

HI932

AUTOMATIC POTENTIOMETRIC TITRATOR



MANUALS

HI932 AUTOMATIC POTENTIOMETRIC TITRATOR

Congratulations on choosing your new Hanna titrator. It is a powerful and versatile instrument capable of accurate and fast analysis of a wide range of samples. In this manual, you'll find:

QUICK START GUIDE

This guide will help you quickly setup, operate, and introduce you to your new titrator. It covers basic connections, user interface, how to perform calibrations, and how to run a titration.

INSTRUCTION MANUAL

The manual provides a comprehensive description of the operating principles user interface, general options, methods, titration/direct reading mode, pH, mV and ISE mode, maintenance, etc.

APPLICATIONS BROCHURE

This brochure contains complete instructions for commonly-used analyses. Additional methods and method packs are available; contact your local Hanna office for more details.

TITRATION THEORY

This guide outlines the principles of operation of the titrator. It covers the chemistry of titrations, titration types, and result calculations.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com or view our worldwide contact list for a Hanna Instruments representative near you at www.hannainst.com.

HI932

AUTOMATIC POTENTIOMETRIC TITRATOR



QUICK START GUIDE

**Dear
Customer,**

Congratulations on choosing a Hanna Instruments product.

Please read this Quick Start Guide carefully before using the instrument. This guide will provide you with the necessary information for the correct use of the instrument.

The purpose of this guide is to present a quick overview of setting up and using the instrument.

For detailed information illustrating the extensive capabilities of your titrator, please refer to the Instruction Manual.

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INTRODUCTION

The HI932 automatic titrator is designed to perform a wide variety of potentiometric titrations with high accuracy, flexibility and reproducibility, allowing the user to obtain both accurate results and high-speed analysis.

The titrator can perform fixed endpoint or equivalence point titrations and direct measurements by measuring the pH/mV and temperature of the sample.

Reports and methods can be transferred to a PC via a USB interface, saved to a USB storage device or printed directly from the titrator. An external keyboard can also be attached for added convenience.

The HI922 Autosampler can be connected for sample automation.

How can I find certain information?

- The **Quick Start Guide** will help the user learn how to operate the titrator within a short period of time.
- The **Instruction Manual** provides a complete description of the operating principles (user interface, general options, methods, titration/direct reading mode, pH, mV and ISE mode, maintenance, etc.).
- The **Titration Theory** outlines the basic concepts of titration.
- The contextual **Help** screens contain detailed explanations of every screen.

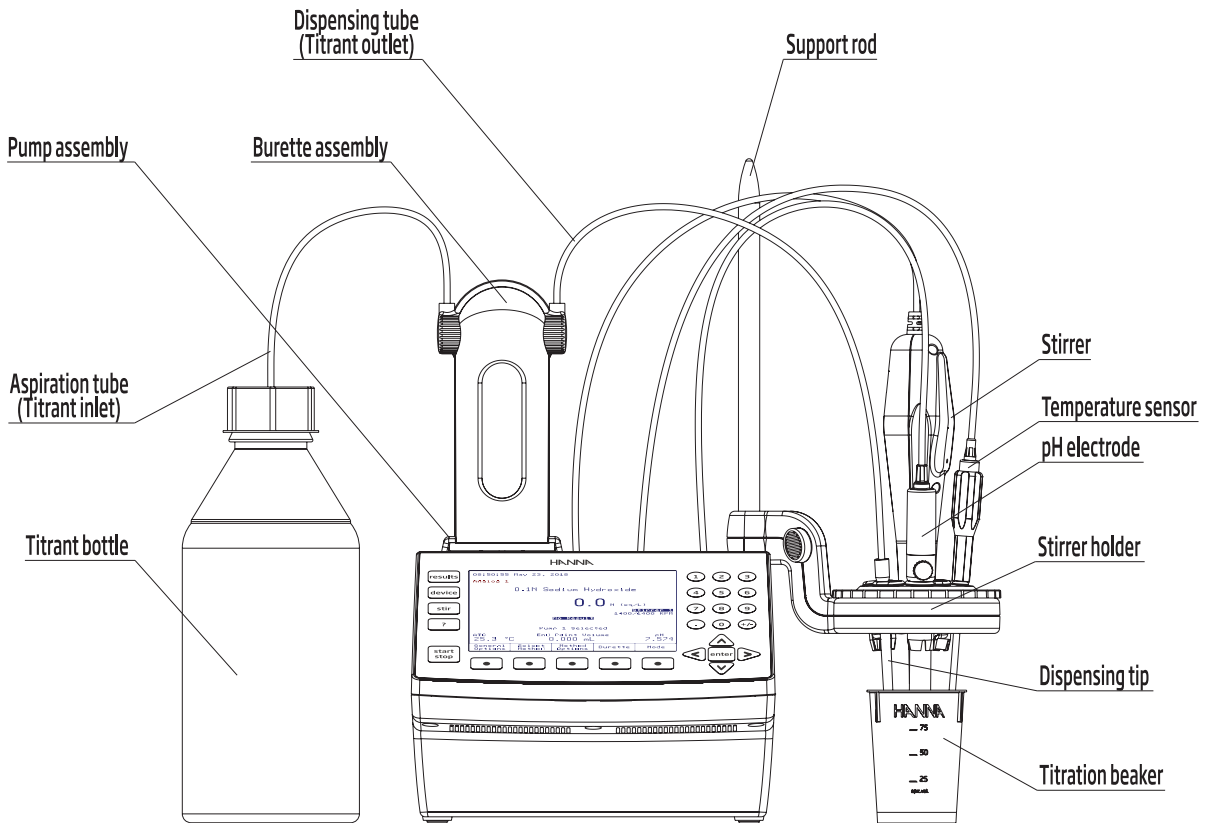
SAFETY MEASURES

The following safety measures must be followed:

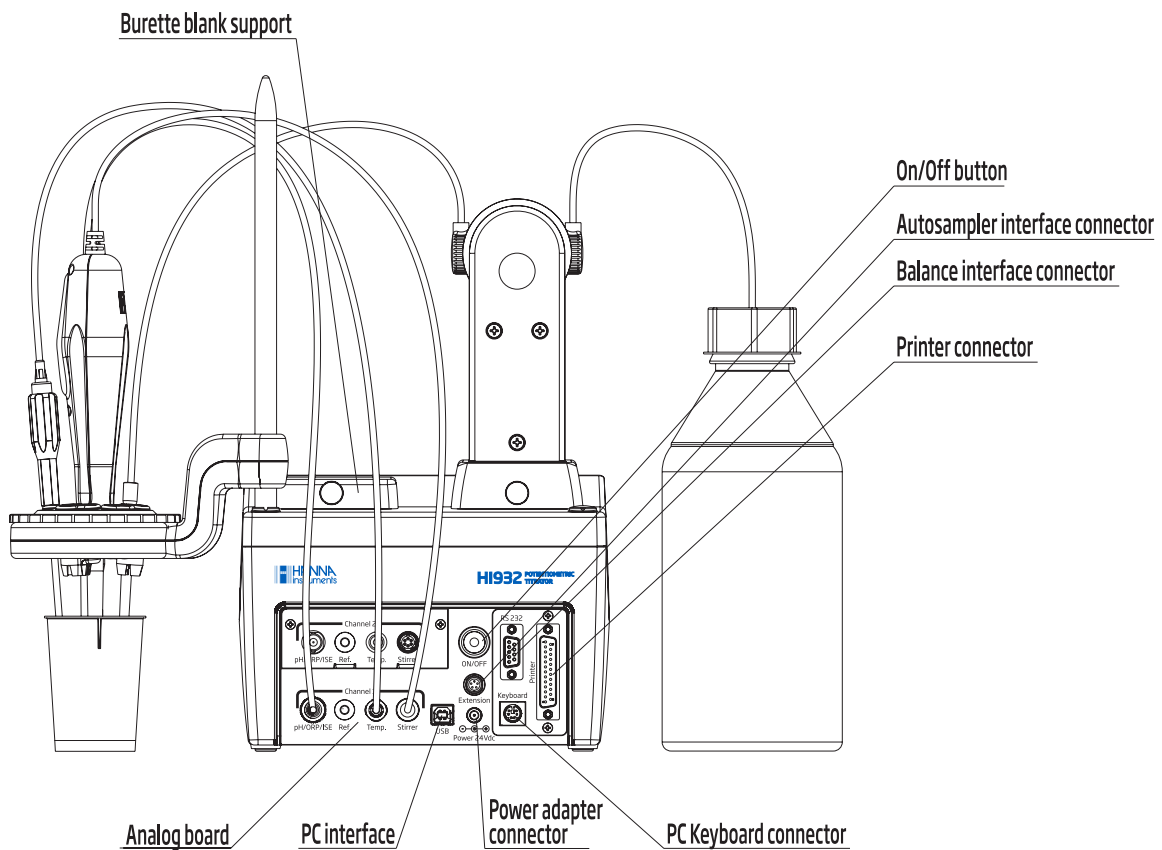
1. Never connect or disconnect the pump assembly or other peripheral with the titrator turned on.
2. Verify that the burette and the attached tubing are assembled correctly.
3. Always check that the titrant bottle and the titration beaker are placed on a flat, stable surface.
4. Always wipe up spills and splashes immediately.
5. Avoid the following environmental working conditions:
 - Severe vibrations
 - Direct sunlight
 - Atmospheric relative humidity above 95% non-condensing
 - Environment temperatures below 10°C and above 40°C
 - Explosion hazards
6. Have the titrator serviced by qualified service personnel only.

TITRATOR CONNECTIONS

FRONT VIEW



REAR VIEW

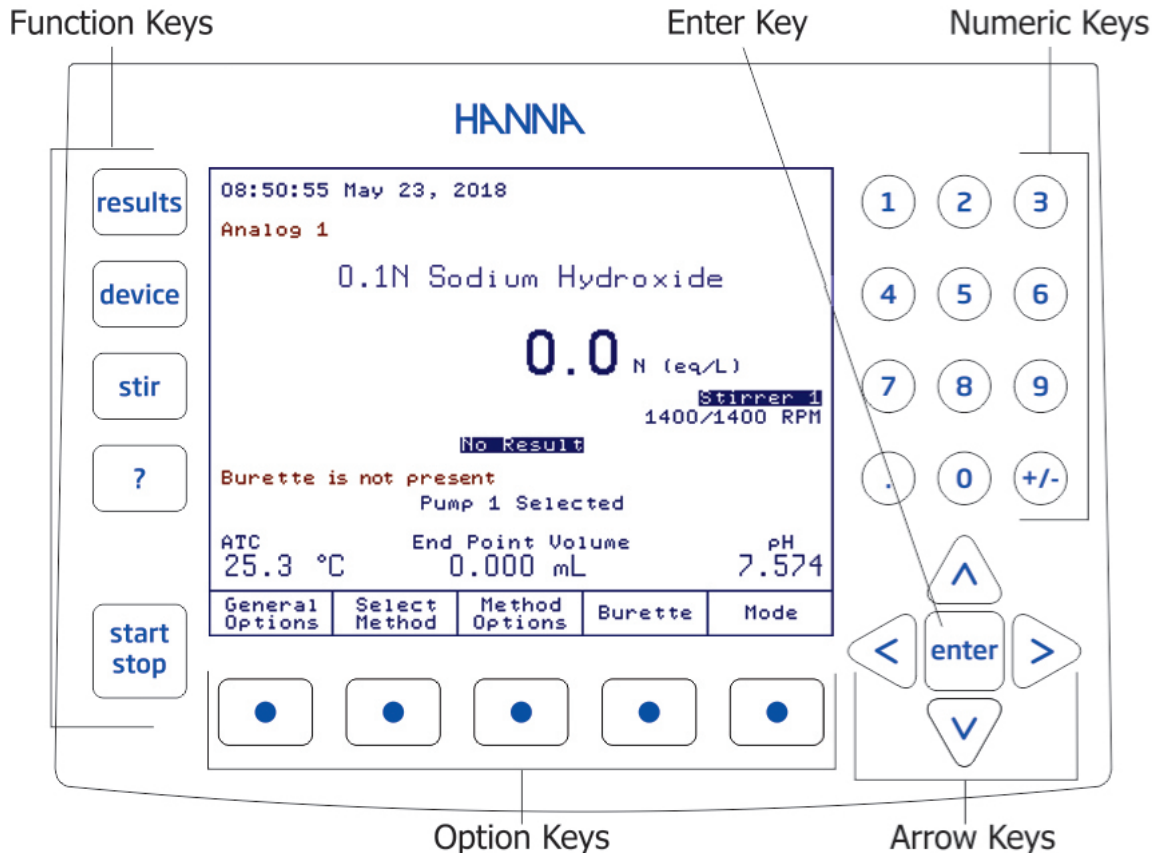


USER INTERFACE

Keypad

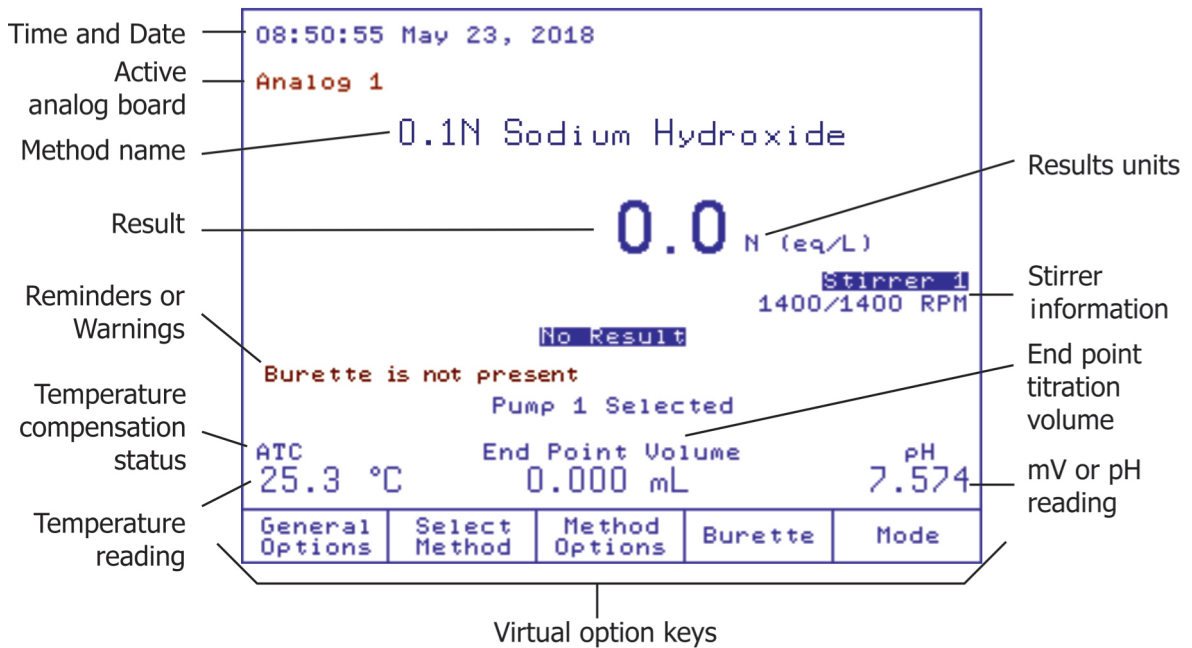
The titrator's keypad has 27 keys grouped in five categories, as follows:

Display




The user interface contains several screens. In each screen, many information fields are present at the same time. The information is displayed in an easy-to-read manner.

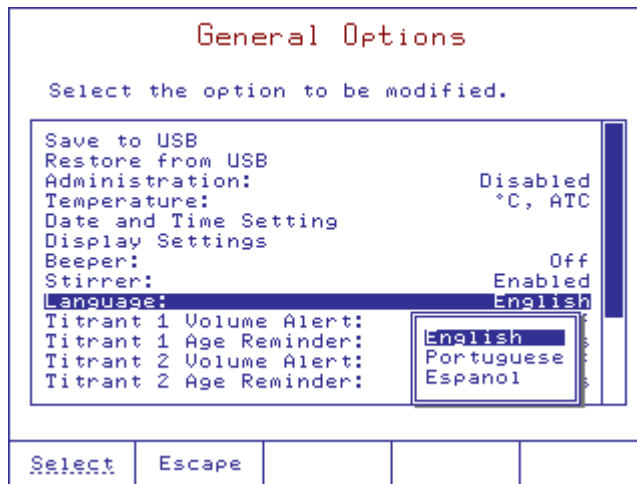
Virtual option keys describe the function performed when the corresponding option key is pressed.



HOW TO SELECT YOUR LANGUAGE

To change the language, press  from the main screen. Highlight the *Language* option. Using the  and  keys, select the language and press .

Restart the titrator in order to apply the new language setting.



HOW TO USE THE CONTEXTUAL HELP

Information about the titrator can be easily accessed by pressing . The contextual help can be accessed at any time and it provides useful information about the current screen.

