



## Five reasons to choose automation in titrators

For several decades, titration has been used as a core technology to determine unknown concentration of an ion or compound within a sample. For many industries, manual titration remains the method of choice, though some are starting to see the benefits of automatic titration. With manual titration, visual inspection and manual addition of the reagent (also known as titrant) leads to subjective analysis and is entirely dependent on the chemist's or analyst's skillset. Additionally, this also requires the operator to invest time for manual calculations and determining end results of each titration.

Recent competition in the market and the growing need to meet new technology advancements has led to tighter requirements for the quality of standards and reported results. Industry users are looking for faster response times, repeatability, precision, and accuracy, and GLP documentation to be embedded within their standard operating procedures (SOPs).

Automatic titration helps enable manufacturers and industry users to feel confident in their product quality, helping ensure results are independent of subjective bias. It is a leading technology within the scientific community, recognized for generating accurate and reproducible results.

### How does automatic titrator help solve crucial issues?

To gain deeper insights on this issue, let us first review the mechanism of action for titrators.

A solution of a known strength (titrant) is added to a sample (analyte). The addition of the titrant continues until we see an endpoint. Once the endpoint is determined, the chemist can calculate the exact concentration of the analyte present in the sample. Most common titrations that take place are:

- Acid-Base Titration
- Precipitation Titration
- Complex Metric using EDTA - Typical for hardness analysis
- Redox - Typical for dissolved oxygen analysis with Winkler technique

In an acid-base titration, one may observe a color change. In a precipitation titration, the chemist may be looking for a cloudy appearance (halides with silver nitrate). To assess a change in pH an indicator solution such as phenolphthalein or methyl orange is used. The accuracy of such manual titration is entirely dependent on the chemist and is subjective on their perception. Moreover, this color change technique is unusable with colored samples.

## Top five benefits of using automatic titration technology

Automation removes subjective bias.

**1. Use of sensor technology:** An automatic titrator uses electrode technology, known for its accuracy and reproducibility. For instance, a pH electrode can be used for an acid-base titration, a silver electrode can be used for precipitation titration, a calcium electrode can be used for complex metric using EDTA and a redox electrode can be used for ORP titration.

All such electrodes are termed as an indicator electrode whilst being used in titration technology. The main function of indicator electrodes is to observe major changes in millivolt (mV) values during titration. The end results are based on objective data rather than any subjective perceptions of the chemist. This helps ensure that the sensor provides consistent results, avoiding the subjective bias of the end-user.

**2. Accuracy of dispense criteria:** In addition to the sensors in use, another crucial factor for titration accuracy is the consistency of the titrant being dispensed. In automatic titration, highly precise dispenser systems are utilized. The dispenser systems employ a piston driven burette that is controlled by the main unit. Modern automatic titrators dispense very low volumes of titrant, as low as one micro-liter, which is next to impossible if titration is performed in a traditional, manual way. The dispenser can be preset to allow repeated dispensing based on the operator's requirements. Due to the micro-level dispensing volumes, the analysis can be completed in a precise manner, driving significant improvements in the accuracy of results. Moreover, samples can be titrated in a reproducible manner, since the instrument dispenses with preset parameters. The operator can attain accurate results with fewer steps and significantly less room for error.

**3. Reduce chemicals and sample size:** To achieve accurate results, it is recommended to use smaller sample sizes. Automatic dispensers allow for minimal use of titrant with accuracy of one micro-liter, which is highly unlikely in a manual titration technique.

From an environmental standpoint, disposal of chemicals is a critical issue. Regulatory bodies are strict with industries and are constantly pushing industries to limit hazardous disposal. Automation in titration supports this cause due to the limited consumption of titrant. This can lead to reduced waste and expenses, since there is a reduction in the amount of titrant that needs to be purchased.

Note: Reduction in titrant consumption does not compromise the accuracy of the analysis due to the highly precise dosing of the burette.



**4. Time efficient and reduced chemist burden:** Manual titration is extremely cumbersome and time consuming. Chemists are burdened with the task of continuously adding titrant while observing sample changes. The chemist is completely occupied throughout the process, including the manual calculations of the final results.

