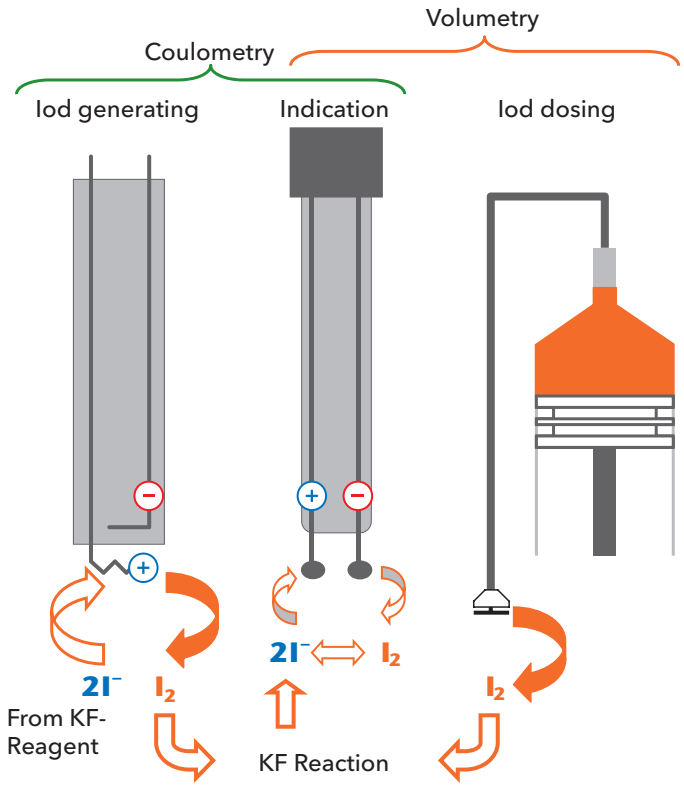
Karl Fischer Titration – the method for determining water

Experienced analyst may be unpleasantly reminded by the pyridine smell, when hearing the name Karl Fischer. However, modern reagents and most user-friendly analyzing instruments have eliminated the problem. Nowadays all applications can be handled and processed very easily by using the **coulometric** and **volumetric** Karl Fischer titration instruments. Thanks to its selectivity and precision, the Karl Fischer titration very easily and accurately established as the most important method for determining water and humidity.

The basic principle of the water determination according to Karl Fischer (short: KF) is a reaction of iodine with water in an alcoholic solution with presence of sulfurous acid and a base.

With the **volumetric** method the iodine can be accurately added through a piston burette or **coulometric** directly produced in the reaction vessel. The difference between the volumetry and coulometry mainly exists in the manner of dosing the iodine for the titration.

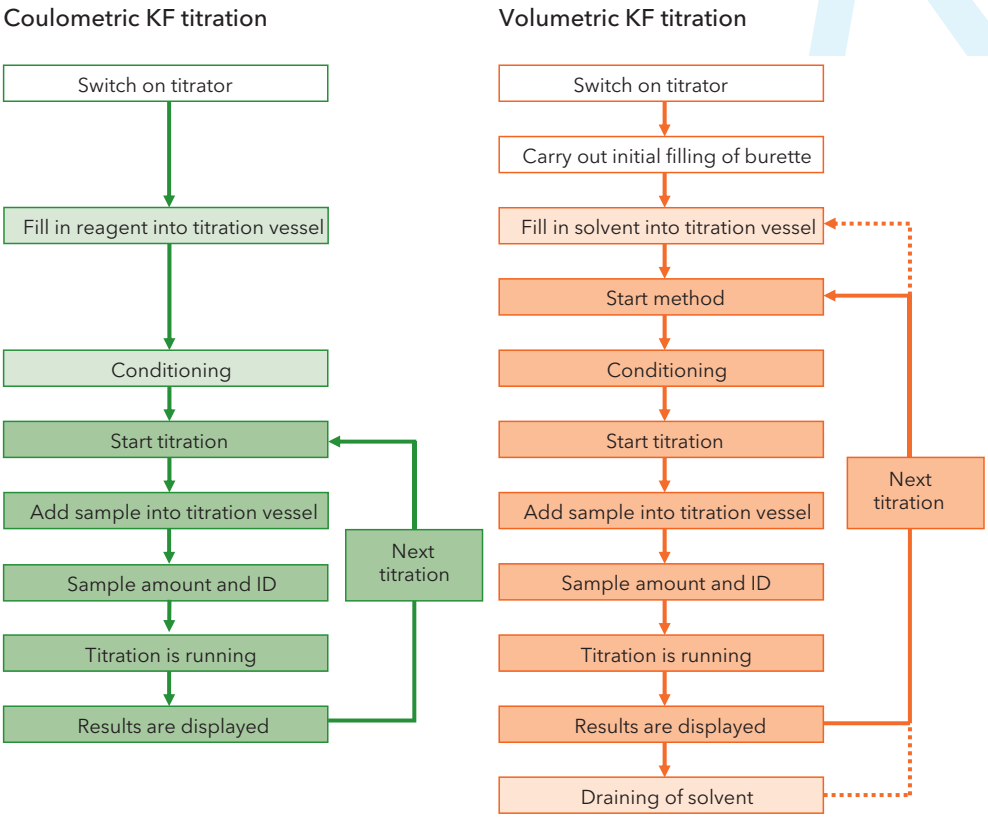
The illustration shows the different types of dosing:



TitroLine® 7500 KF

TitroLine® 7500 KF *trace*

In practice small differences occur between the two methods which are displayed in the table. The advantages of the volumetry lie in the different types of sample addition and solvent variations, offering more flexible operation potentials. Where on the other hand the coulometry can handle lower detection limits and the even simpler handling. The compared work flow with coulometry and volumetry are shown with the following illustration. The clearly shorter and easer sequence is noticable with the coulometry.



Comparison: Coulometric and volumetric Karl-Fischer-titration		
Property	**Coulometry**	**Volumetry**
Water amount and sample amount	Small water amount Small sample amounts	Medium and large water amounts Adapted sample amount
Sample types	Liquid Gaseous (i.e. KF oven) Solid samples with oven	Solid Liquid
Sample addition and preparation	Direct with syringe Gas inlet with oven External extraction Solid samples are evaporated with an oven	Solid samples are added directly Sample preparation with homogenisator Working at higher temperature Direct with syringe
Working method	Very fast Very simple	Fast Simple
Working range	µg range 10 µg up to 5 mg water	mg range 200 µg up to 50 mg water
Trueness	Pretty good for small water amounts > 400 µg Wasser (± 0,5 %)	Pretty good for water amounts > 5 mg water (± 0,5 %, standardization required!)
Reproducibility	Typical RSD of appr. 1 % for water > 400 µg	Typical RSD of appr. 1 % for water > 5 mg

TitroLine® 7500 KF and TitroLine® 7500 KF *trace* –

You can't go wrong with the new TitroLine® KF titrators from SI Analytics

The TitroLine® 7500 KF is the volumetric generalist for a wide range of use and the TitroLine® 7500 KF *trace* is the specialist for low water contents. Both new titrators are to be characterized by following features:

- Fast, easy and precise
- With standard methods for different applications (titer, blank value, 1 or 2 component reagent)
- The addition of solvent and the extraction of the titrated sample are managed by the titration stand TM 235 KF (optional for TitroLine® 7500 KF trace)
- Online display of curve and measurement drift during titration

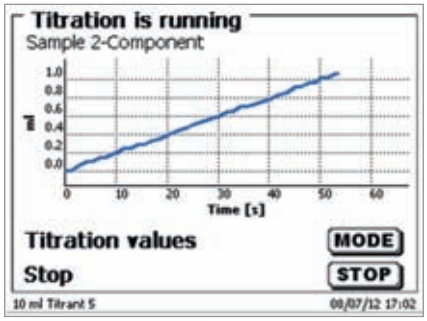
Advantages TitroLine®/TITRONIC®

TitroLine® 7500 KF *trace*

Karl Fischer Titration made easy

Titration curve live

The online display of the measurement curve, measurement drift and titration solvent consumption (TitroLine® 7500 KF only) make accurate monitoring of the titration possible and one can determine any unwanted side reactions immediately.