METHODS

The HI932 titrator can store up to 100 methods (standard and user) and 30 autosampler sequences.




Standard Methods

Each titrator is supplied with a package of standard methods. Standard method packs are developed at Hanna Instruments to meet analysis requirements of specific industries (e.g., water treatment, wine, dairy, etc.).

User-Defined Methods

User defined methods allow the user to create and save their own methods. Each new method is based on an existing method which is altered to suit a specific application.

HOW TO CALIBRATE A pH ELECTRODE

To enter pH calibration mode, press , then , then .

PREPARATION

Pour small quantities pH 4.01, pH 7.01 and pH 10.01 buffer solutions into clean beakers. If possible, use plastic beakers to minimize any EMC interferences.

For accurate calibration and to minimize cross-contamination, use two beakers for each buffer solution: one for rinsing the electrode and one for calibration.

CALIBRATION PROCEDURE

- If the instrument has been previously calibrated and calibration was not cleared, the old calibration can be cleared by pressing .

Note: It is very important to clear calibration history when a new electrode is used. Most errors and warning messages that appear during calibration depend on calibration history.

- Use the or to select pH 4.01 buffer solution.
- Use the second beaker of pH 4.01 buffer solution to rinse the pH electrode, temperature probe and propeller stirrer.
- Immerse the pH electrode, temperature probe and propeller stirrer in the pH 4.01 buffer solution. The pH electrode's bulb must be completely immersed in the buffer solution and the reference junction needs to be 5-6 mm below the surface. Add additional buffer if necessary.
- Press to turn on the propeller stirrer.
- Once the reading has stabilized, press to update the calibration.
- Repeat this procedure for pH 7.01 and 10.01 buffer solutions.
- Press to accept and exit pH calibration mode.

HOW TO PERFORM A TITRATION

Required Solutions

- Titrant - 500 mL of 0.1 M (mol/L) Sodium Hydroxide (NaOH) in a titrant bottle.
- Sample - 0.1 mol/L Hydrochloric Acid (HCl).
- Distilled or deionized water.

Note: Analytical grade reagents and water should be used for accurate results.

Priming the Burette

- Insert the aspiration tube in the titrant bottle and the dispensing tube in a waste beaker.
- From the main screen press .
 - Highlight the *Prime Burette* option and then press .
 - Enter the number of burette rinses. At least 3 rinses are recommended.
 - Press to start.
 - The message "Executing..." will be displayed.

Note: Make sure you have continuous liquid flow inside the burette. For accurate results, the aspiration tube, the dispensing tube and the syringe must be free of air bubbles.

Method Selection

For this analysis, we will use the *H11009 Neutralization w/ NaOH*.

To select this method:

- Press . Use the and keys to highlight *H11009 Neutralization w/ NaOH*.
- Press .

Setting Method Parameters

To display the method parameters, press .

The **View/Modify Method** screen will be displayed.

Only certain parameters can be changed.

For this titration, the NaOH titrant concentration and the size of the HCl sample need to be entered.

To accomplish this:

- Highlight *Titrant Conc.* option, then press . The **Titrant Concentration** screen will be displayed.
- Enter the correct value, then press .
- Highlight *Analyte Size* option, then press .
- Enter the volume of the sample (e.g.: 5 mL), then press .
- Press highlight *Save Method* option and then press .

<p style="text-align: center;">Titrant1 Conc.</p> <p>Enter the titrant 1 concentration.</p> <p style="text-align: center;">0.10676 M (mol/L)</p>					<p style="text-align: center;">Sample Volume</p> <p>Enter the initial sample volume in milliliters.</p> <p style="text-align: center;">1.0000 mL</p> <p>This volume will be used when fixed sample size is selected.</p>				
Accept	Escape	Delete Digit		Exponent	Accept	Escape	Delete Digit		Exponent

Setup Titration Report

Users can select the information that is stored for each titration.

To setup the titration report, follow the procedure below:

- From the main screen, press **results**. The **Data Parameters** screen will be displayed.
- Highlight *Setup Titration Report* and press **Select**.
- Mark the fields to be included in the titration report with the "*" symbol. Use the **▲** and **▼** keys to highlight a field and **Select** / **Unselect** to toggle the field.
- Press **Save Report** to save the customized report.

Preparing the Sample

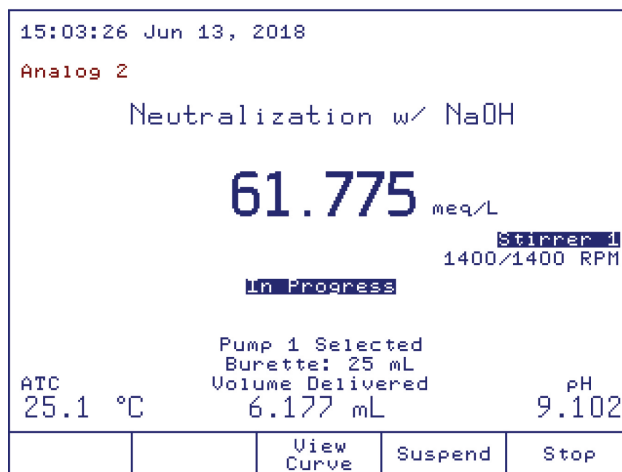
- Add 50 to 65 mL of distilled/deionized water to the titration beaker.
- Use a pipette or burette to add 5.0 mL of the sample (0.1M Hydrochloric Acid (HCl)) into the same beaker.
- Slide the stirrer assembly up.
- Place the beaker under the stirrer assembly.
- Lower the stirrer assembly until the electrodes are submersed and the stirrer is close to the bottom of the beaker.
- Adjust the level of the sample solution with distilled/deionized water so that the pH electrode bulb is completely immersed in the sample solution and the reference junction of the electrode is 5-6 mm below the surface.

Performing a Titration

- From the main screen, press **start stop**. You will be prompted to enter the analyte size. Enter 5 mL and press **enter**. The titrator will start the analysis.
- At the end of the titration, the message "Titration Completed" will appear on the display with the final concentration of the analyte in the sample and the equivalence endpoint volume.

Understanding the Displayed Information

During a titration the following screen is displayed:

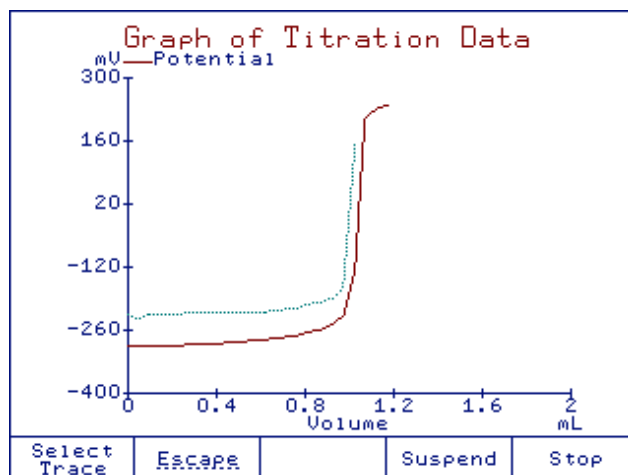
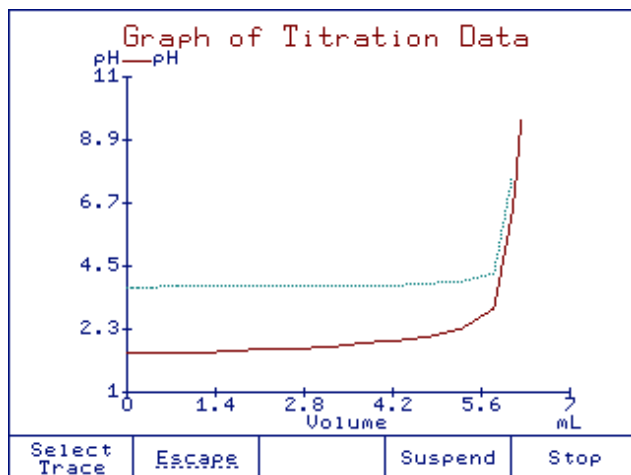


Viewing Graph During Titration

After a few doses are dispensed, **View Curve** will become active. Press **View Curve** to display the real-time titration graph.

The curves displayed are plots of the pH and the 1st derivative versus Titrant Volume (for details, see the Instruction Manual).

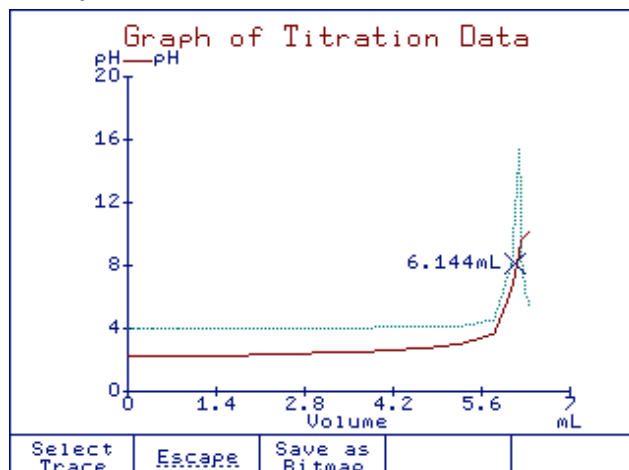
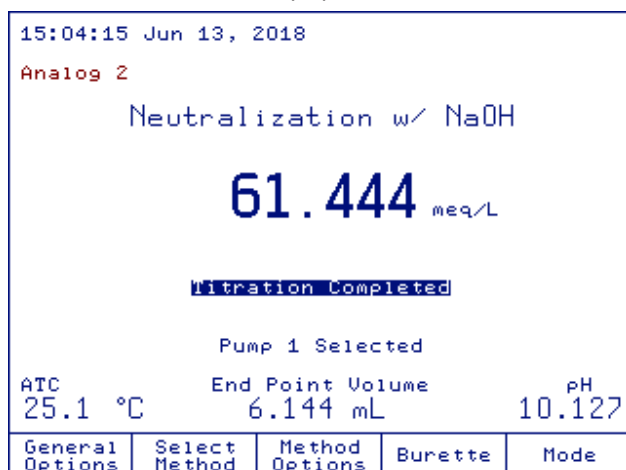
The two graphs are scaled to fit in the same screen window. Press **Select Trace** to change the y-axis scale to either the pH values or the 1st derivative values.



Titration Termination

The titration is normally terminated when the first equivalence endpoint is detected according to the selected algorithm. To ensure the correct detection and interpolation of the equivalence endpoint, the titrator will dispense a few additional doses after the endpoint was reached.

The titration result can be displayed either in the main screen or in the **Graph of Titration Data** screen:



When the titration has ended, the titrator will display the equivalence endpoint volume and the final concentration of the analyte together with the "Titration Completed" message.

To view the titration graph and/or results, press **results**.

When the titration ends, an "x" will mark the endpoint on the pH versus titrant volume curve in the **Graph of Titration Data** screen. The value of the endpoint volume is also displayed next to the endpoint.

Results

The results obtained from a titration are stored in a report file that can be viewed, transferred to a USB Storage Device or PC and printed.

Viewing the last titration data

- From the main screen, press **results**. The **Data Parameters** screen will be displayed.
- From the **Data Parameters** screen highlight the *Review Last Analysis Report* option and press **Select**. The **Review Result** screen will be displayed.
- Use the **Page Up** and **Page Down** keys to display information related to the last titration performed.

See Titration Report on next page.

Printing the titration report

Connect a DOS / Windows-compatible parallel printer directly to the DB 25-pin connector located on the back of the titrator.

Note: When connecting the printer, please turn off the titrator and the printer.

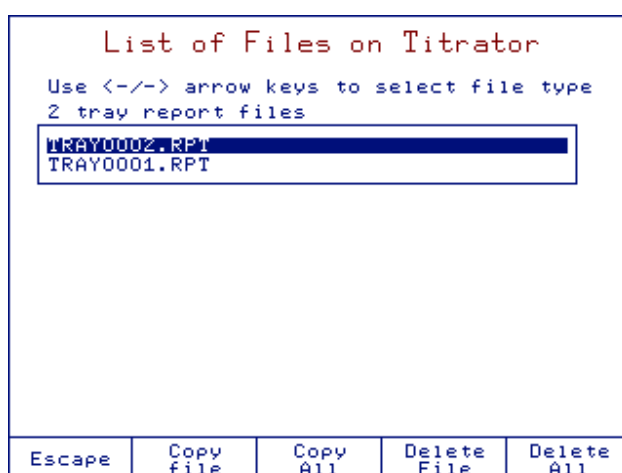
Printing out the report:







- From the **Review Report** screen, press **Print Report**.
- During the information transfer to the printer, the message "Printing" will be displayed on the screen.
- Press **Escape** to return to the **Data Parameters** screen.
- Press **Escape** again to return to the main screen.

Saving data to USB Storage Device

This feature allows saving the results of titrations or pH / mV / ISE logging sessions on a USB storage device.

- From the main screen, press **General Options**, the **General Options** screen will be displayed.
- Highlight the *Save Files to USB Storage Device* option using the **Up** and **Down** keys.
- Insert the USB storage device into the USB socket.
- Press **Select**, the **List of Files on Titrator** screen will be displayed.



- Use the  and  keys to select the report files.
- Press  to transfer all available reports to the USB storage device, or highlight the name of the report file to be transferred and press .
- Transferring a report file will automatically transfer the corresponding log file and titration graph (*.BMP file if applicable).
- Press  to return to the **General Options** screen.
- Press  again to return to the main screen.

Titration report

While scrolling with the  and  keys, the fields below can be seen on the titrator display or printed. The same information is available on the saved report file (Ti_00007.rpt in this example).

HI932 - Titration Report

Method Name: Neutralization w/ NaOH
 Time & Date: 15:01 Jun 13, 2018
 Report ID: Ti_00011

Calibration Data

Buffer	Potential	Efficiency	Temp.
Time and Date			
4.010pH	169.3mV	98.8%	24.0°C A
	11:44 Jun 13, 2018		
7.010pH	-5.8mV	98.7%	23.9°C A
	11:42 Jun 13, 2018		
10.010pH	-180.7mV	98.7%	24.0°C A
	11:46 Jun 13, 2018		

GLP & Meter Information

Sample Name:
 Company Name:
 Operator Name:
 Electrode Name:
 Field 1:
 Field 2:
 Field 3:
 Titrator Software Version: v1.00
 Base Board Software Version: v1.00
 Pump 1 Software Version: v1.00
 Pump 2 Software Version: v1.00
 Stirrer 1 Software Version: v1.00
 Titrator Serial Number: TT180525011
 Analog Board1 Serial Number: AB180525005
 Analog Board2 Serial Number: AB180525006
 Pump 1 Serial Number: DP180525004
 Pump 2 Serial Number: DP180525007
 Stirrer 1 Serial Number: OS180524001
 Analog 1 Calibration Date: May 25, 2018
 Analog 2 Calibration Date: May 25, 2018

Method Parameters

Name: Neutralization w/ NaOH
 Method Revision: 3.0
 Analysis Type: Standard Titration

```

Analog Board:           Analog 2
Stirrer Configuration:
  Stirrer:              Stirrer 1
  Stirring Speed:      1400 RPM
Pump Configuration:
  Titrant pump:        Pump 1
Reagent Addition 1:    Disabled
Reagent Addition 2:    Disabled
Dosing Type:          Dynamic
  Min Vol:             0.050 mL
  Max Vol:             0.500 mL
  delta E:             20.000 mV
End Point Mode:       pH 1EQ point,1st Der
Recognition Options
  Threshold:           50 mV/mL
  Range:               NO
  Filtered Derivatives: NO
Pre-Titration Volume:  0.000 mL
Pre-Titration Stir Time: 0 sec
Measurement Mode:     Signal Stability
  delta E:             1.0 mV
  delta t:             2 sec
  Min wait:           2 sec
  Max wait:           15 sec
Electrode Type:       pH
Blank Option:         No Blank
Calculations:         Sample Calc. by Volume
Dilution Option:     Disabled
Titrant Name:         0.1N HaOH
Titrant Conc.:        0.1000 N (eq/L)
Analyte Size:         10.0000 mL
Analyte Entry:        Fixed
Maximum Titrant Volume: 20.000 mL
Potential Range:     -2000.0 to 2000.0 mV
Volume/Flow Rate:    25 mL / 50.0 mL/min
Signal Averaging:    1 Reading
Significant Figures:  XXXXXX
  
```

N (eq/L) --> meq/L

```

V eq 1000meq
-*--*-----
  L   eq
-----
mL   L
--*-----
  1000mL
  
```

V = volume dispensed in liters.
 0.100 eq/L -> titrant conc.
 10.000 mL -> sample volume

Nr	Volume [mL]	mV	pH	Graphic	Temp. [°C]	Time
0	0.000	274.4	2.219	0.0	24.9	A 00:00:00
1	0.050	274.4	2.220	1.0	25.0	A 00:00:07
2	0.100	274.4	2.220	0.0	25.0	A 00:00:10
3	0.200	274.3	2.222	-0.8	25.0	A 00:00:12
4	0.400	274.0	2.227	-1.6	25.0	A 00:00:15
5	0.800	273.2	2.241	-2.0	25.0	A 00:00:18
6	1.300	271.5	2.271	-3.4	25.0	A 00:00:24
7	1.800	269.5	2.304	-3.9	25.1	A 00:00:30
8	2.300	267.2	2.344	-4.7	25.1	A 00:00:37

9	2.800	264.4	2.393	-5.7	25.1	A	00:00:43
10	3.300	260.8	2.455	-7.2	25.1	A	00:00:50
11	3.800	256.1	2.535	-9.3	25.1	A	00:00:58
12	4.300	250.3	2.635	-11.7	25.1	A	00:01:05
13	4.800	241.9	2.779	-16.8	25.1	A	00:01:14
14	5.300	228.3	3.011	-27.2	25.1	A	00:01:23
15	5.800	193.0	3.614	-70.5	25.1	A	00:01:31
16	6.077	21.0	6.556	-620.0	25.1	A	00:01:48
17	6.128	-38.2	7.568	-1183.2	25.1	A	00:02:03
18	6.177	-123.6	9.031	-1708.0	25.1	A	00:02:19
19	6.227	-157.7	9.616	-682.8	25.1	A	00:02:28
20	6.278	-174.5	9.903	-335.8	25.1	A	00:02:35
21	6.339	-187.8	10.130	-215.9	25.1	A	00:02:42

Titration Results

Method Name: Neutralization w/ NaOH
 Time & Date: 15:01 Jun 13, 2018
 Analyte Size: 10.0000 mL
 End Point Volume: 6.144 mL
 pH Equivalence Point: 8.063
 Result: 61.444 meq/L
 Initial & Final pH: 2.219 to 10.130
 Titration Duration: 2:42 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

HI932

AUTOMATIC POTENTIOMETRIC TITRATOR



INSTRUCTION MANUAL



**Dear
Customer,**

Thank you for choosing a Hanna Instruments product.

