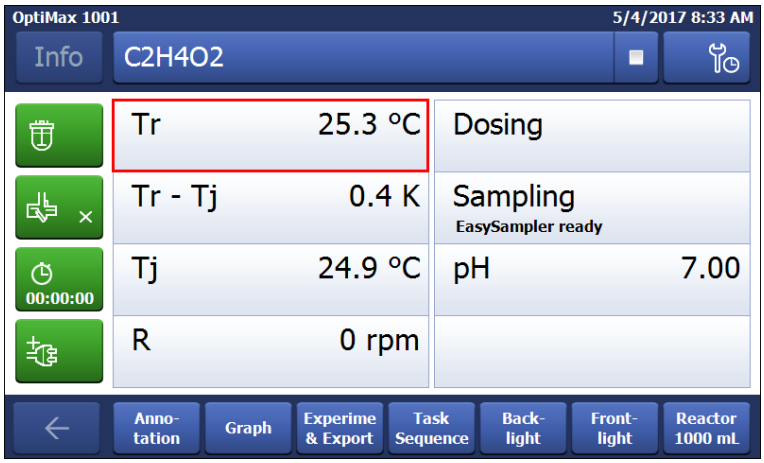
⇨ The Tr ramp will start immediately.

Parameter	Description	Values
Tr ramp	Defines heating or cooling the reactor jacket over a certain duration or by rate.	-
Duration	Duration means your end temperature is reached at the end of the timespan you have entered.	-
Rate	Defines the end temperature is reached through the Centigrade per minute you have defined.	-

5.3.5 Disable Tr

The Tr sensor can be disabled. Disabling the Tr sensor will also disable the Reflux / Distillation mode.

1 Tap the **Tr** value field on the main screen.



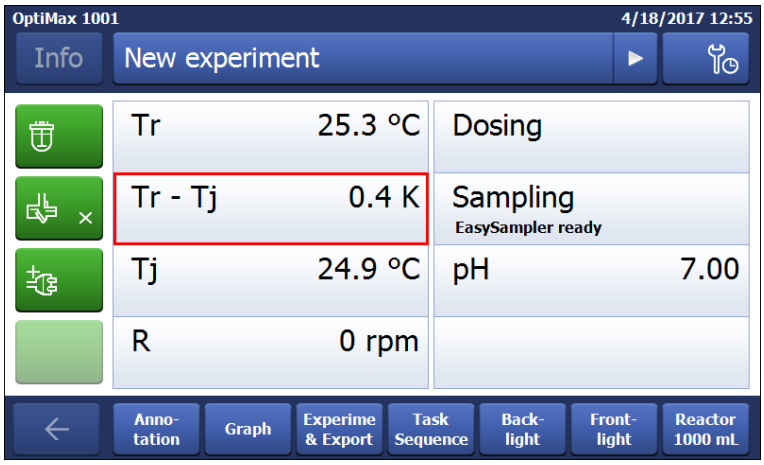
2 Tap **Disable Tr**.

⇨ The Tr sensor is now disabled and will no longer show values.

5.3.6 Create a Reflux / Distillation Mode

- Tr sensor has to be connected and enabled.

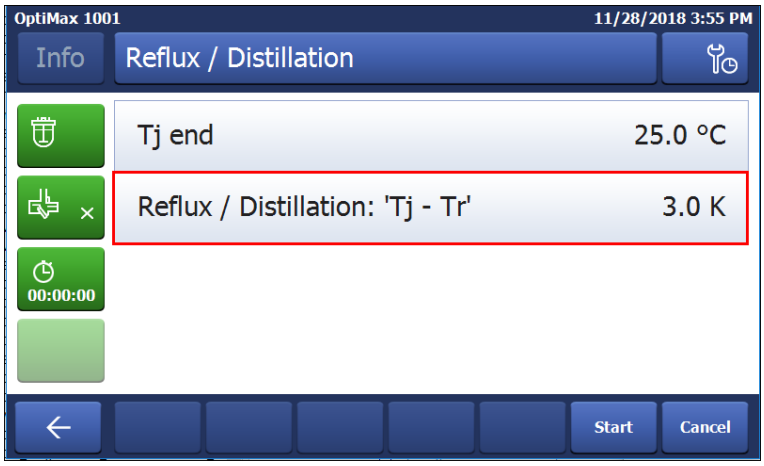
1 Tap the Tr-Tj field.



2 Enter a Tj end temperature.

3 Tap **Ok**.

4 Tap **Reflux / Distillation** and enter a Tj-Tr value appropriate for your reaction.



5 Tap **Ok**.

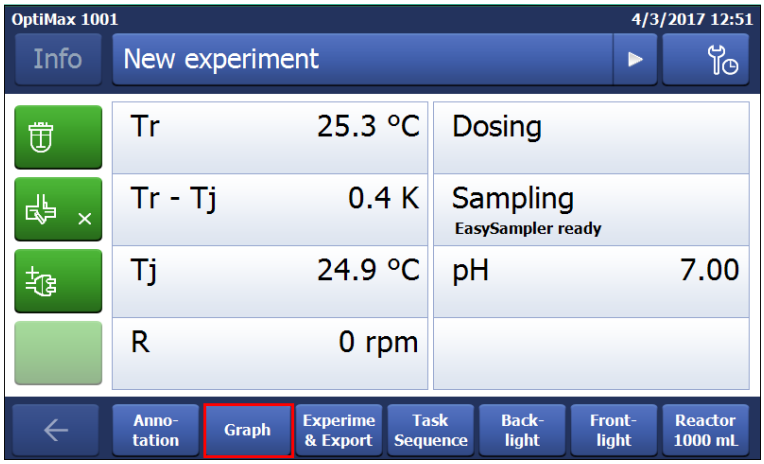
6 When all parameters are entered correctly tap **Start**.

