

Sampling Matters

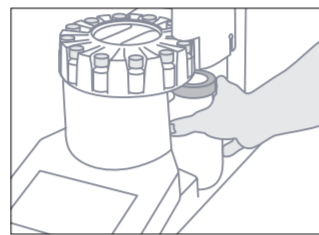
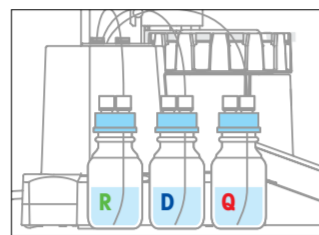
Tips & Tricks for High Quality Samples

Good Instrument Preparation

EasySampler Set-up

For proper set-up follow the instruction in the EasySampler™ 1210 User Manual.

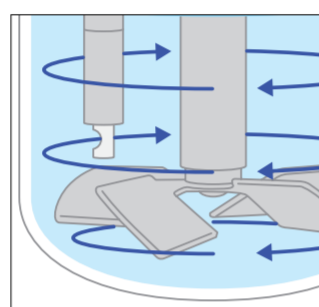
- Place three (3) solvent bottles (min. 180 mL) on the left-hand side of EasySampler.
- Pierce the septum and push the solvent line through the hole into the bottle until the bottom is reached. Loosen the blue cap to prevent vacuum formation.
- Place an empty waste bottle with septum and cap under the needle.



Probe Introduction

Place the probe in the reactor when asked to do so during the prepare step. Confirm that:

- The pocket is facing 180° away from the stirrer (see schematic reactor view, right).
- The probe pocket is not touching the stirrer or the glass wall when moved out.
- Remove the probe from heterogeneous reactions after adjusting the height before pressing "OK" in the prepare step.
- Ensure the sample pocket is fully submerged in the reaction so that it is filled throughout the sampling process.
- Good mixing is essential – stir well to assure that representative samples are taken.

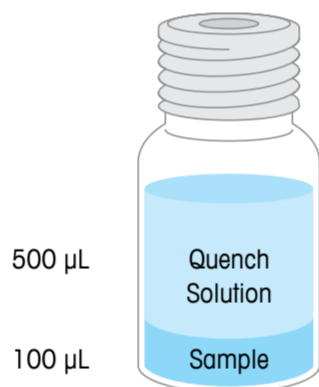


Probe pocket facing 180° away from the stirrer

Choice of Solvents

Quench (Q) and Dilution (D) solvents must dissolve the solids of heterogeneous mixtures. This will ensure high quality samples for accurate analytical results and prevent blockage in the system. For good quench selection:

- Take 100 µL of a sample of reaction mixture and mix it with 500 µL of quench solution in a vial. If the solids are dissolved, the quench solvent is appropriate.
- If a buffer solution is used as one of the solvents (Q or D) to stabilize the pH of the reaction sample, no precipitation must occur when mixed with the other solvents. Mix the buffer 1:1 with each of the Q and D solvents. In case of precipitation, lower the concentration of the buffer to prevent tubing blocking.



Prevent Air in Feeding Lines

Air in feeding lines will lead to the abortion of samples or sequences. Please consider the following points to avoid this problem:

- Check that the solvent bottles are filled with solvent. Ensure that all tubing ends are located at the bottom of each solvent bottle.
- Some solvents or combination of solvents degas over time. It is recommended to always degas (sparge, sonication, filtration) the solvents prior to use with EasySampler.

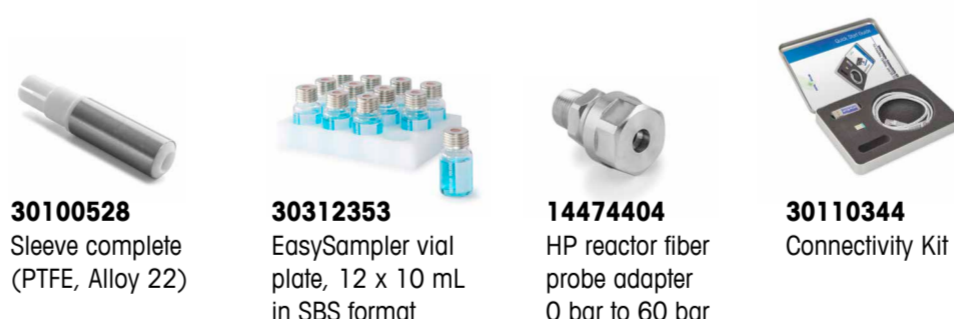
If an "air in feeding line" error appears, check:

- That solvent bottles are filled and the tubing is below solvent level.
- If all fittings are tight.
- If the bubble detector is wet or dirty.
- If solvents are degassing.
- Once the cause has been rectified, run a "clean and prepare" process.

EasySampler Instrumentation



EasySampler Accessories

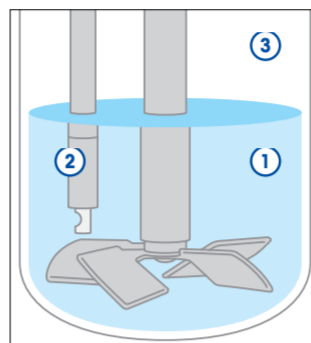


Good Sampling Practice

Pressure Reactions

The following criteria must be fulfilled when using EasySampler in pressure reactions:

- Pressure range: 1.013 bar – 10 bar (14.7 psi – 145 psi)
- Temperature range: 20 °C – 100 °C
- Reactor volume: up to 2500 mL
- Use a new sleeve for each experiment and take maximum 24 samples per sleeve.
- Use pressure adapters as shown below.



Correct placing of the probe in the pressure reactor (see right image):

- Fill the reactor with solvent.
- Fit the EasySampler probe into the reactor at a height that assures that the sleeve is completely immersed.
- Pressurize the reactor and charge the reactor with remaining solvents and reagents.