Please read this instruction manual carefully before using this instrument. This manual will provide you with the necessary information for the correct use of this instrument, as well as a precise idea of its versatility.

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com or view our worldwide contact list for a Hanna Instruments representative near you at www.hannainst.com.

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CHAPTER 2. SETUP
CHAPTER 3. USER INTERFACE
CHAPTER 4. GENERAL OPTIONS
CHAPTER 5. TITRATION METHODS
CHAPTER 6. TITRATION / DIRECT READING MODE
CHAPTER 7. pH MODE
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CHAPTER 10. AUXILIARY FUNCTIONS
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RECOMMENDATIONS FOR USERS
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1. INTRODUCTION

HI932 is an automatic potentiometric titrator with high accuracy, great flexibility and repeatability.

The titrator is designed to perform a variety of potentiometric titrations, allowing the user to obtain both good results and high-speed analysis.

The main attributes of the HI932 titrator are:

- Small footprint, requires minimal bench space
- Casing made with strong, chemically resistant plastic
- Flexible electrode holder supports up to 3 electrodes, 4 dispensing tubes, 1 temperature sensor and removable stirrer
- Electrode holder positions electrodes in the center of beaker, allowing for smaller sample sizes
- Integrated Peristaltic Pump available for reagent addition
- Support for 100 titration methods and 30 autosampler sequences
- User-customizable reports
- Integrated research grade pH/mV/ISE meter
- Clearly displayed warning and error messages

This manual provides information regarding installation and functionality of the titrator and refined operation suggestions. Before using the titrator, it is recommended you become familiar with its various features and functionality.

CHAPTER 2. SETUP

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2.1. UNPACKING

Remove the titrator and accessories from the packaging and examine it carefully to make sure that no damage has occurred during shipping. Notify your nearest Hanna Service Center if damage is observed.

Each [HI932](#) potentiometric titrator is supplied with:

ITEM	QUANTITY
Titrator	1 pc
Pump Assembly	1 pc
Burette Assembly	1 pc
• Burette (with 25 mL syringe)	
• Aspiration Tube with Fitting and Protection Tube	
• Dispensing Tube with Normal Dispensing Tip, Fitting, Protection Tube and Tube Guide	
• Tube Locks	
• Tool for Burette Cap Removal	
• Light Spectrum Protection Screen	
Electrodes Holder and Stirrer	1 pc
• Stirrer Holder	
• Overhead Stirrer	
• Propellers (3 pcs)	
• Support Rod	
Burette Blank Support	1 pc
Pump and Burette Locking Screws with Plastic Head	2 pcs
Temperature Sensor	1 pc
Shorting Cap	1 pc
Power Adapter	1 pc
USB Cable	1 pc
Instruction Manual	1 pc
USB Memory Stick	1 pc
HI900 PC Application (Installation Kit on USB Stick)	1 pc
Quality Certificate	1 pc

See [APPENDIX 2](#), titrator components section for pictures.

If any of the items are missing or damaged, please contact your sales representative.

Note: *Save all packing materials until you are sure that the instrument functions correctly. Any damaged or defective items must be returned in their original packing materials together with the supplied accessories.*

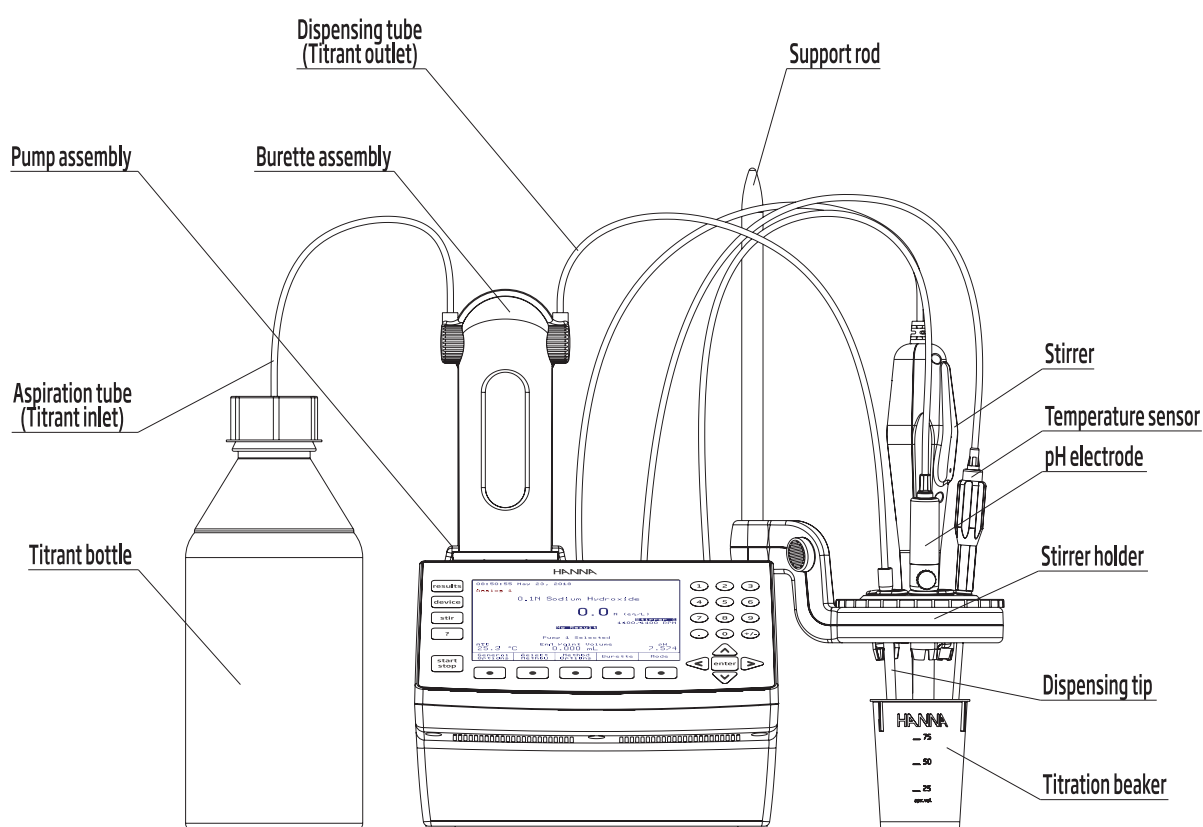
2.2. SAFETY MEASURES

The following safety measures must be followed:

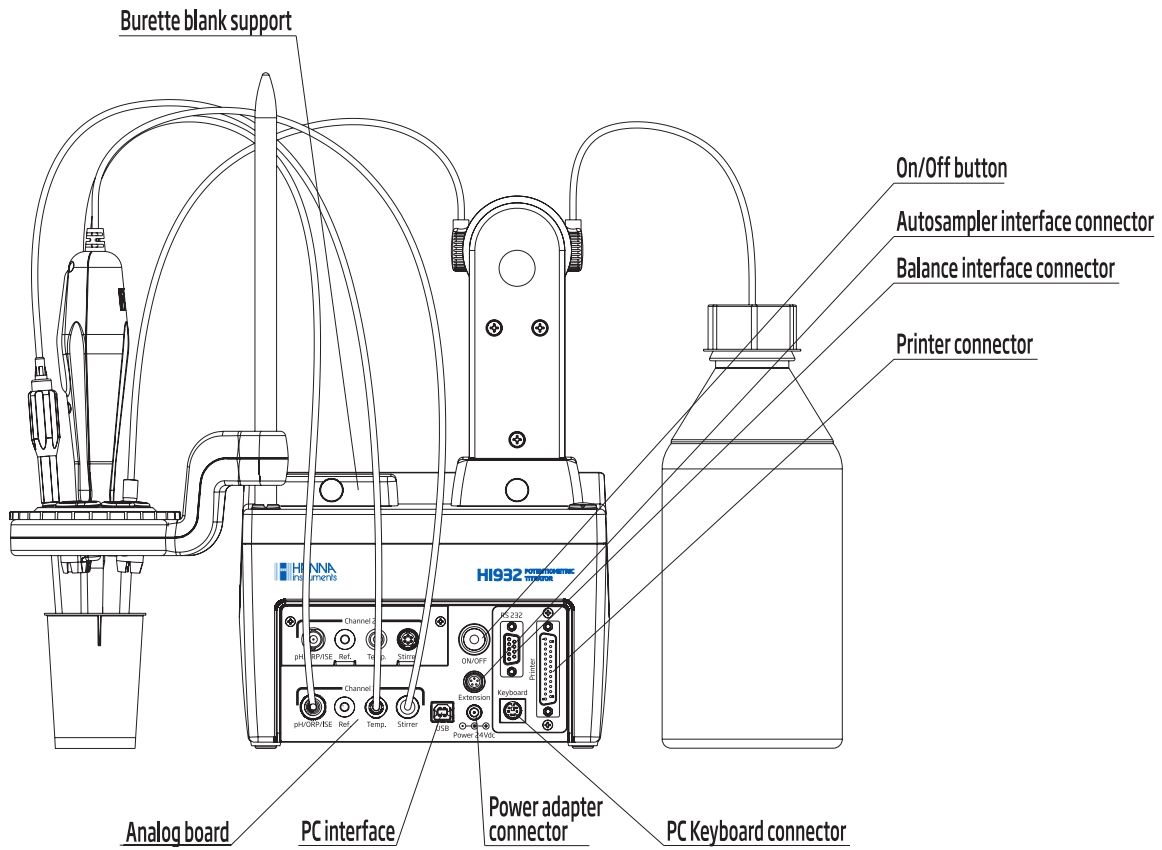
1. Never connect or disconnect the pump assembly with the titrator turned on.
2. Verify that the burette and the attached tubing are assembled correctly (see [Maintenance, Peripherals, Burette Maintenance](#) for more details).
3. Always check that the titrant bottle and the titration beaker are on a flat surface.
4. Always wipe up spills and splashes immediately.
5. Avoid the following environmental working conditions:
 - Severe vibrations
 - Direct sunlight
 - Atmospheric relative humidity above 95% non-condensing
 - Environment temperatures below 10°C and above 40°C
 - Explosion hazards
6. Have the titrator serviced only by qualified service personnel.

2.3. INSTALLATION

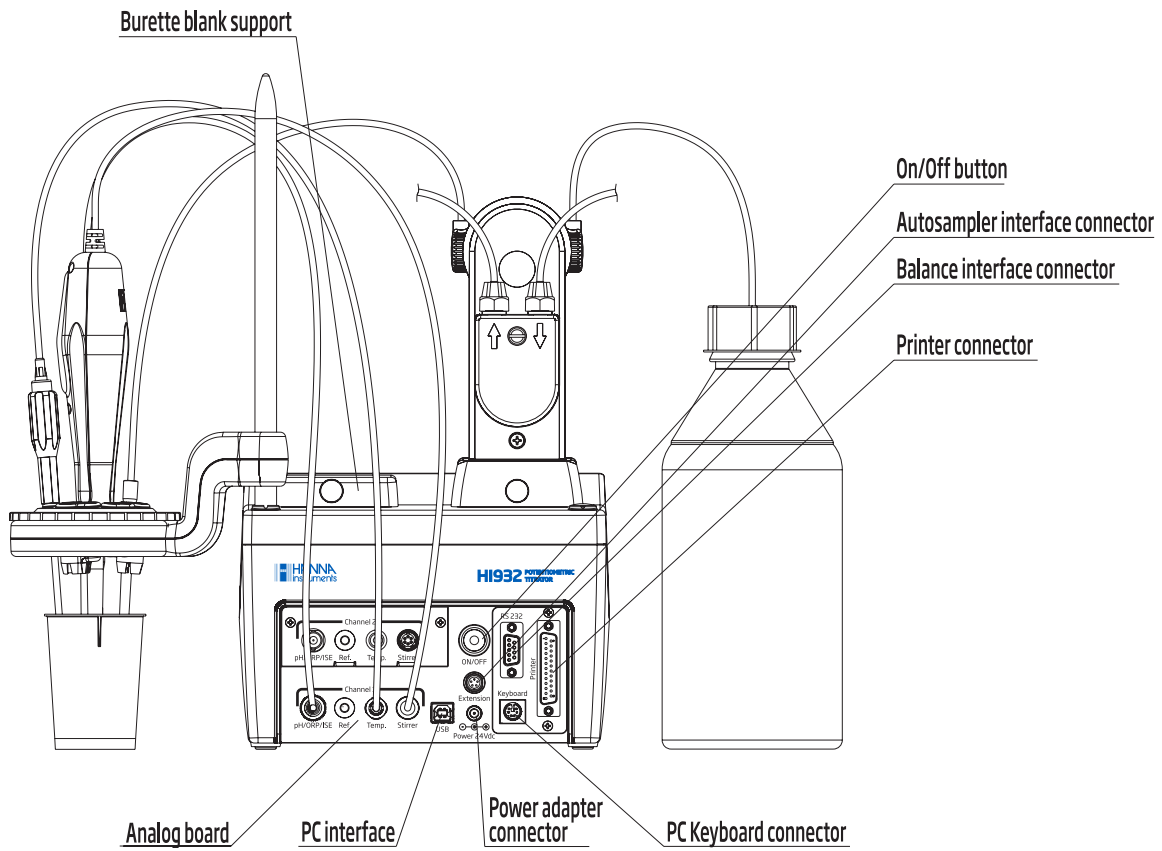
2.3.1. TITRATOR FRONT VIEW



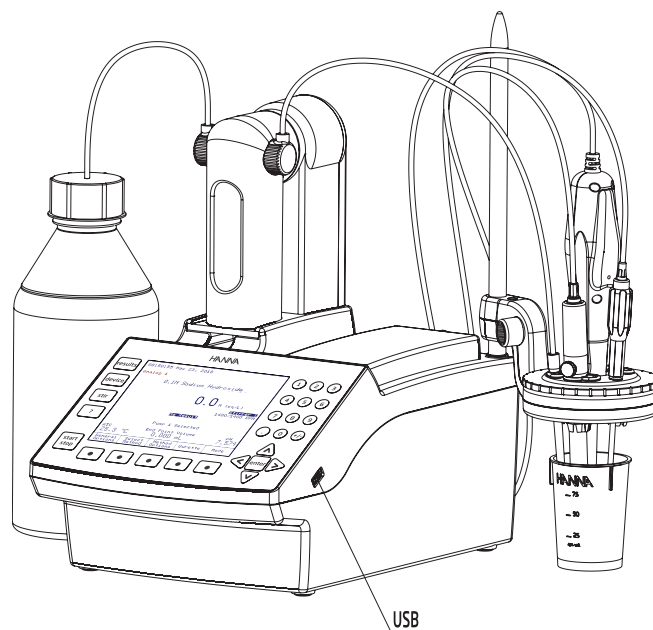
2.3.2. TITRATOR REAR VIEW



2.3.3. TITRATOR REAR VIEW WITH PERISTALTIC PUMP



2.3.4. TITRATOR RIGHT-SIDE VIEW



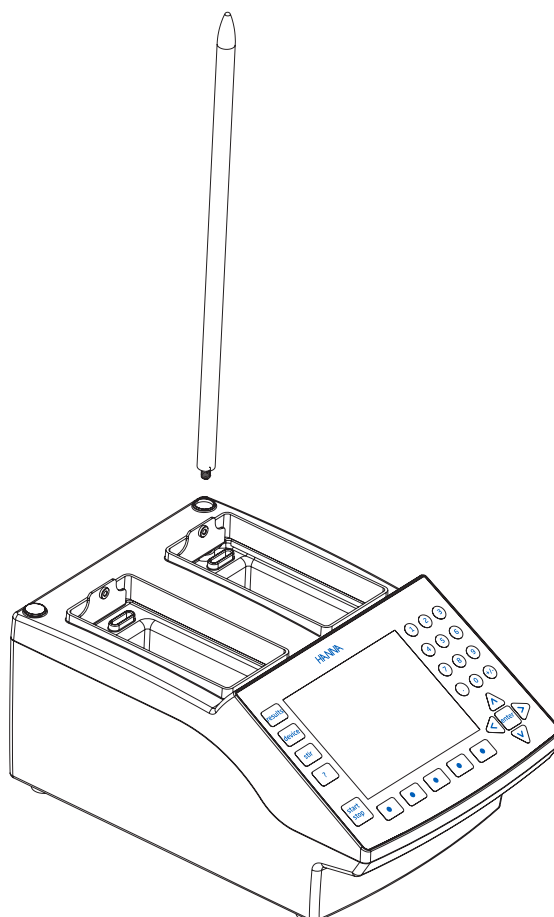
2.3.5. TITRATOR ASSEMBLY

Note: Assembly operations must be completed before connecting the Titrator to the power supply!