⇨ The action will start immediately.

5.4 Trend Graph

5.4.1 Enter Trend Graph Screen

– Tap on the Graph button.



⇨ The trend graph viewer is displayed.

5.4.2 Select Trend Graph

You can display four trend graphs in the trend graph viewer.

1 Tap on one of the Parameters in the upper part of the trend graph viewer.

2 Tap on **Shown trend** to change the displayed trend.

3 Select the trend you want to display.

4 Tap **Apply** to display the trend graph.

5.4.3 Navigation in Trend Graphs

In the graph you can navigate in two ways:

- Going left or right on the time axis
- Zooming

Navigation on time axis

– Use the arrows to navigate on the time axis.

Zooming

1 Touch the screen with your finger and move it diagonally on the area you want to zoom on the graph.

2 To end the zoom tap **No zoom** to return to the normal view.

5.4.4 Add Annotations in Trend Graph View

1 Enter the trend graph view.

2 Tap on **Note**.

3 Enter your note.

4 Tap **OK**.

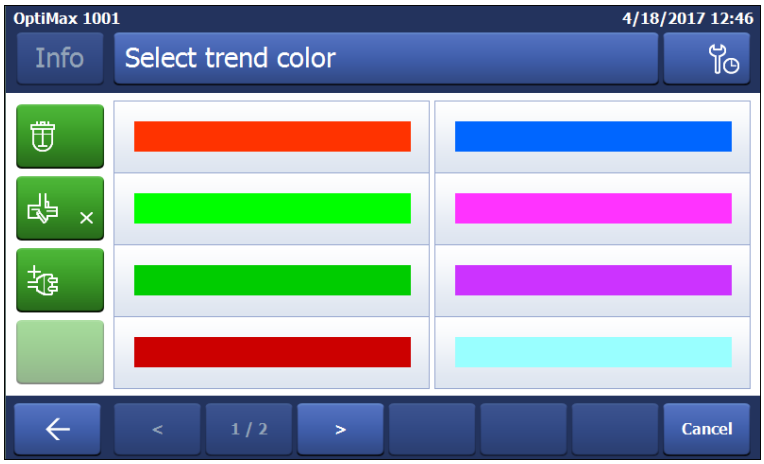
⇨ Notes are shown on the trend graph as red triangles.

5.4.5 Change Color of Trend Graphs

1 Tap on the trend graph that you want to change.

2 Tap on **Color**.

3 Select the new color of the trend graph.



4 Tap on **Apply**.

5.4.6 Take Snapshot

The snapshot is taken from the whole trend graph area, if you want to have a specific part of the experiment as a snapshot you can use the zoom function.

– Tap on **Take Snapshot**.

5.4.7 Export Snaphot

- An empty USB stick is inserted.

1 Tap on Export Snapshot.

2 Select the Snapshot you want to export from the list.

⇨ The Snapshot is stored on the USB stick.

5.4.8 Experiment Time and Time of Day

You can choose between two time displays:

- Time of Day
- Relative time

– You can toggle between the two time displays by tapping the button on the left bottom of the screen.

5.5 Task Sequence

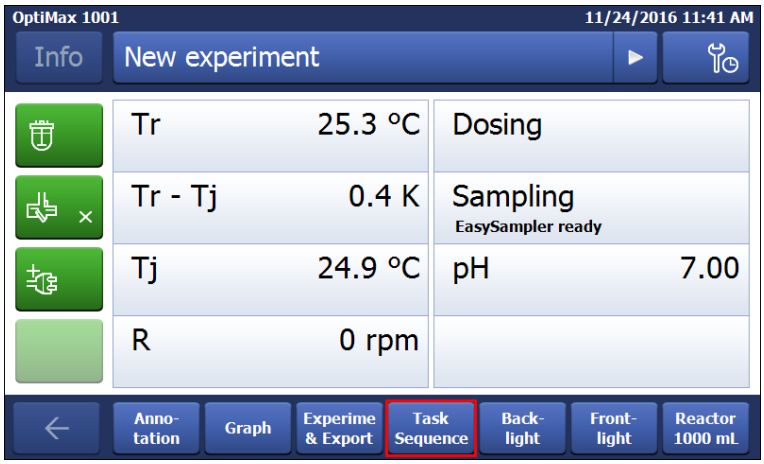
5.5.1 Preparing a Task Sequence

It is possible to preprogram a task sequence with up to 6 steps.

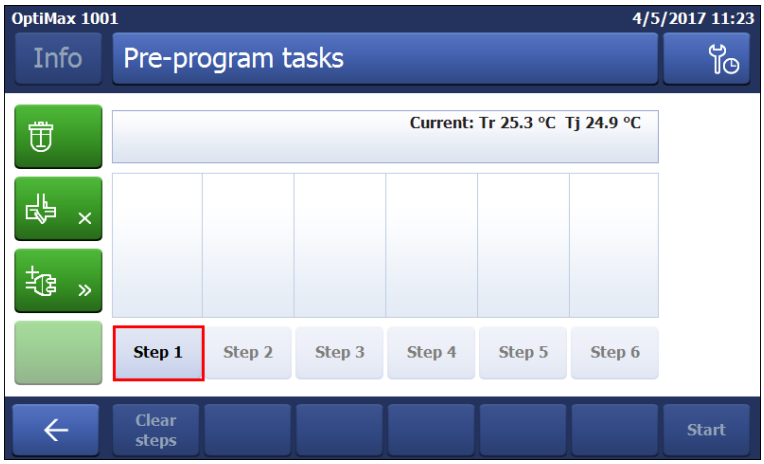
The following parameters can be used:

- Tr (only if connected)
- Tj
- Tr - Tj
- R
- Wait
- Dosing with a DU SP-50 (only if connected)
- Dosing via an ECB (only if connected)

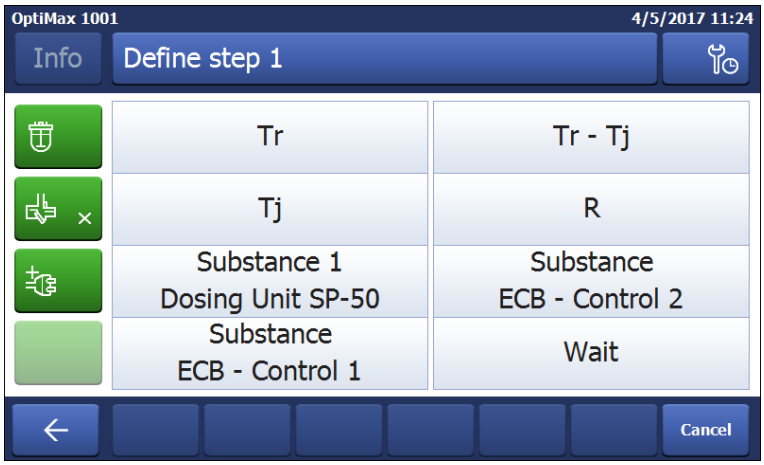
1 Tap on button **Task Sequence**.



2 Tap on button **Step** 1.



3 Choose an action from the list of parameters.

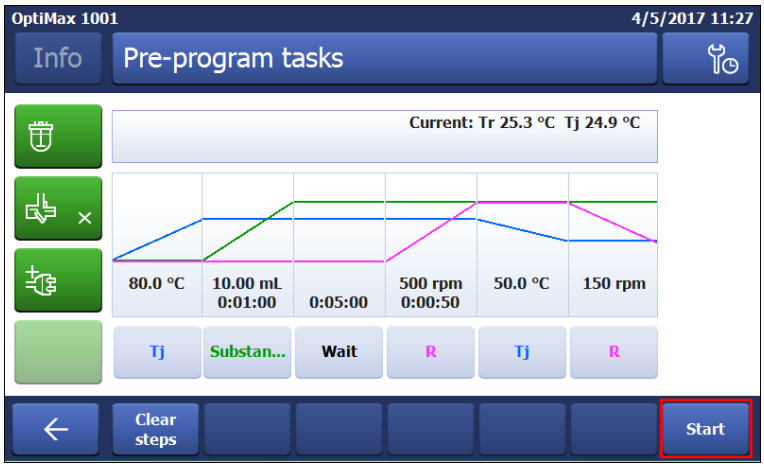


4 Enter desired values for the parameter.

5 Tap **OK.**

6 Repeat as often as needed or up to 5 times.

7 Tap **Start** to initialize your task sequence.

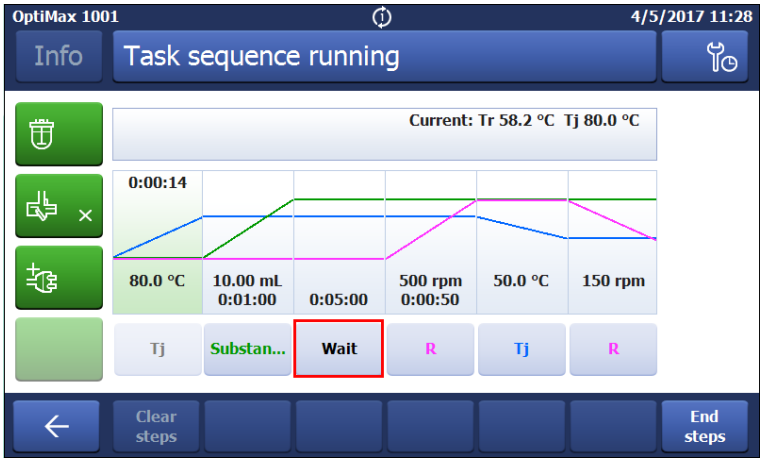


⇨ The **Task Sequence** will start immediately.

5.5.2 Edit Steps in a Task Sequence

You can edit a step as long as it has not run yet or is not active.

1 Tap on the step you want to change.



2 Select the correction task from the list.

3 Enter the correct parameters for your experiment.

4 Tap on **OK**.

⇨ The edited step is shown in the **Task sequence**.

5.5.3 End a Task Sequence

- The task sequence is running.

– Tap in the Task Sequence window on the **End Steps** button.

⇨ The sequence will stop immediately.

– You can reactivate the steps by pressing start or delete all steps by pressing clear steps.

5.6 Settings

5.6.1 Change Network Settings

This function may be needed if you want to connect the instrument to the software.

The "Dynamic Host Configuration Protocol" allows to automatically integrate a device into an existing network without manual configuration. When the system is started, it obtains the IP address and the subnet mask from the DHCP server.

If a DHCP server is not available, the IP address and the subnet must be manually entered.

Note Instruct the person responsible for IT to make the following settings.

1 Tap .

2 Tap on **System Settings**.

3 Tap on **Network settings**.

4 Select IP-Address to enter the IP-address manually. In case DHCP is enabled, a warning screen reminds you to disable it.

5 Enter the IP-Address and confirm it with **OK**.

6 Select Subnet Mask and enter the subnet mask.

7 Confirm your entry with **OK**.

5.6.2 Change Time Settings

You can change different parameters:

- Date and time
- Time zone
- Date format
- Time format

NOTICE

Changing time settings

Changing the Time zone or Date and Time can lead to loss of experiment data. A warning on the touchscreen will appear.

– Make sure you have exported your experiment data.