TitroLine® 7500 KF

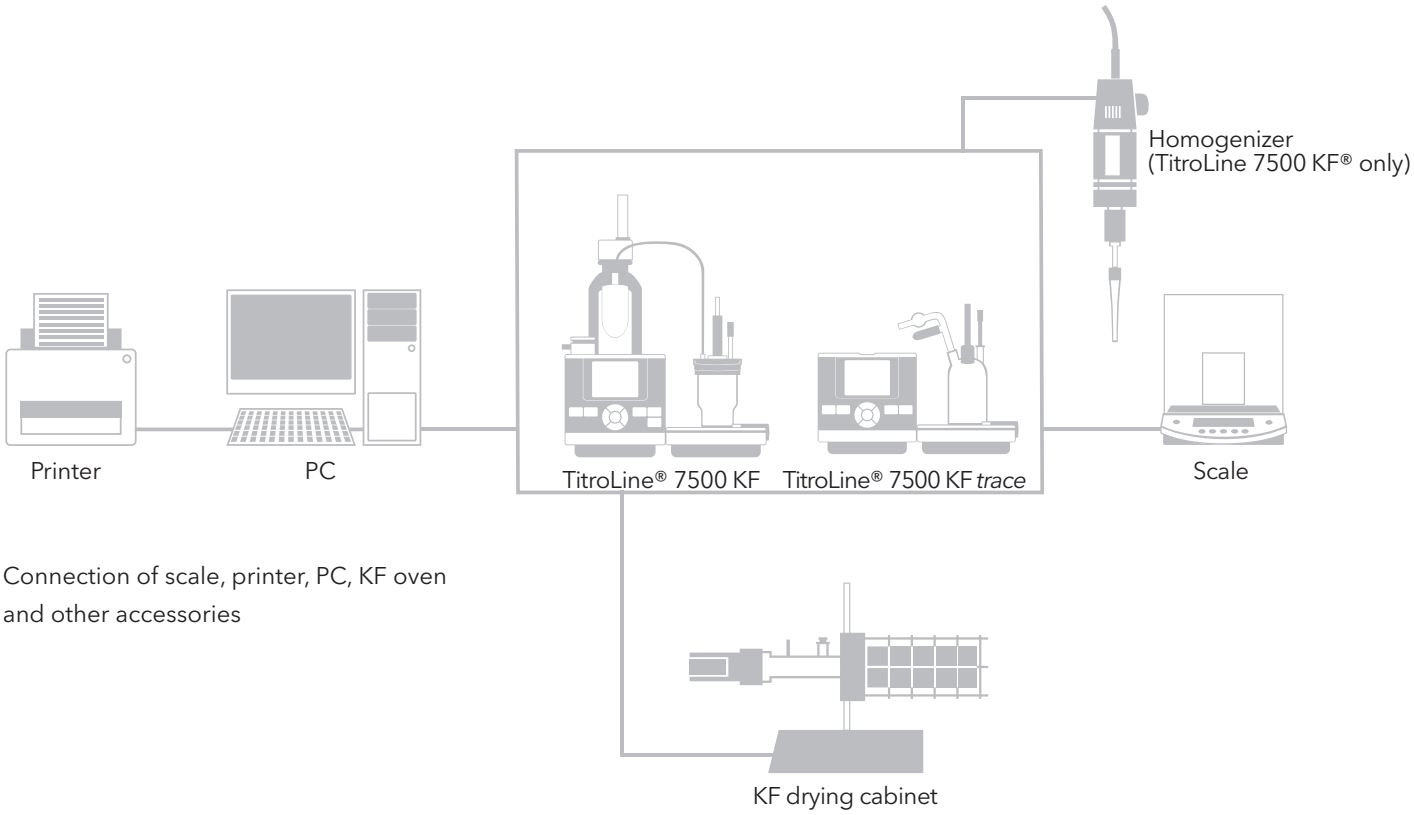
Accessories

Titration stand TM 235 KF

Titrated samples are simply extracted by pressing a button on the KF titration stand TM 235 (standard on TitroLine® 7500 and KF and part of the modules 2 + 4 TitroLine® 7500 KF *trace*). With another push on a button you add fresh solvent or anolyte. A built-in magnetic stirrer ensures a consistent dilution of solution and sample.

The titration vessels are sealed to thus avoid the ingress of moisture (low drift!). The removable glass vessel on the TitroLine® 7500 KF comes in two sizes and is easy to clean. It is also available as thermostatable version.

For the TitroLine® 7500 KF *trace* you have the choice of two different vessels made of solid glass with three and five openings. They have a very low drift.



Connection of scale, printer, PC, KF oven and other accessories

Specifications –TitroLine® 7500 KF and TitroLine® 7500 KF *trace*

Specific Features	TitroLine® 7500 KF	TitroLine® 7500 KF *trace*
Measuring range	10 ppm–100%	1 ppm–5% (10 µg–200 mg)
Accuracy	Dosing accuracy <0.15%	<0.3% at 1 mg water
Applications	KF volumetry, Dead- stop-titrations (SO_2, bromine number …)	KF coulometry, bromine number
Titration stand with integrated pump and magnetic stirrer TM 235 KF	■	Module 2 and 4

You will find more general features on page 146/147