2.3.5.1. ASSEMBLING STIRRER AND ELECTRODES HOLDER

To assemble the electrode holder and support rod:

- Remove protective cap from titrator case
- Insert the support rod into the titrator case and turn it clock-wise to secure it in place

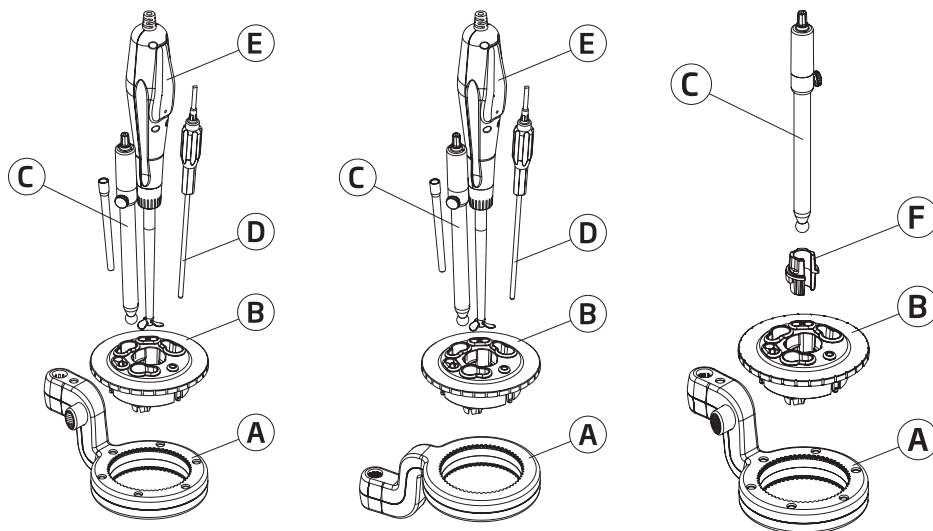


2.3.5.2. ATTACHING STIRRER AND ELECTRODES

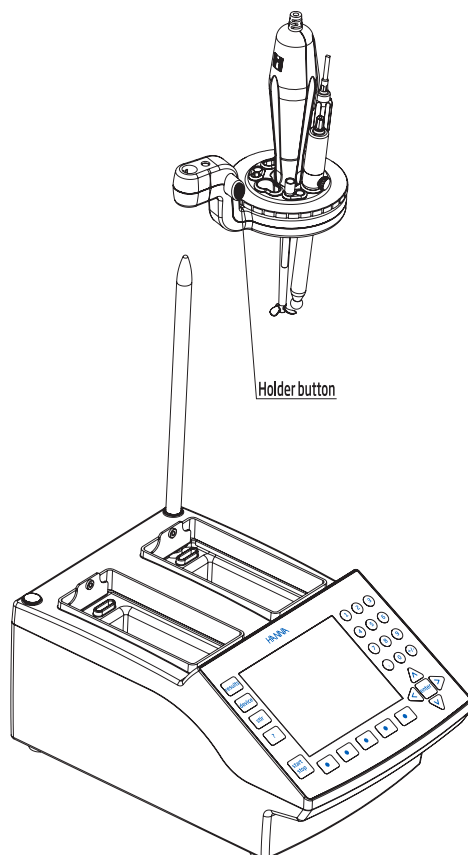
To attach the stirrer to the titrator, follow these steps:

- Place the electrodes holder (B) in the stirrer support housing (A). Stirrer support housing can be inverted if necessary.
- Insert electrode (C), temperature sensor (D) and stirrer (E) into the dedicated holes in the electrode holder. Push them until they are in stable position.

Note: For small sample sizes, use the electrode adapter (F) in the center of the holder.



- Slide the electrode holder into the support rod and set the desired height using the holder button.

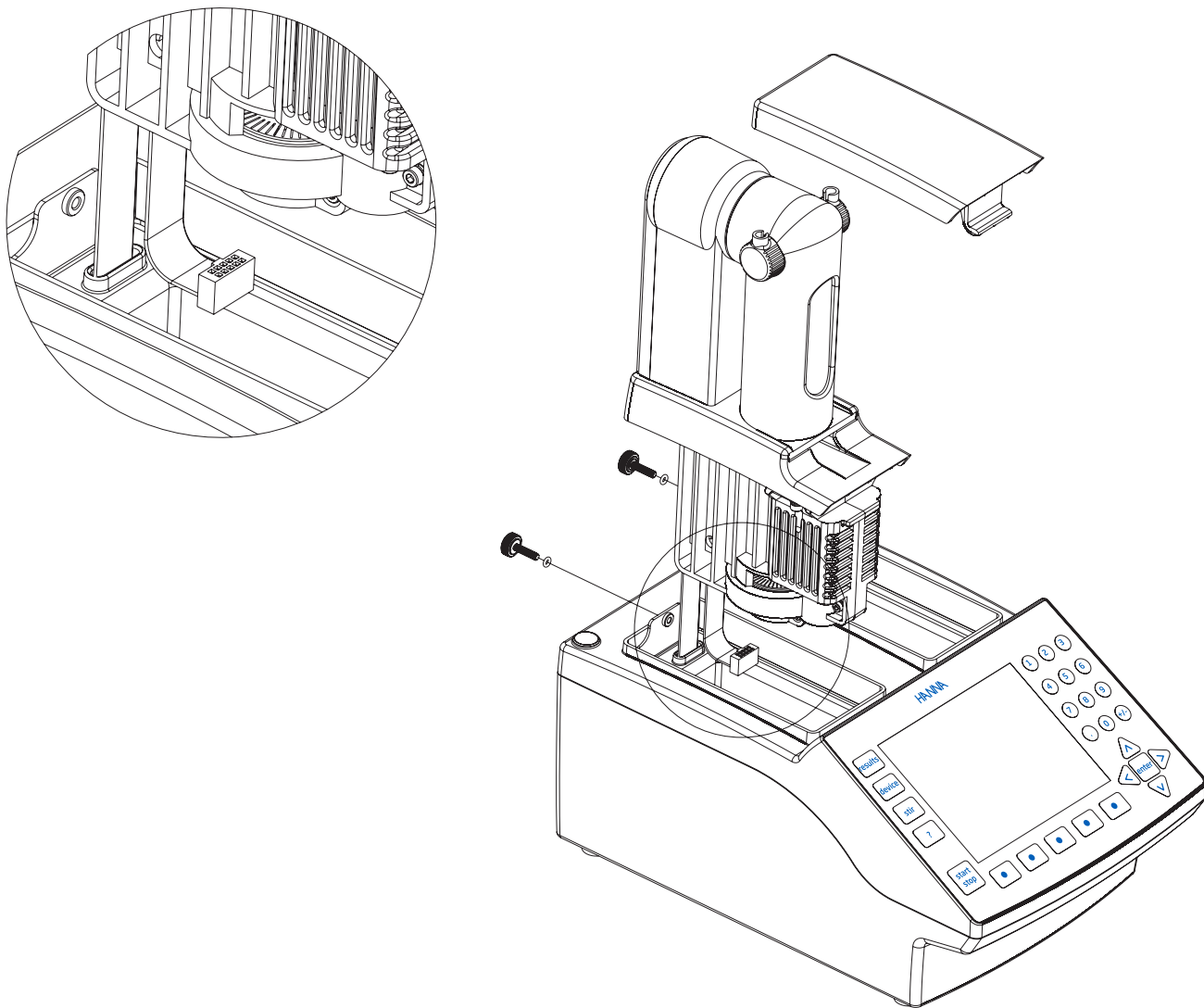


2.3.5.3. CONNECTING THE PUMP

To connect the pump, follow these steps:

- Retrieve the pump cable from inside the bay. The pump 1 connector is located in the left bay and pump 2 in the right bay.
- Connect the cable to the pump as shown below. The pump connector is located on the bottom of the pump.
- Lower the pump into the titrator, then slide it towards the front of the titrator case until it is firmly latched.
- Secure the pump with the locking screw.

This procedure can be repeated to connect a second pump.



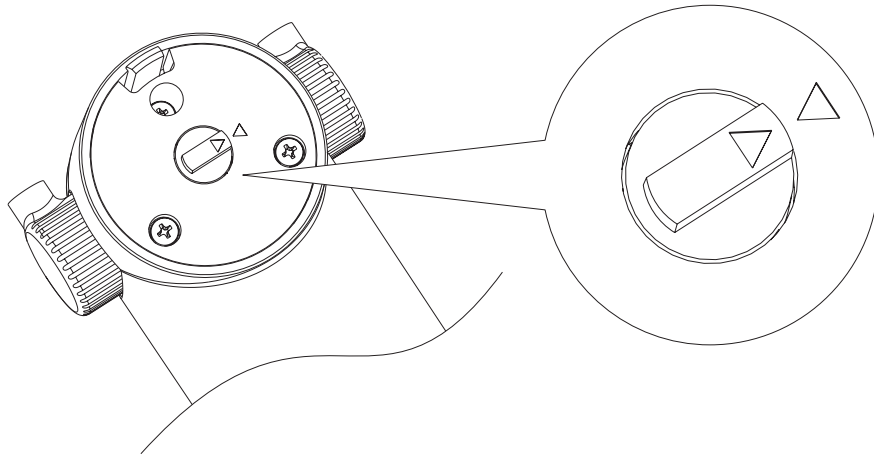
2.3.5.4. ATTACHING BURETTE BLANK SUPPORT

To attach the burette blank support, follow these steps:

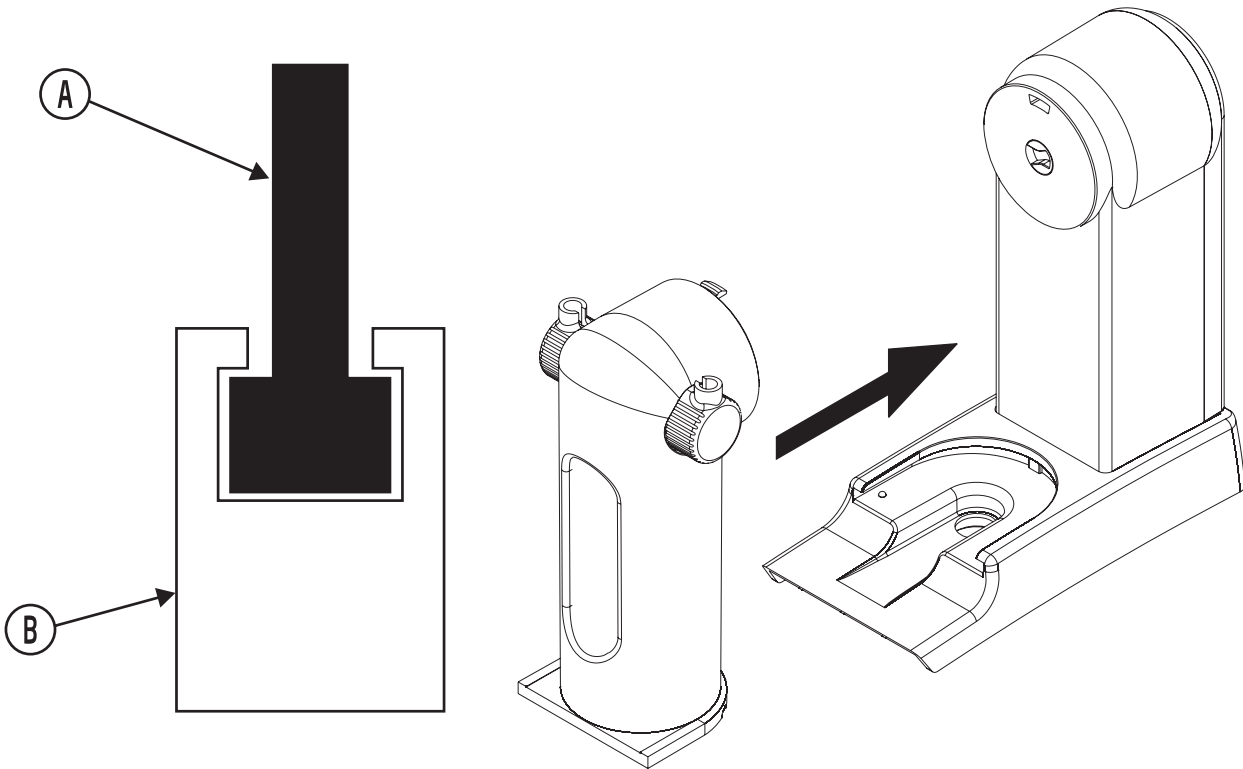
- Insert burette blank support into the bay. Lower the burette blank support into the titrator, then slide it towards the front of the titrator case until it is firmly latched.
- Secure the burette blank support with the locking screw.

2.3.5.5. ATTACHING THE BURETTE

Make sure that the mark from the valve actuating cap and from the burette body are aligned.



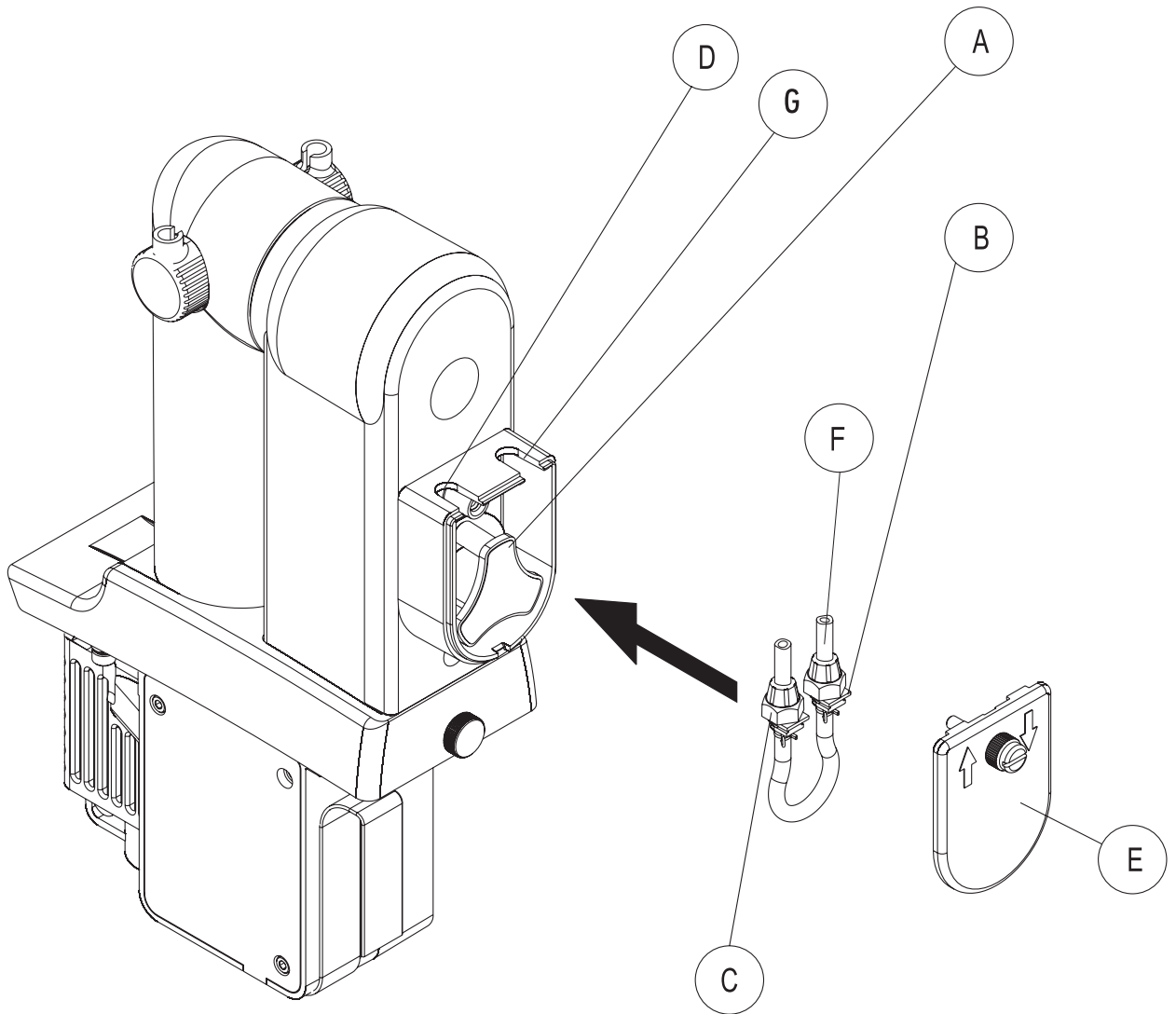
While ensuring the correct coupling between the syringe plunger (A) and the pump piston (B), slide the burette into the support on the burette pump.