1 Tap .

2 Tap on **System settings**.

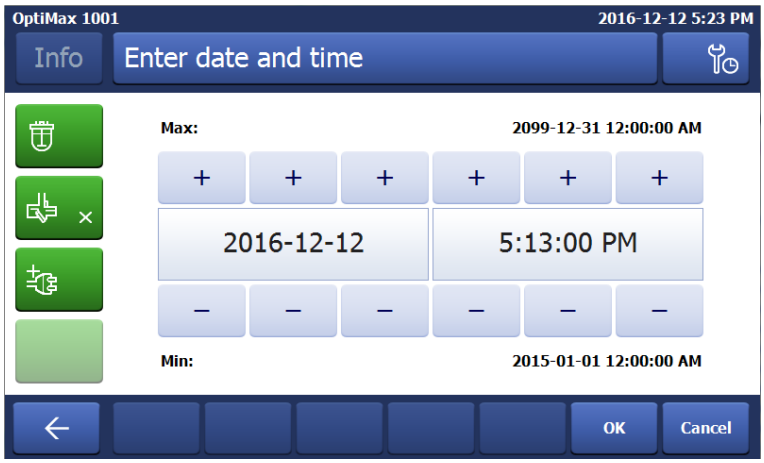
3 Tap **Time settings**.

4 Select the time setting you want to change.

5.6.2.1 Change Date and Time

1 Tap on **Date and time**.

2 You can change the values by tapping on the plus and minus buttons.



3 Tap **OK**.

NOTICE

Changing time settings

Changing the Time zone or Date and Time can lead to loss of experiment data. A warning on the touchscreen will appear.

– Make sure you have exported your experiment data.

4 Tap **Apply** if you have saved your data.

5.6.2.2 Change Time Zone

1 Tap on **Time zone**.

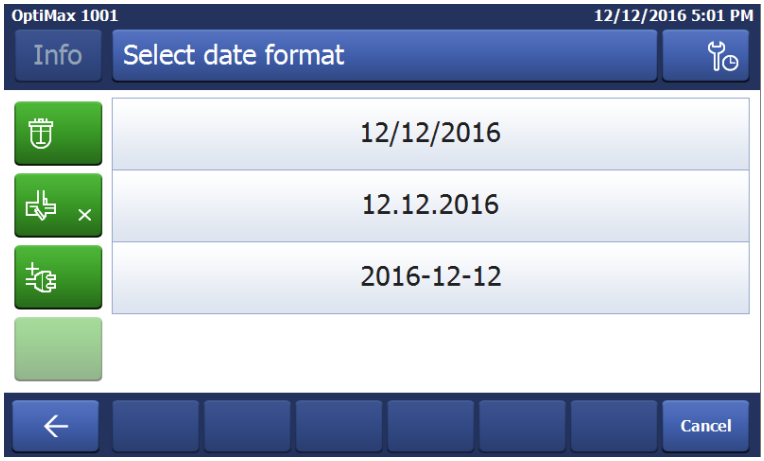
2 Select the time zone you are in. You can go through the pages by tapping the arrow button.

3 Tap **Apply**.

5.6.2.3 Change Date format

1 Tap on Date format.

2 Choose one of the formats.



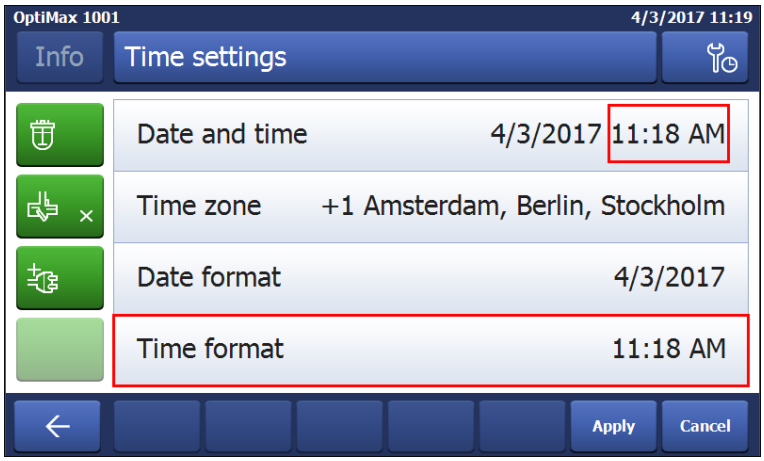
3 Tap **Apply**.

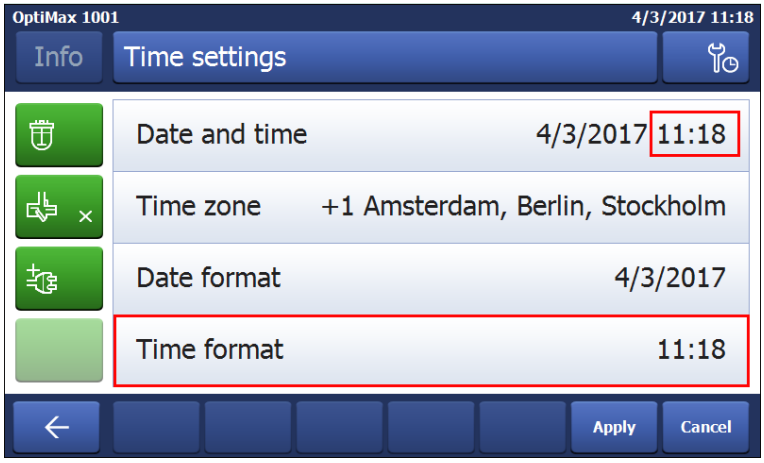
⇨ The date format is changed. This change has no influence on the data storage.

