Measuring TA in Wine

Find out all you need to know about measuring Titratable Acidity in wine making

HANNA instruments

Contents

Introduction

Hobbyists and professional winemakers alike know that there are a variety of factors involved in crafting superior, high-quality wines. Taste, mouth feel, color, and aroma are just a few of the characteristics that contribute to a complex and well-balanced wine.

All of these important qualities are, in some way, governed by science. In order to properly evaluate these qualities, it is necessary to understand and accurately quantify the chemical components behind them.

Quantifying wine characteristics is of little use if the data collected does not accurately reflect the wine's character. One way of ensuring quality data collection is through appropriate test method selection, proper sample preparation, and effective analysis. Since wine possesses many unique properties, it is essential to employ methods of analysis that are effective.

This eBook should serve as a guide to understanding the role of acidity in wine and juice as well as highlighting the necessary tools required for accurate acidity measurements.

We cover:

- How Acidity affects wine quality
- The necessary tools
- How to use these tools to get accurate results

1 What is Acid Content?

There are two measurements winemakers that are typically concerned with regarding acid content in wine or juice: pH and acidity. While these two parameters may sound like the same thing, they are actually quite different.

The pH of a wine is a measurement of the activity of free hydrogen ions in solution. A solution with a lower pH indicates a higher concentration of free hydrogen ions and is referred to as “acidic”.

A solution with higher pH has a lower concentration of free hydrogen ions and is called “basic” or “alkaline”. The pH value of wine or juice affects its microbial stability, influences sensory attributes, and determines the effectiveness of sulfur dioxide (SO_2).

Why Acidity Matters

Total acidity is an indication of all hydrogen ions in both fixed organic and volatile acids present in your wine. It quantifies both the hydrogen ions that are free in solution as well as those that could potentially be released as the acids dissociate. Total acidity is not a typical measurement for wine analysis.

Titratable acidity, or TA, is sometimes used synonymously with total acidity in the wine industry, but they are not the same. This method of analysis is commonly used as an indicator of the acid content of a sample. TA is the acidity determined by titration with a strong base, such as sodium hydroxide (NaOH), to a fixed pH endpoint of pH 8.2.

Acidity is important as it also affects the sensory attributes of wine (i.e. crispness or tartness). Understanding the acid content of wine or juice can help winemakers determine such aspects as proper harvest time, acid adjustments and treatments, and the overall stability or qualities of a wine.

Hanna Note

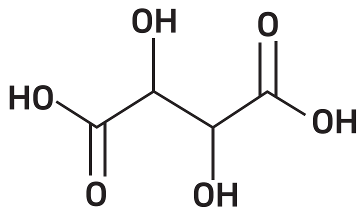
- The total acids in wine are typically grouped into two categories: fixed acids and volatile acids
- Acids are generally linked to three sources:
  - **The Grape**, contributing mostly tartaric and malic acid
  - **Alcoholic Fermentation**, where smaller amounts of lactic, acetic, and succinic accids are produced
  - **Bacterial Activity**, where lactic and acetic acids are mostly produced along with small amounts of various other acids.

2 Understanding Acid Content in Wine

Although a variety of acids exist in wine, tartaric and malic acid make up about 90% of the acid content in grapes, the majority being tartaric. The ratio between these acids fluctuates and is influenced by such factors as grape variety, growing climate, and vineyard management practices. Below is a list of common acids found in wine and their typical concentrations:

Tartaric Acid

Tartaric acid ($C_4H_6O_6$) is one of the main acid constituents of wine. It is generally stable to the metabolic processes of fermentation and microbial degradation. It can be present in grapes from 2 g/L to upwards of 10 g/L.

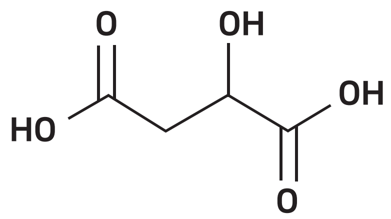


Hanna Note

Although TA represents the sum of all the titratable acids present in wine, it is most often represented as g/L as tartaric acid, the dominant acid present in grapes. Individual acids cannot be quantified with titration.

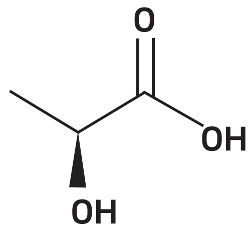
Malic Acid

Malic acid ($C_4H_6O_5$) is the other major acidic component of wine. Malic acid concentrations are highest right before the onset of ripening at about 20 g/L. The concentration of malic acid decreases as the fruit ripens. At harvest, the concentration of malic acid can range between 1 and 8 g/L.