2.3.5.6. CONNECTING PERISTALTIC PUMP TUBING

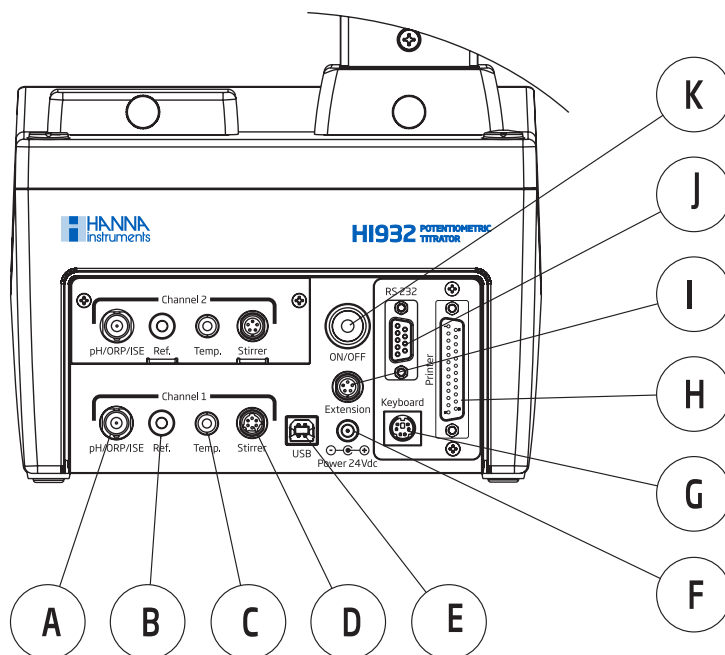
To attach the pump tubing to the burette pump with the built-in peristaltic pump:

- Use a screw driver to remove the plastic cover (E) from the pump.
- Remove the blue tube connectors (F).
- Insert the roller tube (C) into the left side of the holder (D). The fitting on the top of the roller tube will sit in the top of the housing.
- Manually rotate the pump (A) counter-clock wise until the tubing it mounted on the pump.
- Insert the roller tube (B) into the right side of the holder (G). The fitting on the top of the roller tube will sit in the top of the housing.
- Attach aspiration and dispensing tubing to the roller tubing and replace the blue tube connectors (F).
- Replace the plastic cover (E).



2.3.5.7. ELECTRICAL CONNECTIONS

- Connect the electrode to the BNC connector (A).
- Connect the temperature sensor to the RCA connector (C).
- Connect the stirrer to the MINI-DIN connector (D).
- Connect the power adapter cable to the power input connector (F).



Nr	Function	Type of Connector
A	Connection for pH, ORP, ISE half-cell and ISE combination electrodes	BNC Socket
B	Reference electrode	Ø 4 mm Banana Socket
C	Temperature sensor	RCA Socket
D	Stirrer	6-pin Connector
E	USB interface	USB Standard B
F	Power input connector (24VDC)	DC Power Jack Connector
G	External PC keyboard	6-pin Mini DIN (Standard PS2)
H	Printer	DB-25 Socket
I	Connector for autosampler interface	5-pin Connector
J	RS232 interface (Balance Interface)	DB-9 Socket
K	Power switch	

CHAPTER 3. USER INTERFACE

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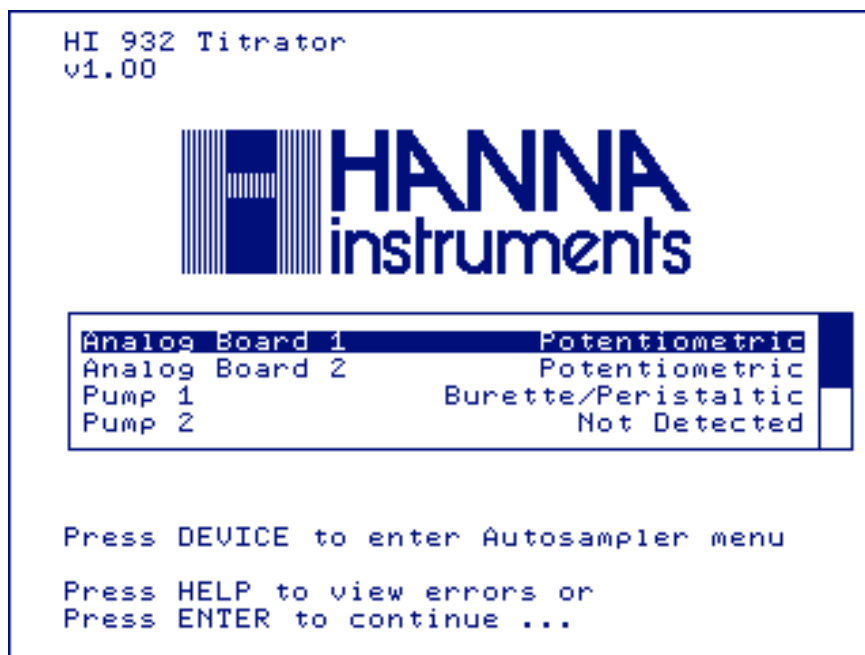
3.3.3. ENTERING TEXT 3-7

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3.1. START UP

Once the instrument is assembled and installed, follow the steps below to start the titrator:

- Connect the titrator to a power outlet with the supplied power adapter.
- Turn on the titrator from the power switch located on the back of the instrument.
- Wait until the titrator finishes the initialization process.
- Press  when prompted or wait a few seconds for titrator to start.



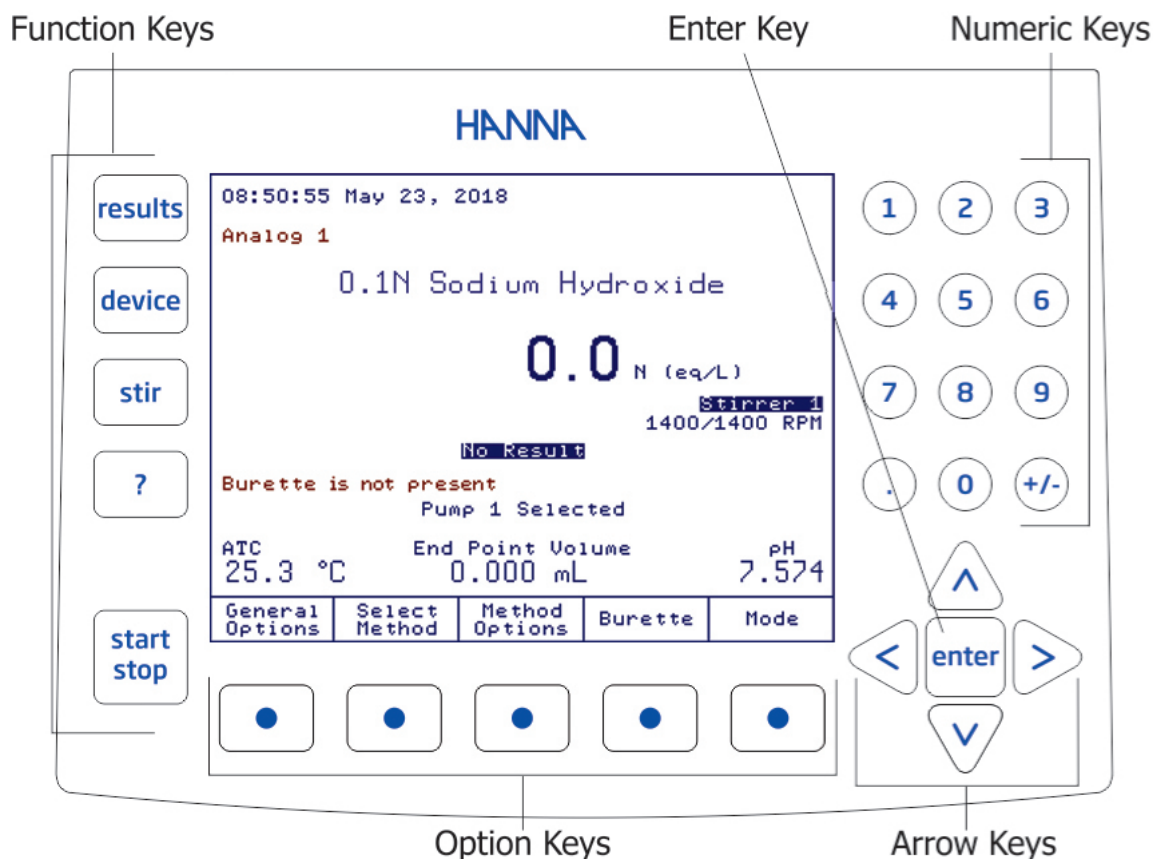
Note: All the performed initialization processes must be successfully completed. If one of the initialization processes fails, restart the titrator. If the problem persists contact your nearest Hanna Service Center.

3.2. DESCRIPTION

This chapter describes the basic principles of navigating through the user interface, selecting fields and entering values from the keypad.






3.2.1. KEYPAD

The titrator's keypad is grouped into five categories, as follows:



3.2.1.1. FUNCTION KEYS

If one of these keys is pressed, the associated function is immediately performed. Some of the keys are active only in specific screens:

-  Starts or Stops a titration
-  Turns the selected stirrer On and Off
-  Access the Autosampler
-  Access the Data Parameters Menu (reports, GLP, meter information, report setup)
-  Displays Contextual Help

3.2.1.2. OPTION KEYS

These keys are assigned to the virtual keys on the display. Their functions are listed in the boxes above the buttons and vary depending on the displayed screen.

An underlined virtual key can also be activated by pressing .

3.2.1.3. ARROW KEYS

These keys have the following functions:

- Move the on-screen cursor.
- Increase and decrease the stirrer speed and other settings.
- In the alphanumeric screen, to select a character.
- Navigate through menu options.

3.2.1.4. NUMERIC KEYS

Keys 0 to 9 Used for numeric entries.

+/- Toggles between positive and negative values.

. Decimal point.

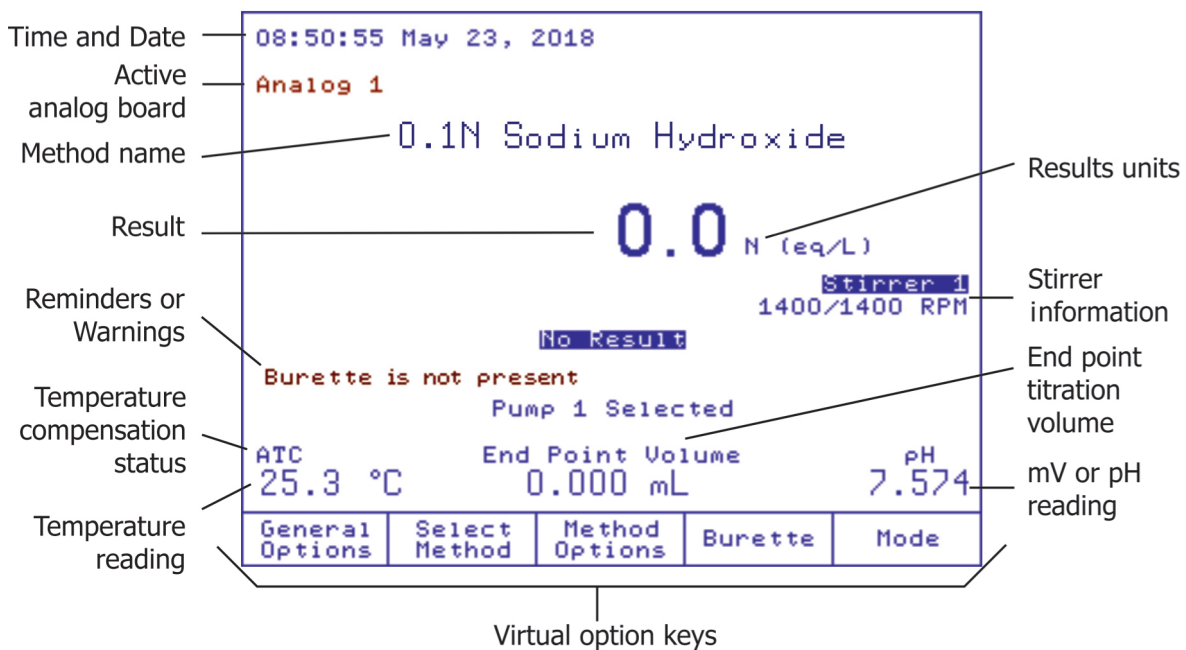
3.2.1.5. ENTER KEY

This key has the following functions:

- Accept alphanumeric data entry.
- Executes the default (underlined) virtual option key.

3.2.2. DISPLAY

The titrator has a large color graphical display. The main screen is shown below with short explanations of the screen segments.



The user interface contains several screens. For each titrator function, one or more screens are used.

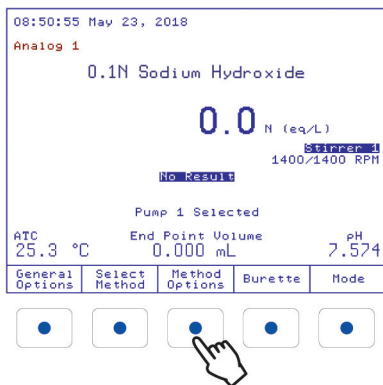
3.2.3. THE MAIN SCREEN

After start up and initialization, the first screen displayed is the main screen.

Main screen fields:

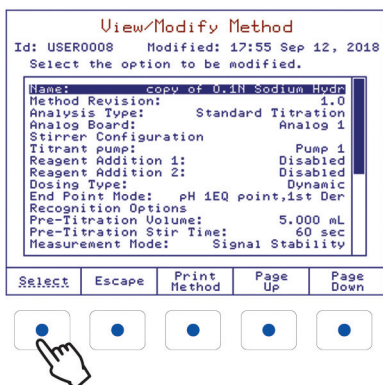
Method name:	Displays the name of the selected method.
Time and date:	Displays the current date and time.
Temperature reading:	Displays the measured temperature.
ATC:	Automatic temperature compensation
Manual:	Manual temperature compensation
Manual :	Temperature probe is not connected, manual temperature compensation
Stirrer information:	The selected stirrer and actual/set stirrer speed is displayed in RPM. When stirrer is off, the stirrer information is not displayed.
End point volume:	Displays the volume delivered to reach the titration end point. When no titration has been performed, the displayed volume is "0.000 mL".
Result:	Displays the titration result or the direct reading measurement.
mV or pH reading:	Displays the current readings. The reading will be in mV or pH.
mV:	Indicates actual potential reading.
rel mV:	Indicates relative potential reading.
pH:	Indicates actual pH value.
Titration status:	Displays the status of the selected titration. No Results is displayed when a titration has not been performed.
Reminders:	Indicates when a task needs to be performed and displays error
Pump 1 selected:	Displays the active pump.
Analog 1:	When two analog boards are present, the active one is shown.

3.3. MENU NAVIGATION



3.3.1. SELECTING AN OPTION

To select an option, simply press the option key below the virtual key. For example, to access the **Method Options** screen press the option key below it.



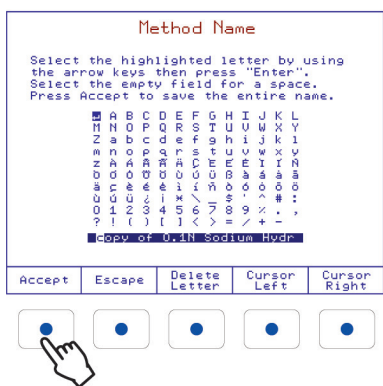
3.3.2. SELECTING A MENU ITEM

To select an item from the menu screen, use the arrow keys and to move the cursor.