5.6.2.4 Change Time Format

1 Tap on **Time format** to toggle between the English version with AM/PM or the standard version with just the numbers.

2 If you change the Time format, the display of Date and Time will be updated accordingly.





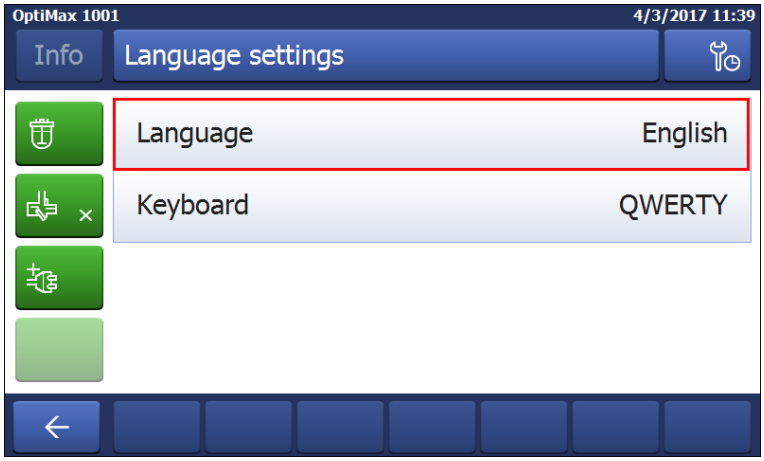
5.6.3 Change Language

1 Tap .

2 Tap on **System settings**.

3 Tap **Language settings**.

4 Tap **Language**.

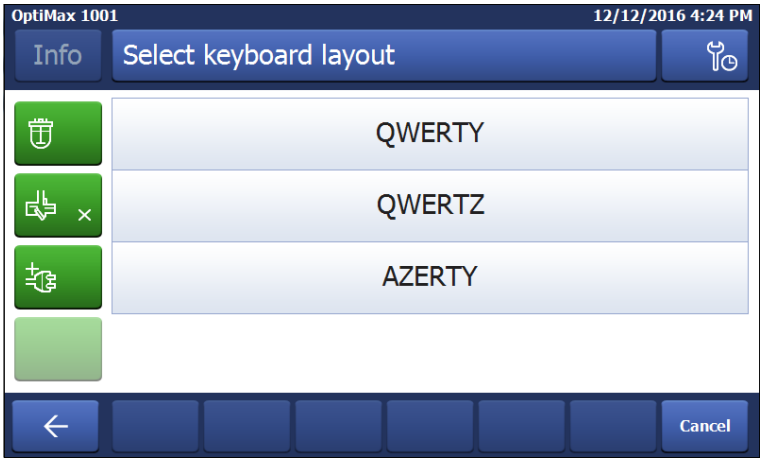


5 Select the desired language. The following languages are available:

- English
- German
- Spanish
- French
- Japanese
- Chinese

5.6.4 Change Keyboard Layout

1 Tap .
2 Tap on **System settings**.
3 Tap **Language settings**.
4 Tap on **Keyboard**.
5 Choose one of the three layouts.



⇨ The setting is automatically applied.

5.6.5 System Information

1 Tap .
2 Tap on **System settings**.
3 Tap **System Information**.
4 The following information are displayed:

- Firmware version
- Serial number
- Machine ID

5.6.5.1 Export Logfiles

Exporting log files can be necessary if a problem with the device occurs. This helps our support to evaluate the problem.

- An USB stick is inserted in the device.

1 Tap .
2 Tap on **System settings**.
3 Tap **System Information**.
4 Tap the button **Export log files**.

6 Maintenance

Maintenance tasks have to be performed in accordance with the instructions given in this chapter. After performing any maintenance tasks it should be ensured that the device still fulfills all safety requirements.

6.1 Update Firmware

The latest firmware versions and instructions for installation are available on the following website:
https://community.autochem.mt.com/?q=software

6.2 Checking the Reactor

To check the reactor vessel for possible damage (scratches and cracks), it must be empty, clean, dry and open. Small hairline cracks can be detected by refraction using an additional light source (focused, not dispersed light).

6.3 Cleaning the Instrument

⚠ CAUTION

Hot instrument parts

Touching hot parts of the instrument can result in burnings.

– Do not clean the instrument before all parts have reached room temperature.

NOTICE

Damage to the device due to incompatible cleaning agents

Inappropriate cleaning agents could damage the housing of the device.

1 Use the described cleaning agent.

2 Should you use other cleaning agents, ensure that they are compatible with the housing material.

The housing of the instrument is not watertight (i.e. splash proof). We therefore recommend that you clean it with a damp cloth using ethanol.

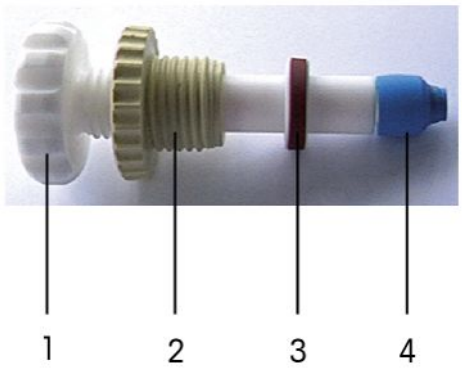
If you have questions about the compatibility of cleaning agents, contact your authorized METTLER TOLEDO dealer or service representative.

6.4 Replacing the valve plug of the bottom drain valve

The 2-piece reactors are supplied with a bottom drain valve with a valve plug made of LUBRIFLON 904.

The valve plug needs to be replaced if:

- It becomes black and hard (high temperatures).
- It has been attacked by chemicals (swollen).



- The reactor has to be empty.

1 Loosen the spindle (1) of the drain valve, unscrew the pressure screw (2) and pull the valve out of the valve guide.

2 Using a sharp knife, make two or three vertical cuts in the valve plug (4), turn it slightly and pull it away from the glass spindle.