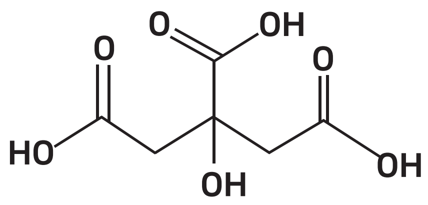
Lactic Acid

Although small amounts of Lactic acid ($C_3H_6O_3$) can be results primary fermentation, it is more common that lactic acid is the result from the conversion of malic acid by lactic acid between. In small quantities it is sometimes beneficial because it serves to soften some of the harshness of malic acid, but in large quantities it can introduce off-flavors and haze in wine.



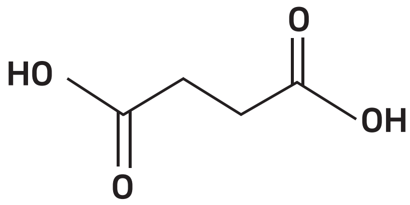
Citric Acid

Citric acid ($C_6H_8O_7$) is often found at concentrations of less than 1 g/L at harvest. Citric acid is subject to conversion to acetic and diacetyl acid through the processes of lactic acid bacteria. In excess both of these compounds can be undesirable in wines.



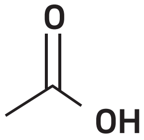
Succinic Acid

Succinic acid ($C_4H_6O_4$) is commonly found in wine but it can exist in very small amounts in grapes. Succinic acid is also produced as a byproduct of yeast metabolism during fermentation.



Acetic Acid

Acetic acid ($C_2H_4O_2$) is a volatile acid and is produced both during and after the primary fermentation by either yeast or acetic acid bacteria respectively. Excessive levels of volatile acidity can indicate potential spoilage. The levels of allowable volatile acidity are federally regulated. The legal limits in the U.S. are 1.4 g/L in red table wine and 1.2 g/L in white table wine, although typical dry wine levels are much lower.



Hanna Note

Just as TA represents the sum of all titratable acids present in wine or juice, volatile acidity (VA) represents the sum of all volatile acids. It is expressed as g/L as acetic acid.

3 The Importance of Measuring Acid Content

Acidity

The amount of acid present in a wine can directly affects its color and flavor, and can serve to balance the sweeter or more astringent wine components. This balance is challenging as too much acid may make a wine tart or sharp, while too little may make a wine flat or flabby. Proper acidity in wine is important to making the wine stable, palatable, and a refreshing accompaniment to food.

The proper acid level of a finished wine can vary based on the wine's desired style, with sweeter wines usually requiring somewhat higher levels of acidity to maintain proper balance with their sweeter components.

pH

A wine's pH is crucial in determining its microbial and chemical stability. Sulfur dioxide is responsible for protecting wine against oxidation and microbial activity. The molecular form of sulfur dioxide is most effective against microbes and is predominate at lower pH values. As the winemaking process progresses pH levels can change due to acid conversion and other metabolic activity. These changes require frequent monitoring of the pH values and sulfur dioxide levels of wine being stored or aged.

Most wines have a pH value between 3.0 and 4.0. White wines tend to have pH values below 3.4 while higher pH values are more common for reds. Red wines somtimes have a higher pH, in part, due to the longer contact time the grape juice has with the grape skins. At various points in the wine making process, it may be necessary to make acid additions in order to remain in the optimum pH range for the desired style or condition of the wine.

The Relationship Between TA and pH

Titratable acidity and pH are related, but the relationship is complex. For example, adding more acid to a wine may not appreciably affect the pH because of compounds such as phenols and other acids present that act in a buffering capacity. The complex correlation between pH and TA makes it crucial to assess both the pH and TA before and after making any adjustments.

If a pH adjustment is required, tartaric acid addition is generally preferred because it is relatively stable and is a stronger acid than malic or citric, yielding a greater pH adjustment per amount used. Malic acid may also be mixed in if trying to match the general acid make-up of the grape variety being used, although malic acid is subject to potentially undesired degradation to lactic acid by malolactic fermentation.

Hanna Note

Citric acid addition is generally not recommended in juice because it can be converted to acetic acid, producing off-flavors or other undesired results.

4 Analyzing Titratable Acidity

Titratable acidity is measured using a method of analysis called an acid-base titration. In an acid-base titration, the concentration of an unknown acid or base (analyte) is determined by adding a volume of acid or base of known concentration (titrant) until an endpoint is reached.

For TA of wine, sodium hydroxide (NaOH), a strong base, is added to a wine sample until a fixed pH endpoint of 8.2 is reached. This titration can either be performed manually, using a glass burette and a calibrated pH meter or color indicator, or automatically using an automatic titrator.