When the menu is larger than the display, a scroll bar is active on the right side.

The and keys can be used to scroll through the pages.

To activate the selected menu item, press or .



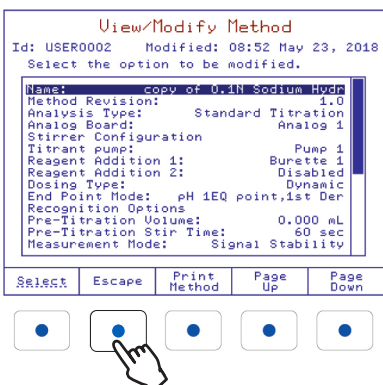
3.3.3. ENTERING TEXT

To enter text in an alphanumeric input box, first erase the previous text by using .

To enter a letter, highlight it using the arrow keys then press . Use the same procedure to enter the whole name.

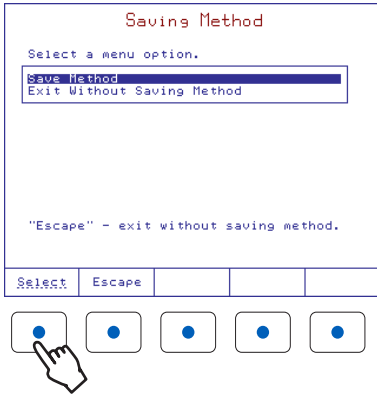
For editing, use the and keys.

When editing is complete, press .



The method name will be updated and displayed in the name field of the **View/Modify Method** screen.

When all the desired parameters have been set, press .




3.3.4. SAVING MODIFICATIONS

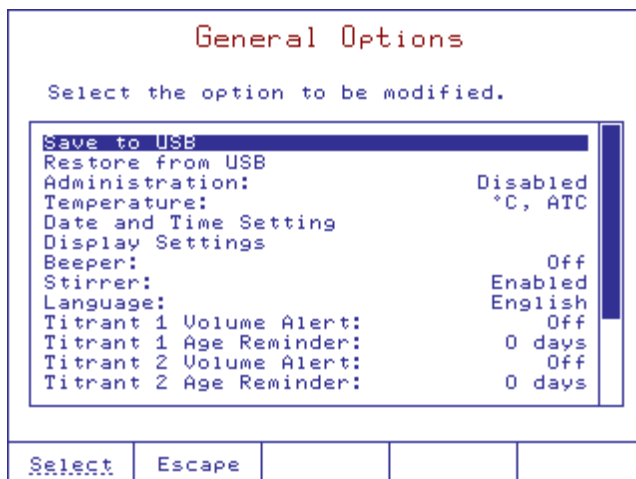
The **Saving Method** screen allows the user to save the modifications. To exit from **Saving Method** screen without saving, press `Escape` or highlight the *Exit Without Saving Method* option and then press `Select`. To save the modifications highlight the *Save Method* option and then press `Select`.

Note: To access the contextual help menu, press `?` at any time. Help is related to the displayed screen. Press `Escape` or `?` to return to the previous screen.

CHAPTER 4. GENERAL OPTIONS

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The **General Options** screen gives access to options that are not directly related to the titration process or pH/mV/ISE measurement. To access this screen, press  from the main screen.



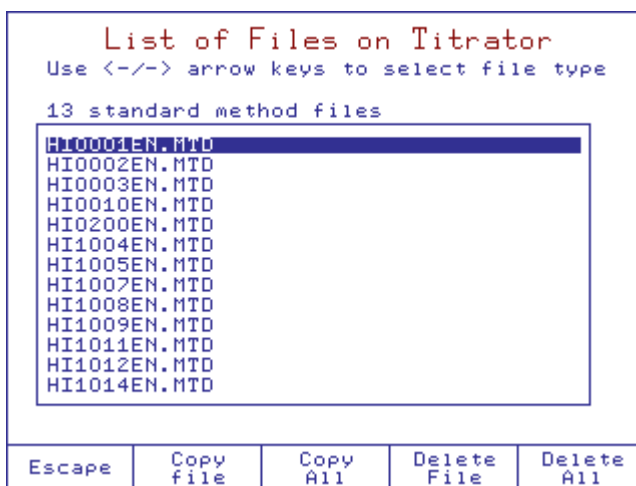
4.1. SAVE FILES TO USB STORAGE DEVICE

This option allows the user to save files from the titrator to a USB storage device.

On the titrator, the available file types are:

- Standard Method Files -HIXXXYY.MTD (e.g.: HI0001EN.MTD, HI1004EN.MTD)
- User Method Files -USERXXX.MTD (e.g.: USER0001.MTD)
- Report Files -Ti_XXXXX.RPT, mV_XXXXX.RPT, pH_XXXXX.RPT, ISEXXXXX.RPT, mVrXXXXX.RPT
(e.g.: Ti_00001.RPT, mV_00001.RPT, pH_00001.RPT, ISE00001.RPT, mVr00001.RPT)

Use the  and  keys to select the file type. The number of files and the file name on the titrator will be displayed.



The option keys allow the following operations:

- Delete File Deletes the highlighted file.
- Delete All Deletes all currently displayed files.
- Copy File Copies the highlighted file from titrator to a USB storage device.
- Copy All Copies all currently displayed files from titrator to a USB storage device.
- Escape Returns to the **General Options** screen.

The status of the transfer (“Successful”/“Unsuccessful”) and the file name of the currently processed file are displayed during copying or deleting.

Note: The saved files will be stored on the USB key in the **HI932** folder, as follows:

- Methods: **USB Drive:\HI932\Methods*.mtd**
- Reports: **USB Drive:\HI932\Reports*.rpt**

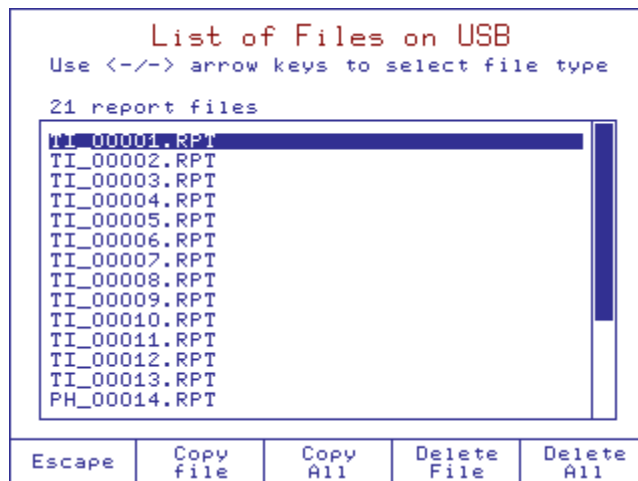
4.2. RESTORE FILES FROM USB STORAGE DEVICE

This screen allows the user to transfer files from the USB storage device to the titrator.

- Standard Method Files - **HIXXXYY.MTD** (e.g.: HI0001EN.MTD, HI1004EN.MTD)
- User Method Files - **USERXXXX.MTD** (e.g.: USER0001.MTD)
- Report Files - **Ti_XXXXX.RPT, mV_XXXXX.RPT, pH_XXXXX.RPT, ISEXXXXX.RPT, mVrXXXXX.RPT** (e.g.: Ti_00001.RPT, mV_00001.RPT, pH_00001.RPT, ISE00001.RPT, mVr00001.RPT)

Use the < and > keys to select the file type.

The number of files and the file name will be displayed.



The option keys allow the following operations:

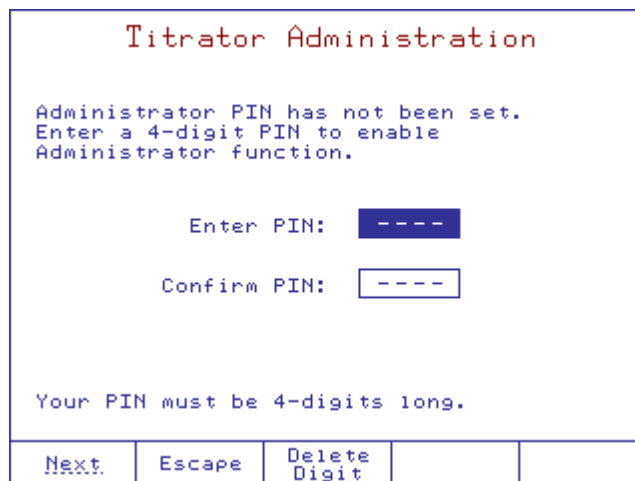
- Delete File** Deletes the highlighted file from the USB storage device.
- Delete All** Deletes all currently displayed files from the USB storage device.
- Copy File** Copies the highlighted file from the USB storage device to the titrator.
- Copy All** Copies all currently displayed files from the USB storage device to the titrator.
- Escape** Returns to the **General Options** screen.

Note: In order to restore files from a USB key, please ensure that the methods and/or reports you wish to transfer to the titrator are in the correct folder:

- Methods: **USB Drive:\HI932\Methods*.mtd**
- Reports: **USB Drive:\HI932\Reports*.rpt**

4.3. ADMINISTRATION

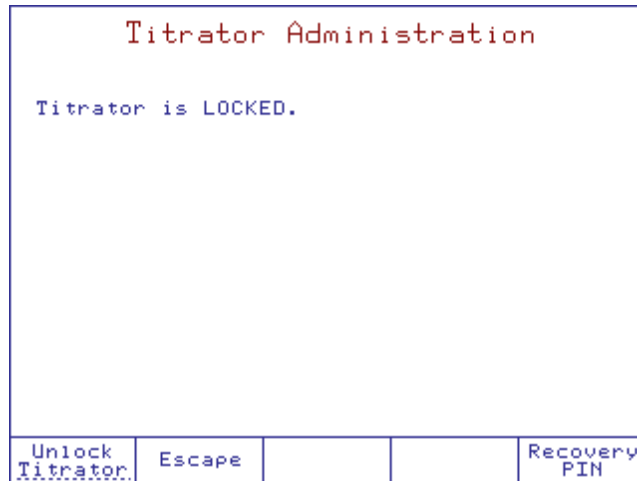
A 4-digit numeric PIN can be set to prevent unauthorized changes from being made. When the user enters administration and a pin has not been set, the user will be prompted to enter a new PIN.



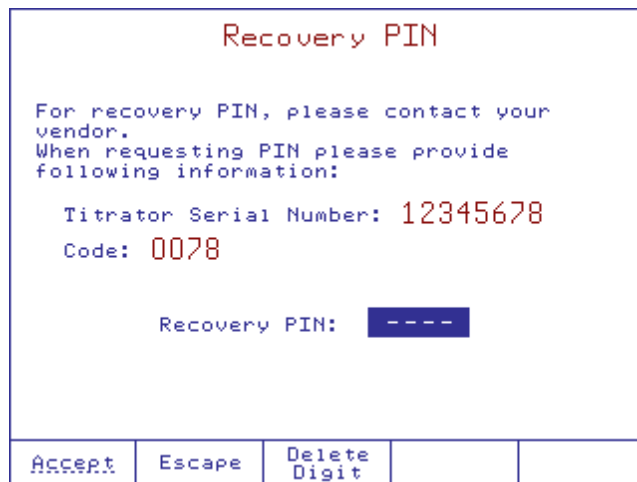
Once a PIN has been set, the titrator can be locked. When a titrator is locked, the users cannot modify methods or delete reports. Basic functions are still available (review reports, save to USB, etc.).



To return to administrator mode, the titrator can be unlocked by entering the PIN.

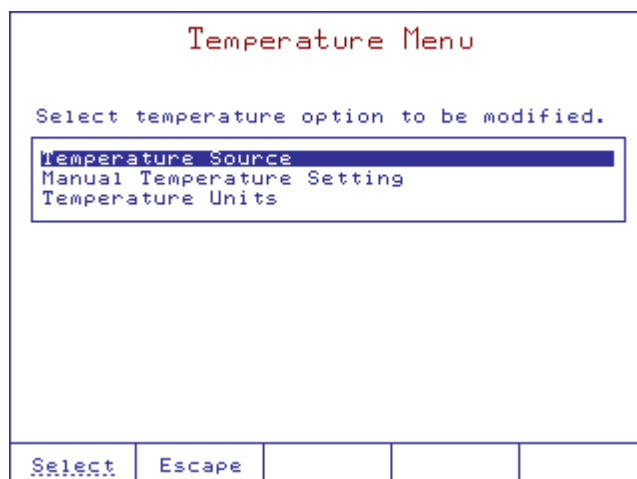


If the PIN is lost or forgotten, press recovery pin and contact technical support to supply the required information.



4.4. TEMPERATURE

The **Temperature Menu** allows access to all of the settings related to temperature.



4.4.1. TEMPERATURE SOURCE

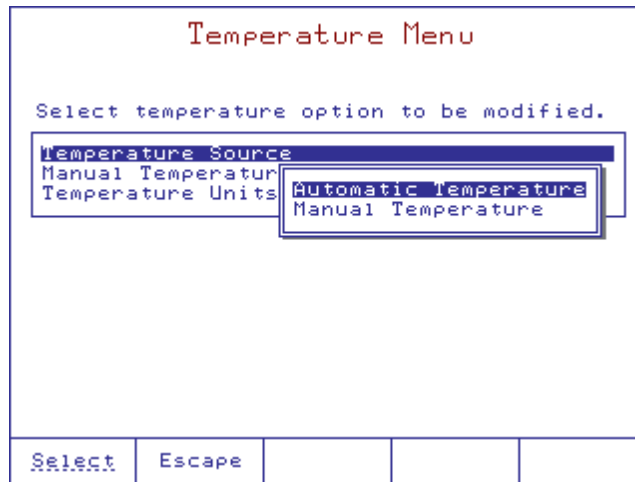
Option: Automatic Temperature or Manual Temperature

Select the temperature source used for temperature compensation.

When Automatic Temperature Compensation is selected, "ATC" is displayed on the main screen and the temperature is read by the temperature probe.

When Manual Temperature is selected, "Manual" is displayed on the main screen and a preset temperature value is used for temperature compensation.

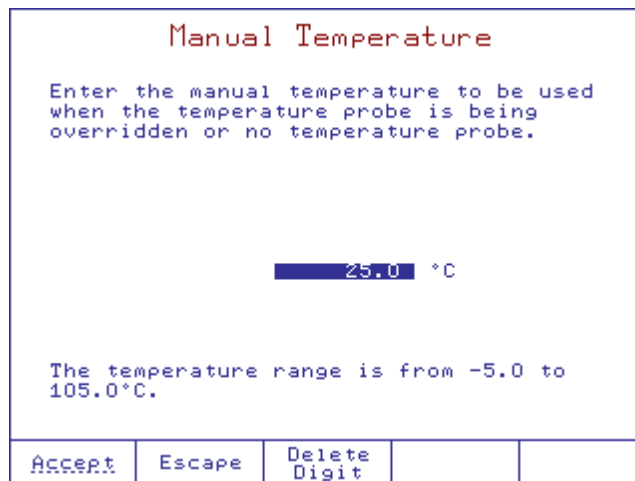
Note: The selected temperature source will be indicated in the report files: A for Automatic and M for Manual.



4.4.2. MANUAL TEMPERATURE SETTING

Option: -5.0 to 105.0 °C (23.0 to 221.0 °F, 268.2 to 378.2 K)

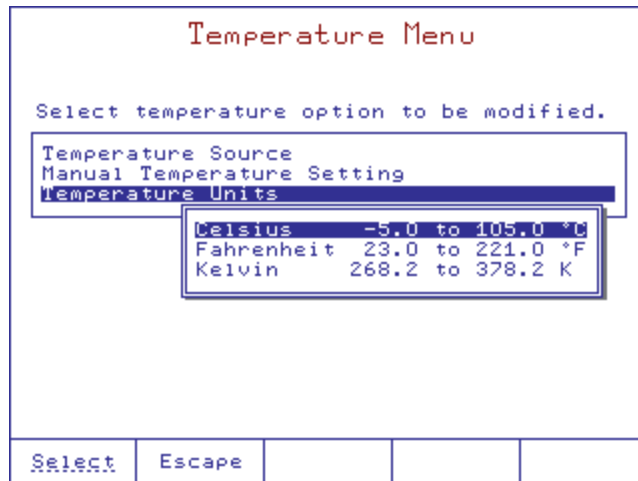
If the temperature probe is not connected, the user can manually set the temperature used by the titrator for compensation.



4.4.3. TEMPERATURE UNITS

Option: °C, °F or K

The temperature ranges are as displayed in the **Temperature Units** screen.