3 Warm the new plug in hot water and push it over the glass spindle. A groove in the glass spindle helps to keep the plug in place.

6.5 Disassembling bottom drain valve for cleaning

The bottom drain valve is delivered already assembled.

The spindle has a strong spring integrated, which compensates expansion and contraction of the reactor materials caused by variations in temperature. At the same time it ensures a proper sealing of the drain. To retain the function of this spring and to avoid breaking of the reactor glass always close the bottom drain valve hand-tight and afterwards reopen it slightly (quarter to half a turn).

In case the valve cannot be disassembled easily due to contamination from the outside, try to rinse it from the outside with a suitable solvent. Never use force while trying to disassemble the valve!

To disassemble the valve for cleaning proceed as follows:

1 Unscrew the spindle (6) and pull it slightly back.

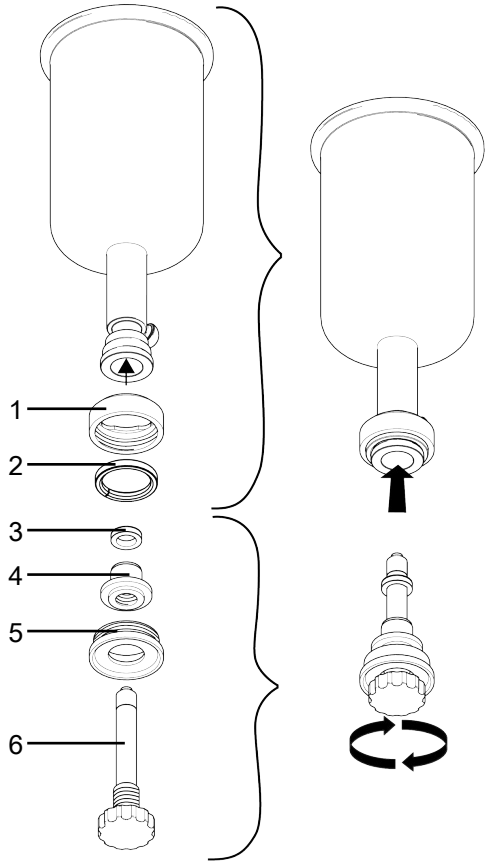
2 Loosen the pressure screw (5) slightly and remove the spindle (6) from the valve.

3 Loosen the pressure screw completely and put it aside.

4 Remove the pressure piece (4) and the sealing ring (3).

5 Remove the insert ring (2) and take away the connecting nut (1).

The reassembly of the bottom drain valve can be learned from the following picture:



1 Slide the pressure screw (5) over the spindle (6).

2 Slide the pressure piece (4) over the spindle (6).

3 Slide the sealing ring (3) over the spindle (6).

4 Slide the connecting nut (1) over the valve joint of the reactor and fix it with the insert ring (2). (Make sure the insert ring is inserted properly!)

5 Insert the pre-mounted spindle (6) into the reactor and screw the pressure screw (5) into the connecting nut (hand-tight).

6 Screw the spindle into the pressure piece (4).

6.6 Exchange PTFE seal in the stirrer adapter

The expected life of the PTFE cord is at minimum 2500 hours of use, replacements can be purchased (Order No. 103547) or it will be replaced during Preventive Maintenance.

1 Disassemble the stirrer shaft from the stirrer motor.

2 Screw off the pressure screw and take out the old PTFE cord.

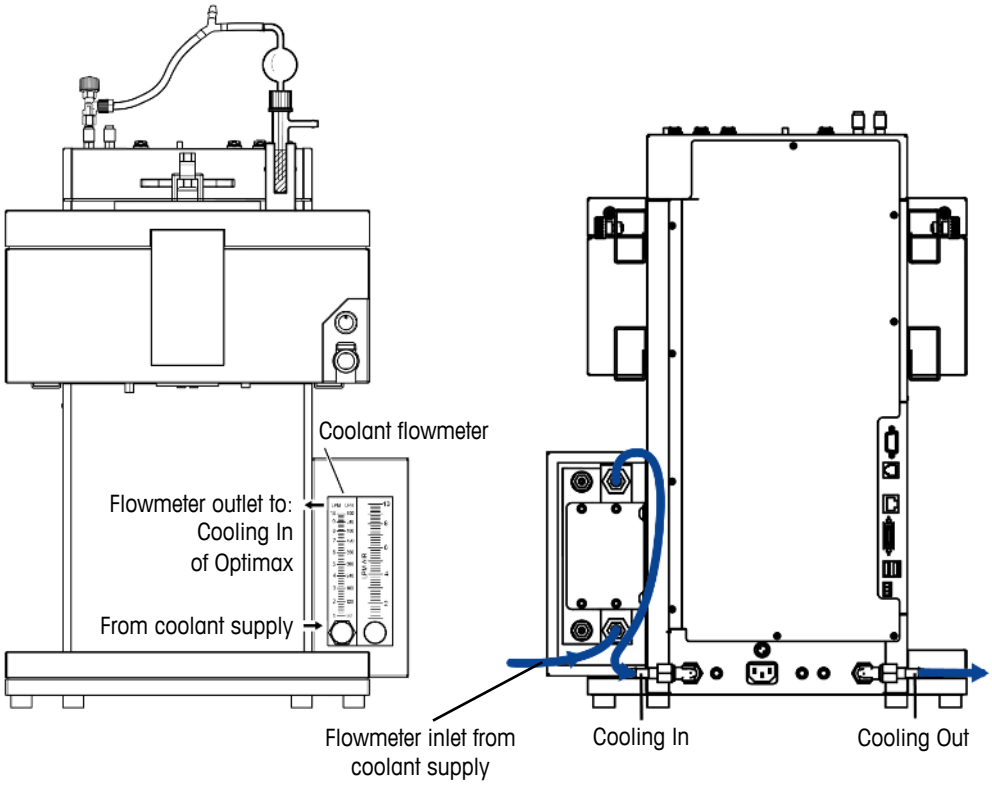
3 Place the new PTFE cord into the adapter.