The volume of titrant added to reach the endpoint is then used to determine the concentration of acidity and expressed as g/L of tartic acid.

Why Acidity Matters

The formula used to calculate TA as g/L of tartaric acid is as follows:

$$\text{Titratable acidity (g/L tartaric acid)} = (V_{titrant} * N_{titrant} *75)/ V_{sample}$$

Where,

$\mathbf{V_{titrant}}$: Volume of titrant in mL

$\mathbf{V_{sample}}$: Volume of sample in mL

$\mathbf{N_{titrant}}$: Titrant concentration in normality

75: Value based on various conversion factors (i.e. molecular weight, reaction ratio, etc.)

Advantages of Automatic Titration

- Removes the risk of over-titration (a common problem when performing a manual titration).
- Saves time by adding titrant automatically and measuring the pH after each dose.
- Better accuracy and ease-of-use with automatic determination of endpoint and automatic calculation of result using the endpoint titrant volume.
- Availability of dynamic dosing feature (some titrator models) that automatically adjusts the volume of each dose based on the rate of pH change in the solution (makes endpoint determination faster and more accurate).

Automatic Titration Equipment and Supplies

eBook focus

	Manual Titration with Color Indicator	Manual Titration with pH Meter	Single-Parameter Titrator	Multiparameter Titrator
Parameters	TA	TA	TA	TA, SO_2, YAN, reducing sugars...
Detection Method	Color change (visual)	Potentiometric (pH electrode)	Potentiometric (pH electrode)	Potentiometric (pH, ORP, ISE electrodes)
Dosing Accuracy	Low	Low	High	Very high
Time	Time-Consuming	Time-Consuming	Rapid	Rapid
Calculations	Manual	Manual	Automatic, fixed	Automatic, adjustable
Measuring Modes	Titration	Titration, pH	Titration, pH	Titration, pH, ORP, ISE
Real-time Graphing	No	No	Yes	Yes
Equipment Cost	$25-100	$600-800	$800	$8-10k
Automation	None	None	1 Sample	Autosampler Compatible (available)

What You Need

Titrator

Must Have

- **Precision dosing system that allows for exact dosing of titrant which improves accuracy**
- **Preprogrammed with a TA method that is optimized for both low range and high range measurements**
- **Titrate to a fixed endpoint and display results as g/L tartaric acid**

Good To Have

- **pH meter with diagnostic messages during the pH calibration process including:**
  - Overall probe condition
  - Clean electrode
  - Buffer contamination

Hanna Note

Applications specific titrators offer:

- Increased convenience and simplicity with prepared chemistry and pre-programmed methods.
- Value of automation available at a cost similar to a typical benchtop meter.
- Increased accuracy due to an automatic dosing system.

Standard potentiometric titrators offer:

- Versatility with the ability to measure multiple parameters with adjustable method options.
- Further automation for multiple sample analysis with the ability to connect to autosamplers for increased throughput and time savings.

Standard titrators require a significant capital investment and can cost 10X as much as a dedicated application specific titrator.

HANNA® instruments

Electrodes

Must Have

- **A combination pH electrode**

  Standard general purpose pH electrode

Good To Have

- **A combination pH electrode that is designed specifically for use with wine**

  HI1048B is a glass body refillable pH electrode with PTFE sleeve junction that is resistant to clogging by the solids present in wine juice and must.

  See Page 25 for complete description

Hanna Note

Electrodes: The typical lifespan for a pH electrode is 1-2 years. It can be used longer as long as it has an acceptable offset (+/- 30 mV in pH 7.01) and slope (greater than 85%).

Buffers: The expiration date on buffer solutions are for sealed solutions. Once open the solutions should be replaced after 6 months.

Calibration Buffers

Must Have

- **Fresh calibration solutions.**

  The accurate detection of the pH end point will only be as good as the quality of the buffers used. Calibration buffers last about 6 months once a bottle is opened.

Good To Have

- **The ability to calibrate to the pH endpoint value.**

  The phenolphthalein endpoint of pH 8.20 is commonly used in titratable acidity measurements. Some titrators have the buffer value pre-programmed while others offer the ability to add it as a custom buffer value.

Hanna Note

- A two point calibration of the pH electrode to the meter should be performed using pH 4.01 and pH 7.01.
- If your titrator/meter can be calibrated to pH 8.2 then use the HI70082M pH 8.2 calibration solution.

Cleaning Solutions

Must Have

- **Cleaning solution for pH electrodes.**

  Besides using a pH electrode with unacceptable electrode characteristic (offset and slope), a build up on the glass bulb of the probe and/or clogging of the reference junction are the main contributors to an inaccurate pH measurement. Routine cleaning should be a part of your standard operating procedure.