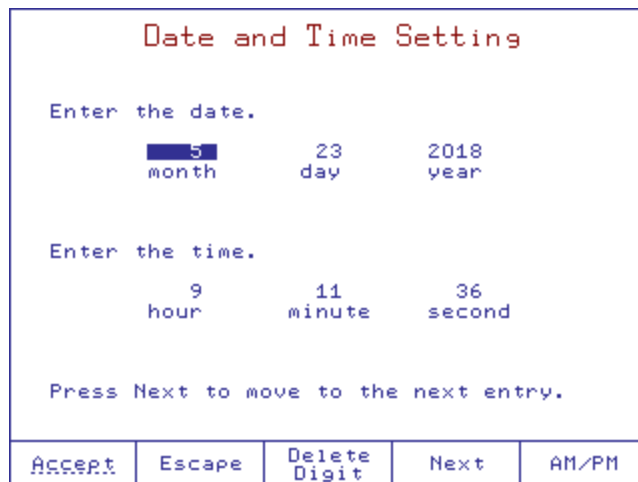
4.5. DATE AND TIME SETTING

This screen allows the user to set the date and time.

Use the  and  keys or the numeric keys to modify the date and time.

Press  to move the cursor to the next field.

Press  or  to change the time format.



4.6. DISPLAY SETTINGS

This screen allows the user to customize the display settings.

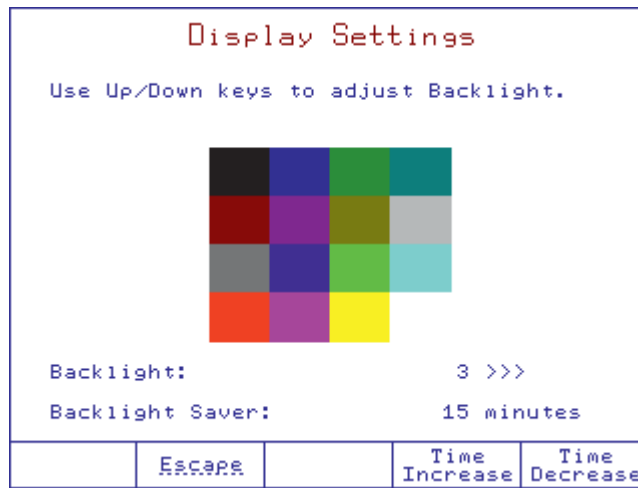
Option Keys:

 Increases the backlight saver time interval

 Decreases the backlight saver time interval

The backlight intensity can be adjusted using  and  keys.

There are 8 levels of backlight intensity, ranging from 0 to 7.

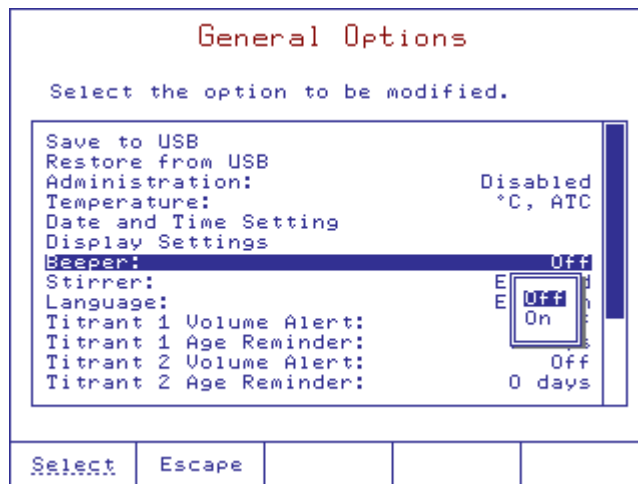


A color palette is displayed in the center of the screen allowing an easy selection of the appropriate backlight intensity. The backlight saver option protects the display during standby periods when no keys have been pressed for a set amount of time. If the display backlight is off, any keystroke will activate the backlight without performing any action. The range for the backlight saver timer is 1 to 60 minutes. To disable the backlight saver, increase the time to the maximum allowed. The "Off" indication will appear.

4.7. BEEPER

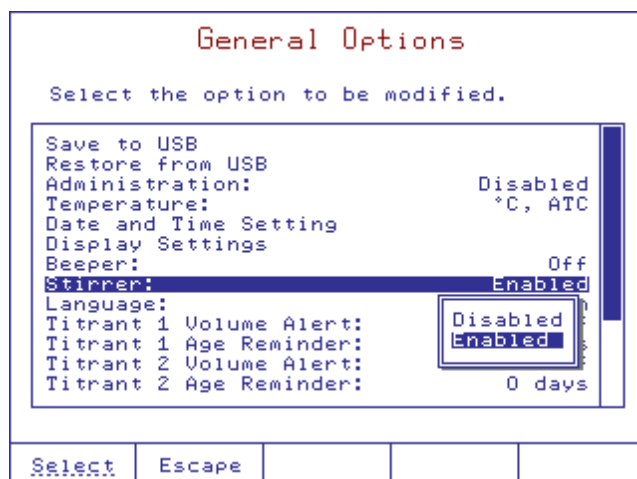
Option: On or Off

If enabled (on) an audible alert will sound after a titration is completed, when an invalid key is pressed or when a critical error occurs during titration.



4.8. STIRRER

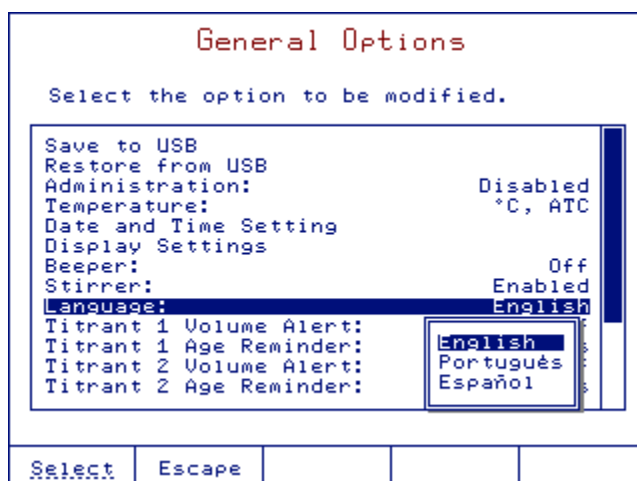
Option: Enabled or Disabled



The stirrer can be disabled in individual titration method, if necessary.

4.9. LANGUAGE

Option: English, Português, or Español

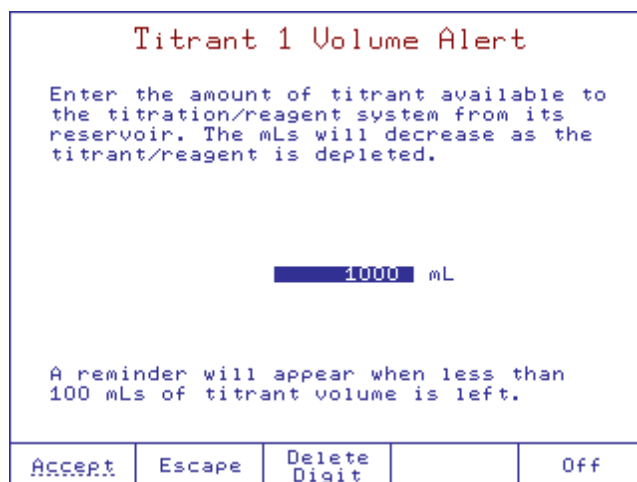


4.10. TOTAL VOLUME ALERT

Option: Off, 0 to 10000 mL

This screen allows a programmable reminder to appear when the titrant reservoir is below 100 mL. The titrant volume will decrease as the titrant is used.

After the new titrant volume has been entered in the **Total Volume Alert** screen, a warning message appears on the main screen reminding the user re-standardize the titrant.



4.11. TITRANT AGE REMINDER

Option: Off, 0 to 31 days

A programmable reminder will appear when it is time to verify the titrant concentration or to change the titrant.

<p style="color: red;">Titrant 1 Age Reminder</p> <p>Enter the number of days to pass since the last Titr. Vol. updating or the last Start pressing, whereafter the reminder appears.</p> <p style="text-align: center;">30 days</p> <p>The range is from 0 to 31 days.</p>				
Start	Escape	Delete Digit		Off

4.12. USB LINK WITH PC

In order to use this feature, the USB cable needs to be connected from the titrator to the PC. Make sure that **HI900** PC application is running on the PC.

<p style="color: red;">USB Link with PC</p> <p style="text-align: center;">Inactive</p> <p style="text-align: center;">Speed 19200</p>				
	Escape			

“Active/Inactive”: shows the status of the USB link with the PC.

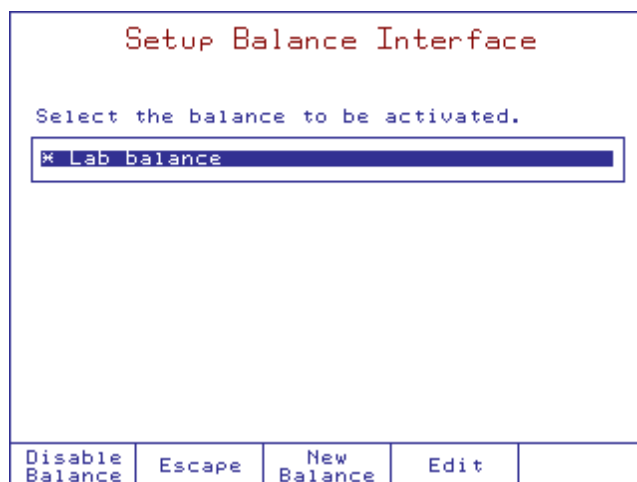
“Active” means that the titrator is using the USB communication with the PC and not with another device.

“Ready” shows that the titrator is able to communicate with the PC.

During transfer of any information between the PC and the titrator, “Transmit” and information about the percentage of current file already transferred are displayed.

4.13. SETUP BALANCE INTERFACE

This screen allows the users to connect an analytical balance for automatic acquisition of sample mass prior to titration or standardization.



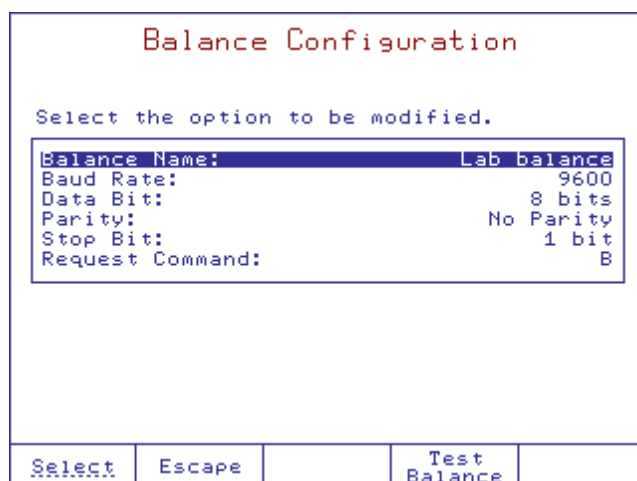
The balance is connected to the titrator via RS 232 interface.

Press to add a new balance to the list.

Press to enable the selected balance.

Press to disable the selected balance (automatic weight acquisition will be not available).

Press to customize the name and serial communication parameters used by the selected balance.

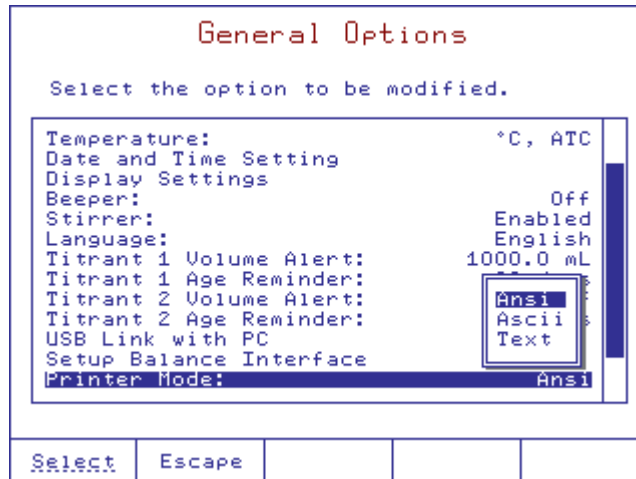


Be sure that the settings on the titrator *Balance Configuration* menu match the settings for your particular balance (baud rate, data bits, parity, stop bits number, request command syntax). It may be necessary to change settings on your balance. Users should consult their balance instruction manual.

Before leaving this screen, be sure the connection with the balance is working properly by pressing the key.

4.14. PRINTER MODE

Option: Ansi, Ascii, or Text



Ansi mode: Use this mode when your printer is set as Ansi. In this case all the accented characters/symbols available in titrator will be printed on your printer.

Ascii mode: Use this mode when your printer is set as Ascii. In this case only some of the accented characters/symbols available in titrator will be printed on your printer.

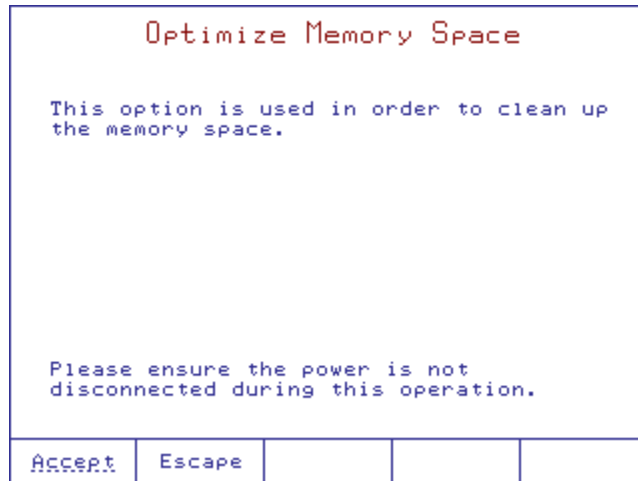
Text mode: Use this mode when you don't need to print the accented characters.

4.15. RESET TO DEFAULT SETTINGS

Note: This will also delete all the user - created methods and restore all manufacturer settings such as titrator configuration, standard method parameters, etc.

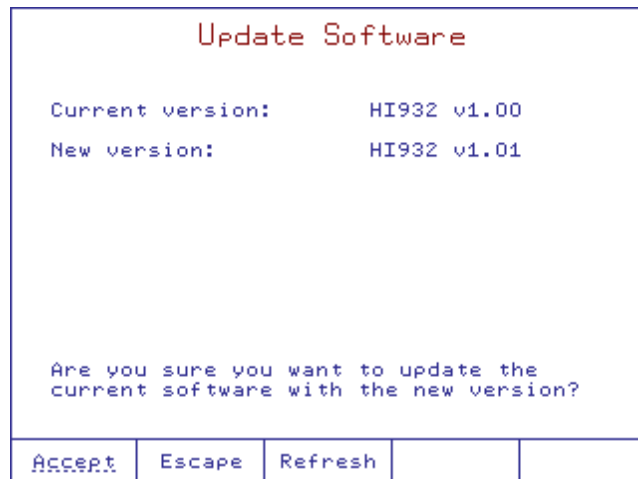


4.16. OPTIMIZE MEMORY SPACE



4.17. UPDATE SOFTWARE

This screen allows the user to update the titrator software from a USB storage device containing a software setup kit.



To update the software:

- Copy the "Setup932" folder to a USB storage device.
- Insert the USB storage device into the titrator.
- Go to **General Options**, then **Update Software**. The titrator will display the current and new software versions.
- Press Accept. When prompted, remove the USB storage and restart the titrator.

CHAPTER 5. TITRATION METHODS

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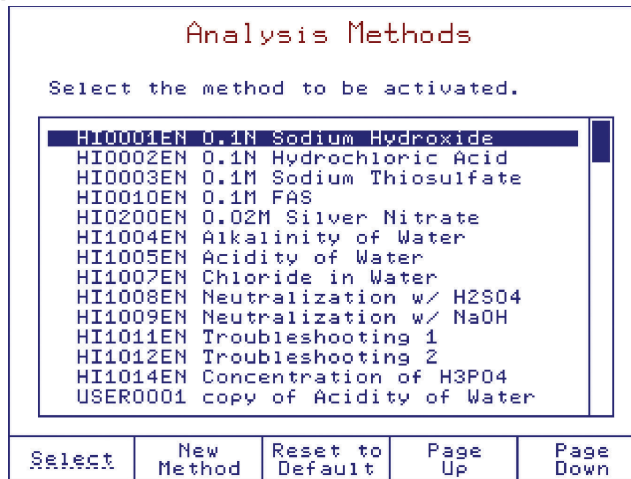
All of the parameters required to complete an analysis are grouped into a method.

The titrator is supplied with a pack of standard methods, these methods have been developed by Hanna Instruments and can be used to create user methods.

Standard and user methods can be upgraded, saved or deleted by connecting the titrator to a PC using the **HI900** PC application or a USB storage device.