4 Screw on the pressure screw.

5 Reassemble the stirrer.

6.7 Changing coolant

If you change the coolant, you must rinse and dry the tubing in the instrument before you use the new coolant.



1 Stop the flow from the coolant supply.

2 Remove the connection tube first at the **Cooling In** inlet, and then at the **Cooling Out** outlet.

3 Rinse and dry the tubing in the reverse direction (from the **Cooling Out** outlet).

4 Reconnect the connection tubing to the new coolant supply.

5 Make sure that your system is tight.

6.8 Disposal

In conformance with the European Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE) this device may not be disposed of in domestic waste. This also applies to countries outside the EU, per their specific requirements.

Please dispose of this product in accordance with local regulations at the collecting point specified for electrical and electronic equipment. If you have any questions, please contact the responsible authority or the distributor from which you purchased this device. Should this device be passed on to other parties, the content of this regulation must also be related.

7 Troubleshooting

Error messages appearing on the touchscreen should offer you a possible counteraction. If this is not the case, please contact the METTLER TOLEDO Service.

Instrument inoperative	If the instrument does not start when you switch it on: – Check the power supply before calling the METTLER TOLEDO Service.
No display on touchscreen	– Make sure the touchscreen cable is connected to the instrument before calling the METTLER TOLEDO Service.
Cooling below Tc not possible	– Call the METTLER TOLEDO Service.
Wrong Tr measurement value	1 Check the immersion depth: The Tr sensor must be immersed in the reaction mass to a depth of at least 1.5 cm for glass sensors or 2.5 cm for sensors made of HC-22! 2 Check the value with a reference thermometer. ⇨ If its values are correct, the sensor is defective
Window of the thermostat fogged	1 Make sure the thermostat is purged or increase the purge rate 2 For one-piece reactors: use the plug to close the bottom drain hole in the thermostat
Heating inoperative	If the heater is inoperative: – Call the METTLER TOLEDO Service.
Stirrer adapter stuck on reactor	1 Turn the adapter loosening device counter-clockwise until it pushes slightly against the ground joint. 2 Carefully turn it further and the stirrer adapter will come loose.
Stirrer inoperative	If the stirrer does not operate after switching on the instrument: 1 Make sure the stirrer isn't blocked. 2 Call the METTLER TOLEDO Service.

8 Accessories

Temperature sensors

Tr sensor, Alloy C-22, 6.35x300 mm — 51162839

Tr sensor glass, 6x300 mm — 51162827

Wear parts

Sealing ring, PTFE
(Set of 5) — 103547

Bottom Drain Connect Set — 51162730

Tip, light blue (Lubriflon 904 = filled PTFE) — 51190515

Spindle bottom drain valve (with tip), PTFE — 51191774

Sealing ring bottom valve, PTFE/Silicone, Torion 14 — 71540

Calorimetry

Upgrade Kit OptiMax HFCal: — 30050150

- Module HFCal
- Calibration heater, Alloy C-22
- Adapter ST19/23 with sealing ring, PTFE
- CAN cable, 100 cm

	Calibration heater, Alloy C-22, 8x300 mm	30050155
	Module HFCal	30050151

Dosing and Sampling

	ECB	30212440
	Dosing unit SP-50	51161770
	EasySampler	30083901

9 Technical Data

Certifications regarding the product can be found under: https://www.mt.com/us/en/home/search/compliance.html/

The model number is identical to the product name of your device.

Power supply

AC power adapter rating	Line voltage	100...240 VAC
	Input frequency	50/60 Hz
	Mains supply voltage fluctuations	Up to ± 10 % of the nominal voltage
Instrument rating	Power consumption	Max. 1290 W

Connections

All electrical connections	Not limited energy
USB	Support of USB 2.0
Electrical connectors	RS232, USB, CAN, Ethernet, Safety Relay and touchscreen
Safety Relay	30 VDC / 1 A

Ambient Conditions

Humidity	Max. relative humidity 80 % for temperatures up to 31 °C decreasing linearly to 50 % relative humidity at 40 °C
Altitude	Up to 2000 m
Overvoltage category	II
Pollution degree	2
Ambient temperature	5 °C...40 °C
Usage	For indoor use only

Materials

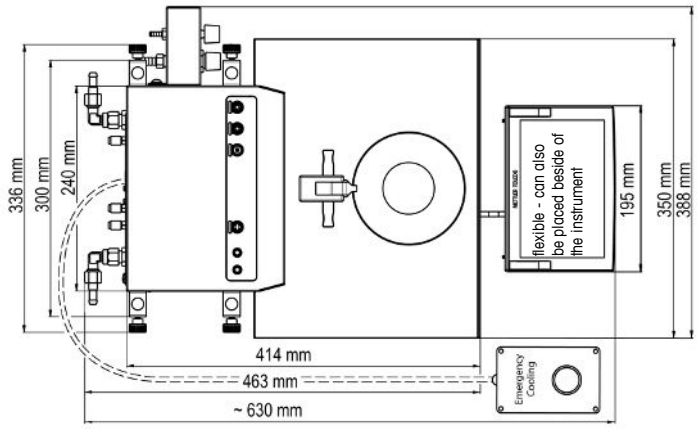
Cover plate	Stainless steel coated with PFA/FEP
Housing material	powder-coated stainless steel
Connectors for purge gas	stainless steel, nickel-plated brass
Purge gas lines	PVC, FEP, PP, PVDF, PTFE, aluminium, nickel-plated brass
Coolant tubing	PVC, PVDF, copper
Cooling connector	Nickel-plated brass
Flowmeters	Stainless steel, acrylic, HDPE
Holder for lab bars	Aluminium
LEMO connectors for Tr sensor and overhead stirrer	Chrome-plated brass with protection cap in POM
Reactor window	Borosilicate glass 3.3
Receptacles for reactors	Anodized aluminum
Fixing rings of thermostats	PTFE C25
Anti twist protection	PEEK HPV and aluminium
USB connector	Stainless steel with protection cap in POM
On/Off switch	Stainless steel
Stirrershaft, -blade	Borosilicate glass 3.3 or Hastelloy® C-22, PTFE
Overhead stirrer	PTFE, PEEK, aluminum, steel
Tr sensor	Borosilicate glass or Hastelloy® C-22
Glass reactors	Borosilicate glass 3.3