Good To Have

- **Application specific cleaning solution designed for the removal of wine stains and deposits.**

  The HI70635L is a cleaning solution designed to remove wine deposits while the HI70636L is a cleaning solution for the removal of wine stains.

Storage Solution

Every pH electrode should be stored with a few drops of storage solution (e.g. HI70300L) in the protective cap. The storage solution is used to maintain a hydrated layer on the glass bulb. This layer takes around 3-4 hours to completely form.

A pH electrode calibrated when the bulb is dry will read differently than a pH electrode with a bulb that has a hydrated layer. It is critical that the pH electrode is properly hydrated prior to calibration.

The storage solution also helps to maintain a liquid junction. Every pH electrode has a porous junction. This junction allows for an electrical pathway from the sample to the internal reference wire.

Crystallization of salt will occur at the junction if a pH electrode is not stored properly. This could lead to erratic readings if the deposits cannot be dissolved.

Hanna Note

A build up on the glass will result in an offset error. That is the voltage generated by the pH electrode while in pH 7 buffer will shift outside the acceptable +/- 30 mV range.

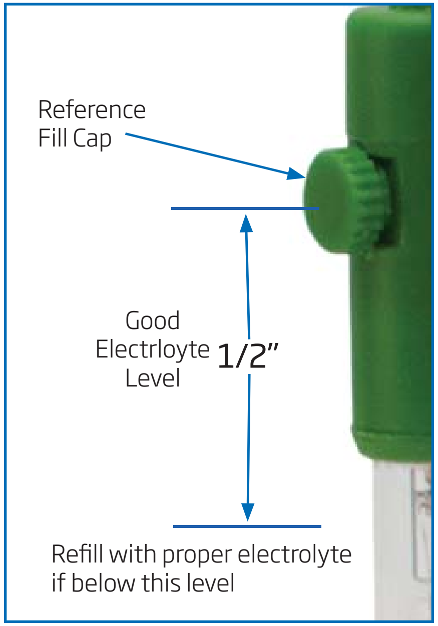
Refilling Solution

Must Have

Refill solutions are used with refillable pH electrodes.

If you use a refillable pH electrode it is important to know whether your pH electrode is a single junction or double junction design.

Single junction electrodes use a potassium chloride (KCl) fill solution that is saturated with silver chloride (AgCl), while double junction electrodes use a fill solution that only contains KCl.



Hanna Note

For refillable pH electrodes it is important to maintain a sufficient amount of fill solution. Both the loosening of the fill cap and a filled pH electrode help to provide a positive head pressure on the electrolyte. This increase in head pressure allows for an increased flow rate from the junction which leads to better stability in pH readings.

The 7071 fill solution is for single junction electrodes while the HI7082 is used for double junction electrodes. The HI1048B pH electrode for wine is a double junction electrode and uses the HI7082 fill solution.

What You Need

Titrant

Must Have

Standardized titrant.

In order to determine the titratable acidity in wine it is necessary to use a sodium hydroxide solution of a known concentration.

An application specific titrator such as the HI84502 is supplied with a titrant that is pre-standardized. The exact concentration is known and is part of the built-in calculation within the meter. The accuracy of the volume of titrant dosed is ensured by a pump calibration procedure using a supplied known standard.

Hanna Note

A standard potentiometric titrator will use a sodium hydroxide (NaOH) solution as a titrant. The NaOH solution can be purchased or prepared in the lab using an analytical balance and volumetric glassware. This solution needs to be standardized by titrating against a primary standard such as potassium hydrogen phthalate (KHP). After performing this titration the exact concentration of NaOH is then known.

What You Need

Labware

Good To Have

The HI84502 mini-titrator/pH meter for titratable acidity of wine is supplied complete. Additional recommended items include: a wash bottle filled with deionized water for cleaning probes between samples, spare 100 ml beakers, and a waste container.

For users that perform the titratable acidity manually or with a standard potentiometric titrator, additional labware items would include: a magnetic stirrer, mechanical or serological pipette, and 100 ml beakers.

Deionized (DI) Water

Must Have

Purified water for sample preparation, final rinse of labware after cleaning, and rinsing of the probes is absolutely necessary. Purified water is available as distilled or deionized. Both can be purchased from a local store or made in the lab with water purification equipment. Water purified by reverse osmosis can also be used but tends to have slightly more impurities as compared to distilled or deionized. In this eBook DI is referenced as the water to use. It is also okay to use distilled water.

What You Need

Application specific mini-titrator for titratable acidity in wine.