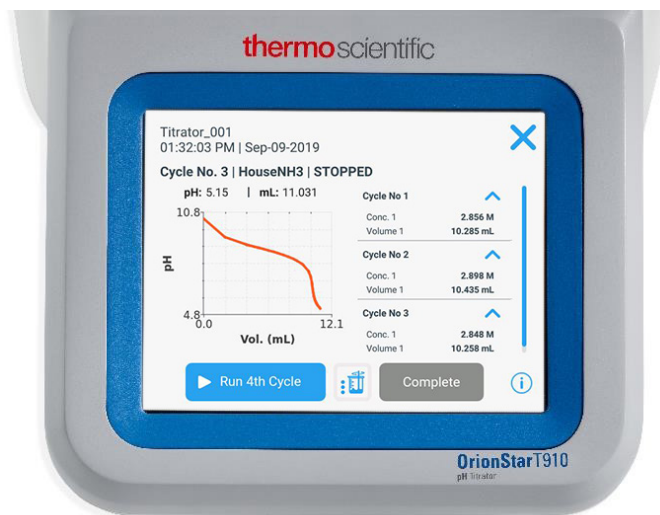
When titration is performed with an automatic titrator, the chemist does not have to be tasked with performing tedious procedures. They simply initiate the titration and can use their valuable time for other productive activities while the instrument completes titration analysis. The instrument stops automatically once the endpoint is achieved and will calculate the results accordingly. Automatic titration is an excellent return on investment for companies, as it improves employee efficiency.

**5. Traceability of results:** With automatic titrator, operators can get multiple data points on a single titration, providing valuable details on every procedural step performed. Multiple data points allow for effective assessment of changes over the duration of a titration. In addition, multiple titrations can be performed to obtain relative standard deviation (RSD) of analysis. This data can be stored in the instrument, on a USB or printed for record keeping.

Automatic titrators help enhance precision, deliver accurate results, improve reproducibility and are an excellent return on investment for companies looking at improving resources efficiency.

### How can we help you meet your goals?

Thermo Scientific™ Orion™ products have helped shape the electrode industry for over 60 years. Blending our electrode technology with our proven titration system and our after-market technical and application support, we can help ensure accurate,



### Ordering information for Thermo Scientific™ Orion Star™ Titrators

Cat. No.	Description
START9100	Orion Star T910 acid-base pH titrator only (order electrode separately)
START9101	Orion Star T910 acid-base pH titrator standard kit with ROSS Ultra glass-body pH electrode and stainless steel ATC temperature probe
START9102	Orion Star T910 acid-base pH titrator difficult sample kit with ROSS Sure-Flow glass-body pH electrode and stainless steel ATC temperature probe
START9200	Orion Star T920 redox titrator only (order electrode separately)
START9201	Orion Star T920 redox titrator kit with glass-body redox electrode
START9300	Orion Star T930 ion titrator only (order electrode separately)
START9301	Orion Star T930 ion titrator salt/chloride kit with silver billet electrode and cable
START9302	Orion Star T930 ion titrator chloride multiple known addition (MKA) kit with chloride ion selective electrode
START9303	Orion Star T930 ion titrator sodium multiple known addition (MKA) kit with ROSS sodium ion selective electrode
START9305	Orion Star T930 ion titrator surfactant kit with surfactant ion selective electrode and double junction reference electrode
START9306	Orion Star T930 ion titrator total hardness kit with calcium ion selective electrode
START9400	Orion Star T940 all-in-one titrator only (order electrode separately)
START9401	Orion Star T940 all-in-one titrator standard pH kit with ROSS Ultra glass-body pH electrode and stainless steel ATC temperature probe
START9402	Orion Star T940 titrator difficult sample pH kit with ROSS Sure-Flow glass-body pH electrode and stainless steel ATC temperature probe

Note: All titrators listed here include 20 mL burette, stirrer probe, dispenser probe, tubing kit, 1 L plastic bottle, GL38 bottle cap with drying tube, computer cable, literature on USB drive, 110-240 V power supply

Learn more at [thermofisher.com/titrator](https://thermofisher.com/titrator)

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