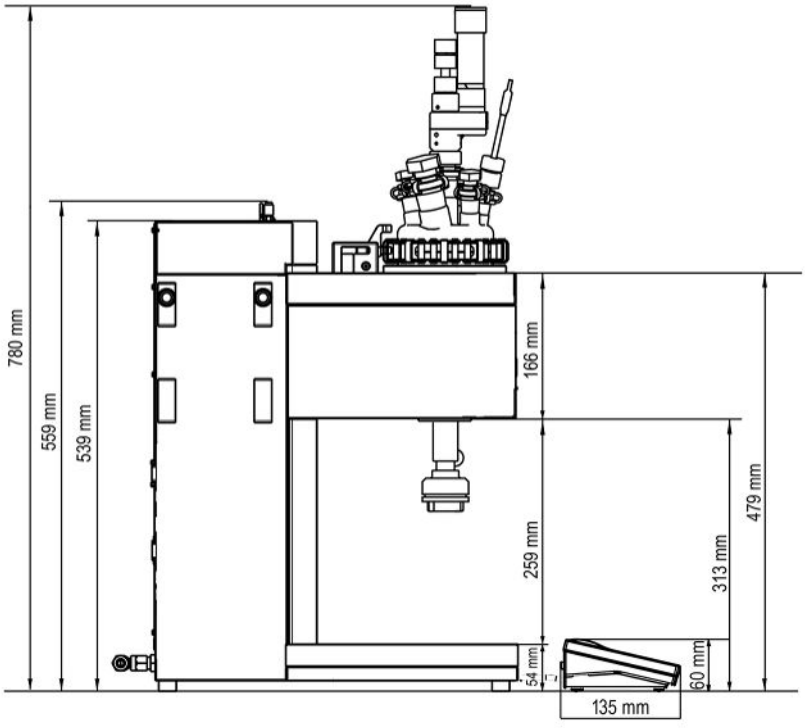
Touchscreen	PA 12, aluminum
Protective cover for Touchscreen	Barex®

Device

Weight incl. touchscreen	35 kg

Dimensions





9.1 Thermostat

Temperatures

Range	Tj: -40 °C to 180 °C* Tr: -40 °C to 180 °C* Tc: -40 °C to 60 °C * The temperature range of Tr / Tj is depending on the temperature of the coolant and the cooling power of the used external cooling system.
Resolution	Tj: 0.1 K Tr: 0.1 K
Maximum permissible errors	1.0 °C for the whole range
Measured value acquisition	Every 2 seconds

9.2 Stirrer

Operating mode	Control to constant value or ramp
Speed range	30…1200 rpm
Torsional moment	Max 153 mNm (for continuous operation)
Lifespan	1000…3000 hours of continuous operation

9.3 Purge gas

Purge gas housing (Purge Internal)	Max. inlet pressure	0-7 bar
	Min. gas flow	0-3 L/min
Inert gas reactor (Inert in)	Max. inlet pressure	0-7 bar
	Min. gas flow	as needed (controlled with the bubbler)
Stirrer (Purge In)		as inert

9.4 Reactors

	1000 mL reactor	**500 mL reactor**	**250 mL reactor**
Pressure	0.05 bar to ambient pressure		
Nominal volume (2-piece reactors)	1310 mL	830 mL	370 mL
Nominal volume (1-piece reactor	1150 mL	700 mL	400 mL
Working volume (with Tr sensor)	150 - 1000 mL	80 - 500 mL	60 - 250 mL

Min. working volumes for reactors equipped with standard Hastelloy temperature sensor and immersion depth of 1.5 cm:

Reactor type	**Stirrer Blade**	**Min. working volume 1000 mL reactor**	**Min. working volume 500 mL reactor**	**Min. working volume 250 mL**
Two piece	Pitched blade	150 mL	80 mL	60 mL
Two piece	Anchor	320 mL	140 mL	80 mL
One piece	Half-moon	320 mL	120 mL	80 mL

9.5 Cooling

Min. Flow of cooling media	2 L/min (at 15 °C)
Cooling types	Tap water or external cooling

Max. pressure of cooling media	• Without flowmeter: 3.5 bar • With flowmeter: 2 bar

Temperature (Tj)	**Cooling power with tap water**	**Cooling power with external cooling / thermostat**
180 °C	Not necessary	Min. 1000 W at 20 °C
20 °C (room temperature)	Not necessary	Min. 1000 W at 10 °C
- 20 °C	Not necessary	Min. 1000 W at 10 °C
- 30 °C	Not recommended	Min 750 W at 0 °C
- 40 °C	Not possible	Min. 750 W at -10 °C

To protect your product's future:
METTLER TOLEDO Service assures the quality, measuring accuracy and preservation of value of this product for years to come.

Please request full details about our attractive terms of service.

www.mt.com
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