* Primary focus for rest of the eBook

Standard potentiometric titrator that can measure titratable acidity, sulfur dioxide, yeast assimilable nitrogen (YAN), and reducing sugars.

Features of an Ideal Titrator

Hanna Note

HI84502 application specific mini-titrator for titratable acidity in wine doubles as a high accuracy pH meter (+/-0.01pH) with Cal-Check, GLP, logging and USB features.

Features of an Ideal pH Electrode for Wine Analysis

Double Junction
An internal junction allows for a silver free fill solution to be used. Fill solutions that contain silver can react with sulfides to form an insoluble precipitate that will clog the outer junction.

General Purpose Glass Bulb
The HI1048B is suitable to use with samples that measure from 0 to 80°C.

CPS Sleeve Junction
CPS™ technology utilizes the porousness of ground glass coupled with a PTFE sleeve to prevent clogging of the junction. The ground glass allows proper flow of the fill solution, while the PTFE sleeve repels solids.

Refillable
Provide a long life by adding to or replacing electrolyte fill solution.

Hanna Note

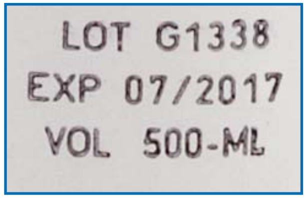
HI1048B application specific pH electrode with Clogging Prevention System (CPS) technology designed for use with wine must and juice.

What You Need

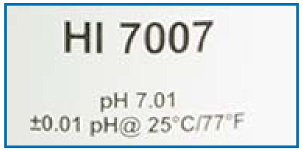
Features of Ideal Solutions

All solutions should be produced in accordance with ISO 3696/BS3978 standards using high purity chemicals, deionized water, certified weight-checked balances, and Class A glassware in a temperature controlled environment monitored with certified thermometers.

Hermetically sealed to prevent any air from entering into the solution causing its premature degradation and altering the known standardized value.



Lot number and expiration date should be found on the bottle for traceability.



pH calibration buffers should have reported values that are accurate to +/- 0.01 pH @ 25°C and are traceable to NIST Standard Reference Materials.

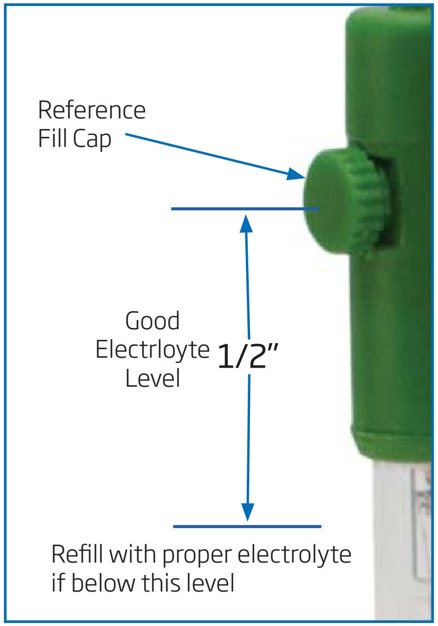
How to Measure TA

Each titrator has a different procedure and set up. The general approach and recommendations outlined in this eBook are useful for all similar titrators. Consult the manual for specific instructions on the operation of individual titration systems.

1 Prepare and Calibrate

a. Preparing the HI1048B pH electrode

- Remove the protective storage cap from the electrode
- Loosen the reference fill cap.
- Connect pH and temperature probes to the titrator.
- Check fill solution level. If fill solution is low (1/2" from top) then fill with HI7082 electrolyte solution.

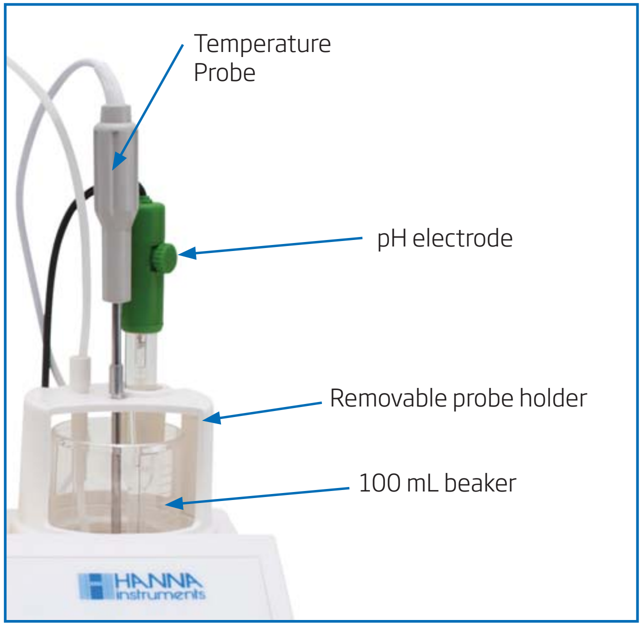


Hanna Note

If the probe was stored dry it is important to hydrate the pH electrode. Place in storage solution for at least 1 hour. If no storage solution is available, use a pH buffer.