Air-Sensitive Reactions

When sampling with EasySampler in air-, moisture- or oxygen-sensitive reactions, we recommend to:

- Degas the solvents by sparging them with nitrogen.
- If the initial reactants are air-sensitive, consider introducing the EasySampler probe first in the reactor before purging the reactor with inert gas.
- Consider adding a derivatization agent in the quench solvent in case the end-product is unstable under atmospheric conditions.

Suspensions, Slurries, Multi-Phasic Reactions

Thanks to the unique probe of EasySampler, sampling suspensions and slurries is possible as long as the quench solvent dissolves the particles. To obtain representative samples from heterogeneous reactions, keep the following tips in mind:

- Make sure a dilution factor (DF) higher than 300 is selected
- Verify that the sampling pocket is oriented 180° away from the stirrer
- Stir well to take samples that are representative of your reaction
- If solvents are immiscible, two liquid phases may be found in the vial. Each phase may dissolve different compounds leading to unpredictable results

Example: Long Overnight Reactions

EasySampler can be easily programmed to assure unattended sampling process during long (> 8 h) reactions. Tips for safe sampling process:

- Make sure the bottles are filled with sufficient amounts of degassed solvents
- Program the sampling sequence to enable complete reaction profiling
- In a sequence of more than 12 samples, a rack change is required whenever the vial in position 12 was filled. When such a sequence is started, the time that the rack will need to be changed will be indicated on the touchscreen.

Common Quench and Dilution Solvents

Quench Solvent*	Dilution Solvent
Acetonitrile / H ₂ O	Acetonitrile / H ₂ O
MeOH / H ₂ O	MeOH / H ₂ O
DMSO / MeOH	DMSO / MeOH
THF / H ₂ O	THF / H ₂ O

* Adjust pH of quench according to reaction conditions.

Good Method Creation

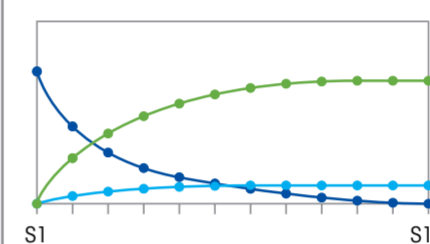
The sampling method depends on different factors such as type of reaction, reagent properties like solubility or concentration and the expected reaction kinetics. The important parameters are dilution factor, sampling times and number of samples.

Proper Dilution Factor

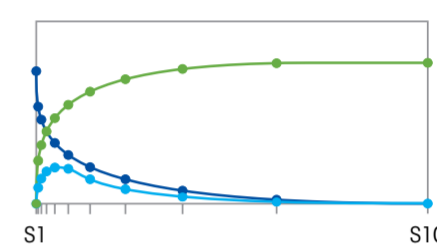
Depending on the concentration of the reaction, users can define a dilution factor in the range of 80 to 450. For heterogeneous reactions, a dilution factor higher than 300 is recommended. The higher dilution factor will ensure that all solids in the sample are dissolved and transferred to the vial for accurate analytical data.

Sampling Times

The sampling interval is typically chosen according to the expected reaction kinetics and the duration of the total reaction time:



A linear sampling sequence is selected if the kinetics is unknown or low order kinetics are expected.



An exponential sampling sequence is selected if the kinetics of higher order is expected.

Tip 1: Take an initial sample at "t₀" before start dosing of the 2nd reactant. This sample will help you to understand whether your initial chemical system was accurate and stable before the reaction starts.

Tip 2: An unscheduled sample can be taken at any time during the sequence as long as there is enough time to complete the sampling process before the next scheduled sample starts.

The minimal sampling interval on the EasySampler depends on the dilution factor, it is between 2 minutes 52 seconds (DF = 80) and 4 minutes 20 seconds (DF = 450). The maximal length of a sequence is 240 hours equal to 10 days.

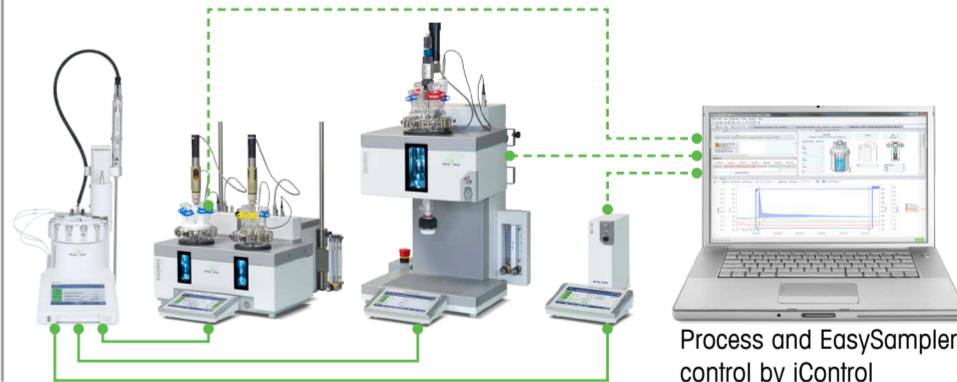
Good Data Handling

Data Management

When using EasySampler stand-alone sampling data can be exported as a CSV file using a USB stick. Many programs such as Microsoft® Excel® are able to handle CSV files.

When using EasySampler with iControl™ software in conjunction with EasyMax™, OptiMax™ or RX-10™ good recipe and data handling is possible:

- Sampling tasks are included in experiment recipe based on time or parameter.
- Recipe including sampling tasks can be saved for later reuse.
- Sampling tasks are displayed in the reaction trend graph.
- "Offline Analytic Data" table provides a list of sampling task data.
- One experiment file with all reactor and sampling data available in iControl.



EasySampler Service



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