b. Prepare calibration buffers

- For three point calibration, pH 8.20, 7.01, and 4.01 buffers are used.
- Fill 100 ml beakers with 50 ml buffer, respectively.
- Place a stir bar into each beaker.
- Place beaker with pH 8.20 buffer in beaker holder.
- Rinse probes with DI water and collect in waste container/beaker.
- Place probe holder with probes on titrator.
- Check to make sure probes are low enough that the junction is covered by the buffer but not too low that the stir bar will hit the electrode.

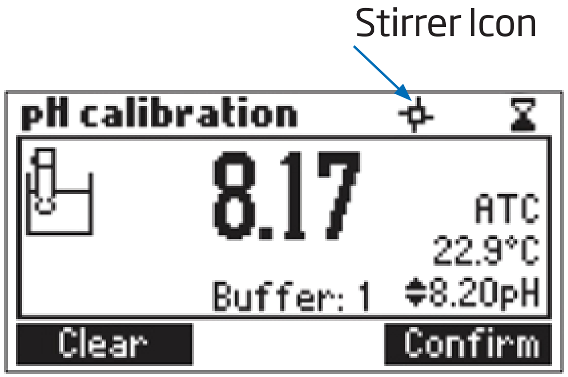


Hanna Note

A best practice to achieve the most accurate calibration is to use two beakers for each buffer solution: the first one for rinsing the electrode and the second one for calibration.

c. Enter electrode calibration mode

- Press the **CAL** key then **Electrode.** The electrode calibration screen will be displayed.
- If using pH 8.20 as endpoint, then pH 8.20 will be displayed. Up/down keys can be used to select a different value.
- Press the **STIR** key if stirrer icon is not present.
- Once pH 8.20 buffer is recognized, **"Confirm"** is displayed. Press the virtual key to accept the calibration point. pH 7.01 will then be displayed along with "Buffer: 2".
- Remove electrode holder and rinse probes with DI water.



Hanna Note

If pH 7.01 is configured as the pH end point for the titratable acidity titration, then pH 7.01 will be the first buffer value displayed in the calibration process.

c. Enter electrode calibration mode (continued)

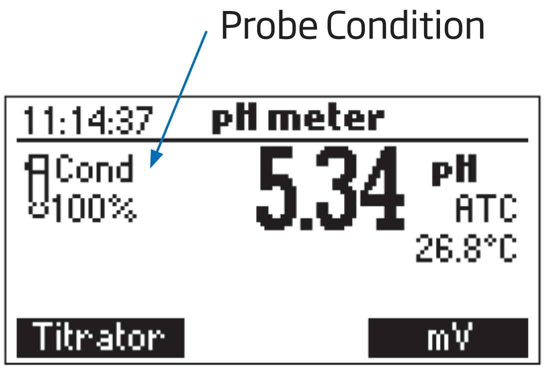
- Replace beaker with pH 8.20 buffer for one that has pH 7.01.
- Place electrode holder back on titrator.
- Press the dedicated **STIR** key.
- Once pH 7.01 buffer is recognized, **“Confirm”** is displayed. Press the virtual key to accept the calibration point. pH 4.01 will then be displayed along with “Buffer: 3”.
- Remove electrode holder and rinse probes with DI water.

Hanna Note

At anytime during the calibration process the ESC (escape) can be used to exit. For example, after confirming the first point the ESC key can be used to only perform a single point calibration.

c. Enter electrode calibration mode (continued)

- Replace beaker with pH 7.01 buffer for one that has pH 4.01.
- Place electrode holder back on titrator
- Press **STIR** key.
- Once pH 4.01 buffer is recognized, **"Confirm"** is displayed. Press the virtual key to accept the calibration point. The initial calibration screen is displayed along with the updated date for the the electrode calibration.
- Remove electrode holder and rinse probes with DI water.
- Press **ESC** to exit to measurement screen.

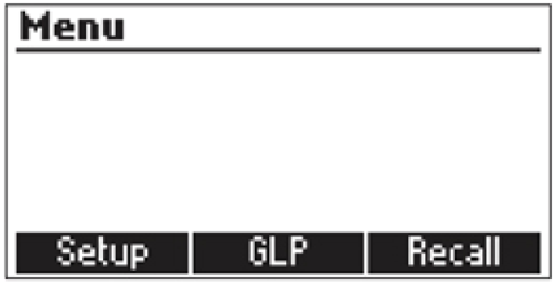


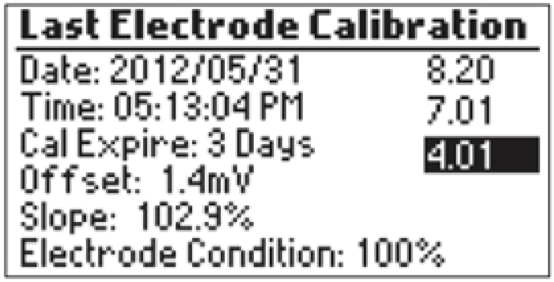
Hanna Note

As long as pH 7.01 and pH 4.01 buffers are used for calibration, the probe condition indicator will be displayed in the measurement screen. This indicator displays the health of the pH electrode as a percentage and is based on the offset and slope.

d. After pH electrode calibration

- Review GLP probe information (optional).
- Press **MENU** key.
- Press **GLP** virtual key.
- Select **Electrode** virtual key.
- Calibration information is displayed including: date, time, buffers used, offset and slope.





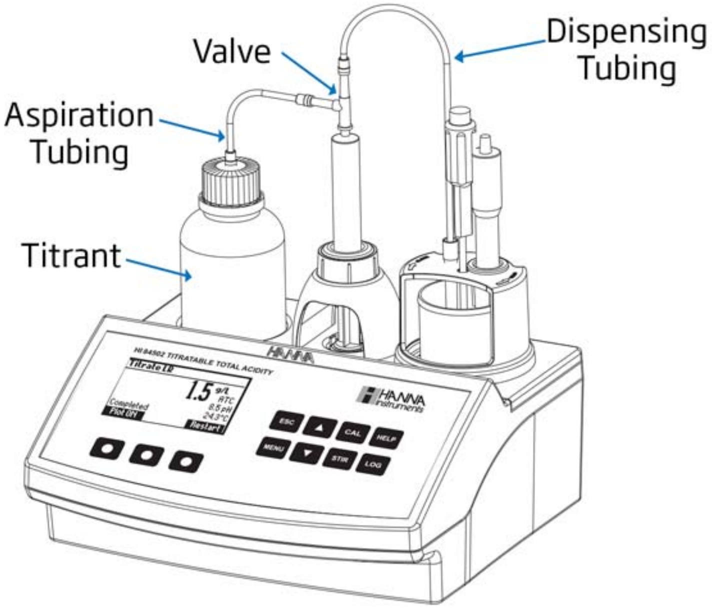
Hanna Note

The GLP data contains critical information about the pH electrode. An offset should fall between +/- 30 mV and ideally the slope should be greater than 90%. Both values will impact the overall electrode condition. Both values are used to display CAL-Check messages during calibration including electrode dirty/broken electrode and buffer contaminated.

How to Measure TA

e. Dosing pump preparation

- Place the HI84502-50 titrant in the bottle holder.
- Set up syringe, valve, and tubing according to instructions.
- Select desired range by pressing the **MENU** key then the **Setup** virtual key. For measurements between 0.1 and 5.0 g/L select **Low.** For measurements between 4.0 to 25.0 g/L select **high**.
- Prime the dosing system. Press **CAL** key then **Prime** virtual key. Press **Start** and the pump will cycle three times. Make sure to have dosing tip in waste beaker since some titrant will be lost by the prime cycle.



e. Dosing pump preparation (continued)

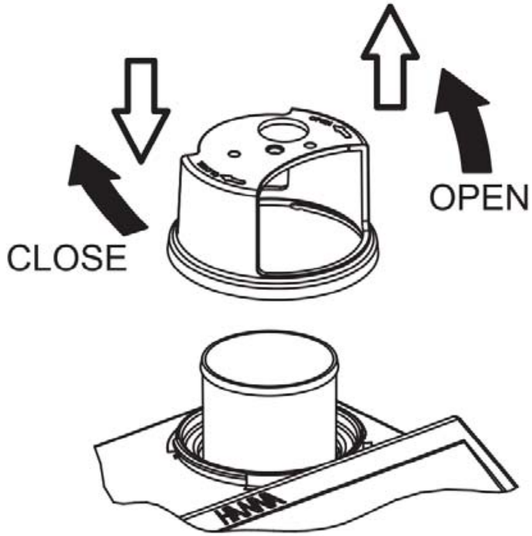
- Press the virtual **Start** key.
- Using the supplied 2000 µl mechanical pipette with a clean tip, add 4 ml (4000 µl) or two doses of the HI84502-55 pump calibration solution to a clean 100 ml beaker .
- Fill the beaker up to the 50 mL mark with distilled or deionized water.
- Add a stir bar in the beaker and place the beaker into the holder of the titrator.
- Place the electrode holder with probes and dosing tip over a waste container.
- Press the virtual **Continue** key. A small amount of titrant will be dosed to ensure no air bubbles are in the dosing tip.

Hanna Note

Using a mechanical pipette is a quick and easy way to measure small volumes very accurately. Proper pipetting technique would be to draw solution up then discharge to wet the inner tip surface. After wetting the inside of the tip then the solution should be drawn up for placing in the beaker. It is also important to slowly draw up the titrant. Do not place tip in titrant and quickly release the plunger.

e. Dosing pump calibration (continued)

- Place the electrode holder with both pH and temperature probes over the beaker.
- It is **important** to make sure that the dosing tip from the dispensing tube is immersed approximately 0.1” (0.25 cm) into the solution.
- Press the virtual **Continue** key.
- The calibration will begin. At the end of the calibration, “calibration, completed” will be displayed.
- Press **ESC** dedicated key to return to main measurement screen.



2 Measurement of Titratable Acidity

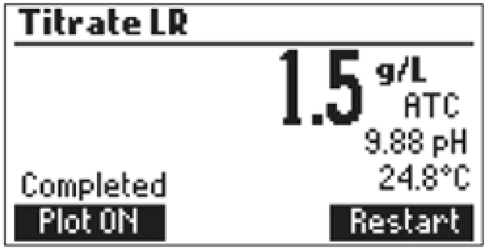
a. Measurement procedure

- Verify that the instrument has been calibrated (pH and pump) before performing any titrations.
- If in pH mode, press the virtual **Titrator** key to place in titration mode.
- Verify correct measurement range is being used.
- For a low range measurement, use the 2000 µl mechanical pipette with a clean tip to add 2 ml (2000 µl) of the wine to a clean 100 ml beaker. For high range measurement, 10 ml (10,000 µl) of wine is added to a clean 100 ml beaker.
- Fill the beaker up to the 50 ml mark with DI water.
- Place the electrode holder with probes and dosing tip over a waste beaker.
- Press **Start** and **Continue**, a small amount of titrant will be dosed to ensure no air bubbles are present in the dosing tip.

How to Measure TA

a. Measurement of Titratable Acidity (continued)

- Rinse probes with DI water.
- Place beaker with a stir bar into the titrator holder. Place electrode holder on top of the beaker.
- It is **important** to make sure that the dosing tip from the dispensing tube is immersed approximately 0.1” (0.25 cm) into the solution.
- Press the **Continue** virtual key to start the titration.
- After the titration is complete the total titratable acidity concentration in g/L of tartaric acid will be displayed.



Hanna Note

It is possible to view a graphical representation of the titration progress by selecting the Plot ON virtual key.

3 Clean and Store

- Once you are finished titrating your samples, remove the pH and temperature probes from the probe holder and rinse with DI water until all wine is removed from the surface.
- Examine the pH electrode to determine if it needs to be refilled with fill solution (the level of the internal solution is less than ½" inch from the fill hole).
- If wine/must is present inside the pH electrode (easier to spot with red wines because you can see the red inside), then empty, rinse, and refill the electrode with fill solution. Tighten the fill hole cap.
- Fill a small beaker with cleaning solution for wine deposits. If the probe is stained or discolored, use wine stains cleaning solution. Immerse the pH electrode for 5 to 15 minutes. Make sure there is enough solution to cover the junction. Rinse the pH electrode with DI water.
- Fill the pH electrode storage cap half way with storage solution and replace the storage cap on the electrode. Make sure there is enough storage solution in the cap to cover the junction of the pH electrode.

Hanna Note

Monitoring the offset of the pH electrode is a great way to know if the probe needs cleaning. If the offset is greater than +/- 30 mV, it is recommended to perform a cleaning procedure. If the offset remains high after cleaning, try replacing the fill solution to see if that brings the probe back within an acceptable range.

Clean and Store (continued)

- Before storing the titrator it is important to clean the tubing, syringe, and valve.
- Remove tubing from titrant bottle and place in 100 ml beaker filled with DI water.
- Remove dosing tip with tubing from probe holder and place in waste container.
- Press **Prime** virtual key and then **Start** virtual key. The dosing pump will cycle three times, rinsing the titrant from the tubing.
- Purge water from tubing.
- Remove tubing from 100 ml beaker containing DI water.
- Press **Prime** virtual key and then **Start**. The dosing pump will cycle three times, purging the water from the tubing.
- Lastly, make sure titrant bottle cap is tightened on titrant bottle.

THANKS FOR READING!

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