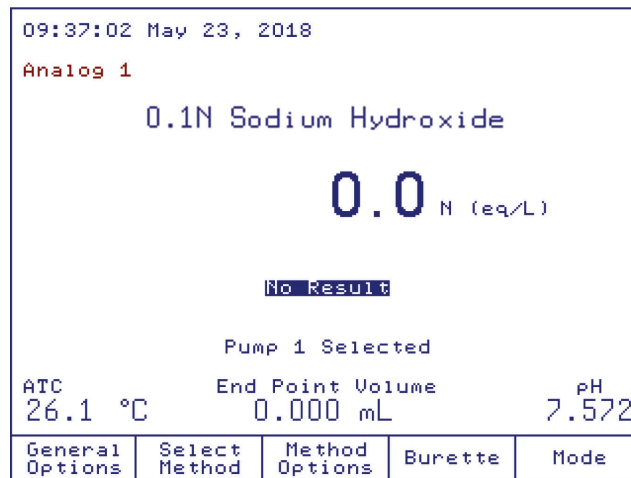
5.1. SELECTING METHODS

To select a method, press **Select Method** from the main screen. A list of available methods will be displayed.



In the **Analysis Methods** screen, you can view the list of all available methods (standard and user methods).

To select a method, highlight the method then press **Select** the name of the selected method will be displayed on the main screen.



5.2. STANDARD METHODS

The standard methods are developed for the most common types of analysis.

Only specific method parameters can be modified by the user (see **Method Options** section).

Also, standard methods can be used as a template to create new user methods.

5.2.1. UPGRADING STANDARD METHODS

To upgrade the titrator with new standard methods, follow the steps below:

From USB Storage Device:

- Insert the USB storage device into the USB port, located on the right side of the titrator.
- Press **General Options** from the main screen.
- Using **▲** and **▼** keys, highlight the *Restore from USB Storage Device* option and choose **Select**.
- Using **◀** and **▶** keys, navigate through file types to find “standard method files”. The list with available standard methods will be displayed.
- Press the **Copy File** or **Copy All** key to upgrade the titrator with the standard methods.
- Press **Escape** to return to **General Options** screen.

From PC:

You can upgrade the titrator with standard methods from a PC using the **HI900** PC application (see **General Options** section).

5.2.2. DELETING STANDARD METHODS

Unnecessary standard methods can be removed from the titrator by following the procedure below:

From General Options Screen:

- Using the **▲** and **▼** keys, highlight the *Save to USB Storage Device* option and press **Select**.
- Using the **◀** and **▶** keys, navigate through the file types menu to find “standard method files”. The available standard methods will be displayed.
- Press the **Delete** or **Delete All** keys to remove unnecessary standard methods.
- Press **Escape** to return to the **General Options** screen.

From PC:

Unnecessary standard methods can be removed from the titrator using the **HI900** PC application (see **General Options** section).

5.2.3. RESTORE THE STANDARD METHODS TO THE MANUFACTURER SETTINGS

You can restore the standard methods to the default setting by highlighting a standard method and pressing **Reset to Default**.

<p style="text-align: center;">Analysis Methods</p> <p>Select the method to be activated.</p> <table border="1"> <tbody> <tr><td>HI0001EN</td><td>0.1N Sodium Hydroxide</td></tr> <tr><td>HI0002EN</td><td>0.1N Hydrochloric Acid</td></tr> <tr><td>HI0003EN</td><td>0.1M Sodium Thiosulfate</td></tr> <tr><td>HI0010EN</td><td>0.1M FAS</td></tr> <tr><td>HI0200EN</td><td>0.02M Silver Nitrate</td></tr> <tr><td>HI1004EN</td><td>Alkalinity of Water</td></tr> <tr><td>HI1005EN</td><td>Acidity of Water</td></tr> <tr><td>HI1007EN</td><td>Chloride in Water</td></tr> <tr><td>HI1008EN</td><td>Neutralization w/ H2SO4</td></tr> <tr><td>HI1009EN</td><td>Neutralization w/ NaOH</td></tr> <tr><td>HI1011EN</td><td>Troubleshooting 1</td></tr> <tr><td>HI1012EN</td><td>Troubleshooting 2</td></tr> <tr><td>HI1014EN</td><td>Concentration of H3PO4</td></tr> <tr><td>USER0001</td><td>copy of Acidity of Water</td></tr> </tbody> </table>					HI0001EN	0.1N Sodium Hydroxide	HI0002EN	0.1N Hydrochloric Acid	HI0003EN	0.1M Sodium Thiosulfate	HI0010EN	0.1M FAS	HI0200EN	0.02M Silver Nitrate	HI1004EN	Alkalinity of Water	HI1005EN	Acidity of Water	HI1007EN	Chloride in Water	HI1008EN	Neutralization w/ H2SO4	HI1009EN	Neutralization w/ NaOH	HI1011EN	Troubleshooting 1	HI1012EN	Troubleshooting 2	HI1014EN	Concentration of H3PO4	USER0001	copy of Acidity of Water	<p style="text-align: center;">Confirmation of Reset Methods</p> <p>Are you sure you want to reset all Standard Methods to default?</p>				
HI0001EN	0.1N Sodium Hydroxide																																				
HI0002EN	0.1N Hydrochloric Acid																																				
HI0003EN	0.1M Sodium Thiosulfate																																				
HI0010EN	0.1M FAS																																				
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HI1009EN	Neutralization w/ NaOH																																				
HI1011EN	Troubleshooting 1																																				
HI1012EN	Troubleshooting 2																																				
HI1014EN	Concentration of H3PO4																																				
USER0001	copy of Acidity of Water																																				
Select	New Method	Reset to Default	Page Up	Page Down	Reset	Escape																															






5.3. USER METHODS

These methods are defined by the user (usually by modifying a standard method).

The user methods can be developed in accordance with the requirements of the user. All method parameters can be modified by the user.

5.3.1. CREATING USER METHODS


To create a new user method, start from a standard or user method and follow these steps:

- Press  from the main screen.
- Using the  and  keys, highlight an existing method from the method list.
- Press . A new user method will be generated.
- Press  to activate the new user method.

Analysis Methods Select the method to be activated.					11:30:37 Sep 20, 2018 Analog 1 copy of 0.1N Sodium Hydr <div style="text-align: center; font-size: 2em;">0.0</div> N (eq/L) No Result Pump 1 Selected ATC 25.5 °C End Point Volume 0.000 mL pH 8.071				
HI0001EN 0.1N Sodium Hydroxide HI0002EN 0.1N Hydrochloric Acid HI0003EN 0.1M Sodium Thiosulfate HI0010EN 0.1M FAS HI0200EN 0.02M Silver Nitrate HI1004EN Alkalinity of Water HI1005EN Acidity of Water HI1007EN Chloride in Water HI1008EN Neutralization w/ H2SO4 HI1009EN Neutralization w/ NaOH HI1011EN Troubleshooting 1 HI1012EN Troubleshooting 2 HI1014EN Concentration of H3PO4 USER0001 copy of Acidity of Water					General Options Select Method Method Options Burette Mode				
Select	New Method	Reset to Default	Page Up	Page Down					

Note: Only a limited number of methods can be installed on the titrator. The titrator can hold 100 methods (standard and user). When it is reached, a warning message will be displayed.

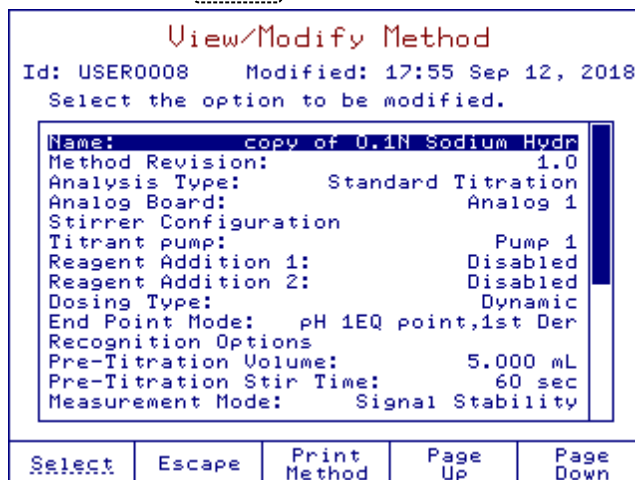
5.3.2. DELETING USER METHODS

To remove a user method, press  from the main screen. Highlight the user method that you want to delete and press . A screen will appear in order to confirm the deletion. Press  again to confirm, or press  to cancel the operation.

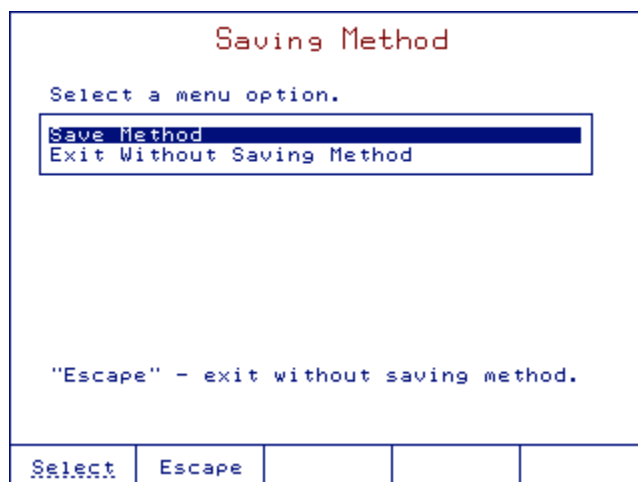
Confirmation of Method Deletion Are you sure you want to delete the selected method? copy of 0.1N Sodium Hydr				
Delete	Escape			

5.4. VIEW / MODIFY METHOD

To modify the method parameters, press Method Options from the main screen. A list of all the parameters for the selected method will be displayed. Using the ▲ and ▼ keys, highlight the option that you want to modify and choose Select. To exit the **View / Modify Method** screen, press Escape.



You can choose to save the modifications or to discard them.

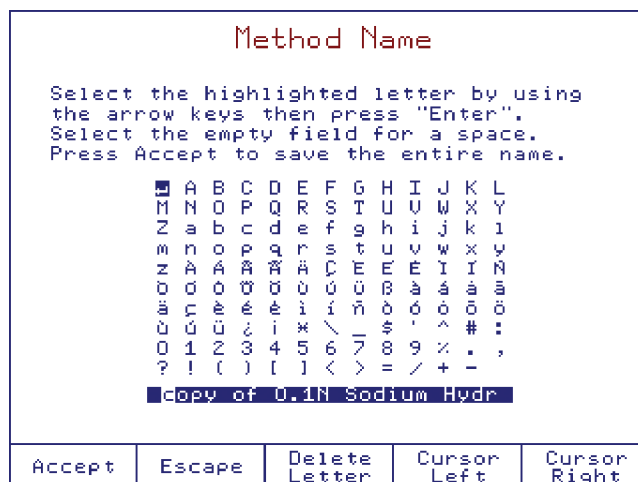


5.5. METHOD OPTIONS

Note: Only certain method options can be changed for standard methods.

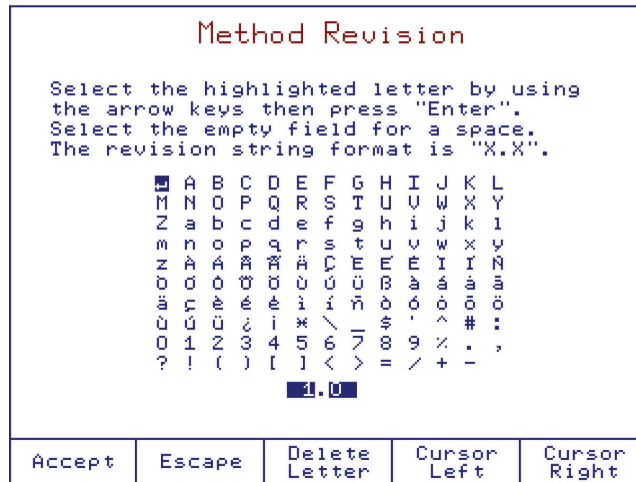
5.5.1. NAME

Option: Up to 24 characters



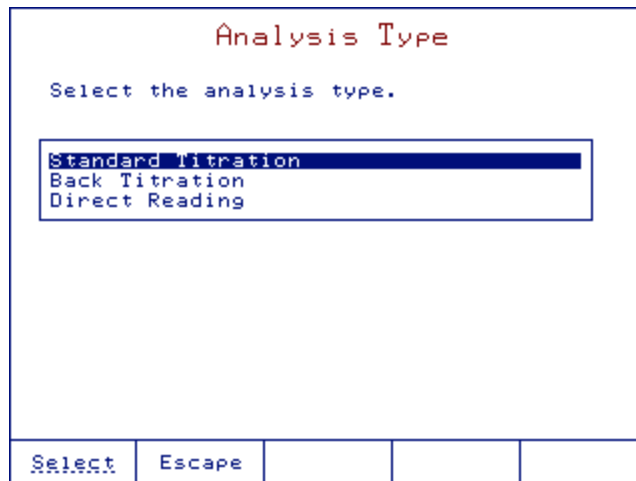
5.5.2. METHOD REVISION

Option: Up to 3 characters



5.5.3. ANALYSIS TYPE

Option: Standard Titration, Back Titration or Direct Reading



5.5.3.1. STANDARD TITRATION

- A titration with a pH or mV equivalence point detection (single or multiple equivalence points).
- A titration with fixed pH or mV end point.
- A titrant standardization.

5.5.3.2. BACK TITRATION

A titration with a pH or mV equivalence point detection consisting of two titration phases:

- Phase 1 – the sample is consumed by a known volume and concentration of titrant 1. A sufficient amount of titrant 1 is dispensed to surpass the equivalence point in order to react quickly with the sample.
- Phase 2 – the excess of titrant 1 is titrated with the titrant 2 to the equivalence point. The concentration of the sample is determined by the amount of titrant used in phase 2.

BREAK AT TITRANT CHANGING

Option: Yes or No

Select "Yes" to stop the titration temporarily between the titration phases, this allows users to perform a task related to the analysis (e. g.: boiling the sample to remove carbon dioxide, pH adjustment, etc.)

Break at Titrant Changing				
Select the option.				
<div style="border: 1px solid black; padding: 2px;"> NO YES </div>				
"NO" - without break at titrant changing. "YES" - with break at titrant changing.				
Select	Escape			

5.5.3.3. DIRECT READING

A direct pH, mV or ISE reading with an optional reagent addition. The titrator will take the measurement automatically once a stable reading has been obtained.

5.5.4. ANALOG BOARD

Option: Analog 1 or Analog 2 (if installed)

View/Modify Method				
Id: USER0003 Modified: 09:40 May 23, 2018				
Select the option to be modified.				
<div style="border: 1px solid black; padding: 2px;"> Name: copy of 0.1N Sodium Hydr Method Revision: 1.0 Analysis Type: Standard Titration Analog Board: Analog 1 Stirrer Configuration Titrant 1 pump: Analog 1 Titrant 2 pump: Analog 2 Reagent Addition 1: Reagent Addition 2: Disabled Dosing Type: Dynamic End Point Mode: pH 1EQ point,1st Der Recognition Options Pre-Titration Volume: 5.000 mL Pre-Titration Stir Time: 60 sec </div>				
Select	Escape	Print Method	Page Up	Page Down

5.5.5. STIRRER CONFIGURATION

Use the arrow keys to select the menu option.

Stirrer Configuration				
Select a menu option.				
Stirrer:		Stirrer 1		
Stirring Speed:		1400 RPM		
Select	Escape			

5.5.5.1. STIRRER

Option: Stirrer 1, Stirrer 2 (if available), or Disabled

Stirrer Configuration				
Select a menu option.				
Stirrer:		Stirrer 1		
Stirring Speed:		1		
		Disabled Stirrer 1 Stirrer 2		
Select	Escape			

5.5.5.2. STIRRER SPEED

Option: 200 to 2500 RPM

Stirring Speed				
Enter the speed of the stirrer within below range.				
<div style="border: 1px solid black; display: inline-block; padding: 2px;">1400</div> RPM				
The range is from 200 to 2500 RPM.				
Accept	Escape	Delete Digit		

5.5.6. PUMP CONFIGURATION

Option: Pump 1 or Pump 2 (if installed)

Note: For back titrations, the pump for titrant 1 and titrant 2 need to be selected.

View/Modify Method				
Id: USER0003 Modified: 09:40 May 23, 2018				
Select the option to be modified.				
Name: copy of 0.1N Sodium Hydr				
Method Revision: 1.0				
Analysis Type: Standard Titration				
Analog Board: Analog 1				
Stirrer Configuration				
Titrant 1 pump: Pump 1				
Titrant 2 pump:				
Reagent Addition 1: Pump 1				
Reagent Addition 2: Pump 2				
Dosing Type:				
End Point Mode: pH 1EQ point,1st Der				
Recognition Options				
Pre-Titration Volume: 5.000 mL				
Pre-Titration Stir Time: 60 sec				
Select	Escape	Print Method	Page Up	Page Down

5.5.7. REAGENT ADDITION

Option: Burette, Peristaltic Pump or Disabled

Reagent Addition 1				
Select the option to be modified.				
Reagent Pump: Disabled				
<div style="border: 1px solid black; padding: 2px;"> Disabled Burette 1 Peristaltic 1 Burette 2 Peristaltic 2 </div>				
Select	Escape			

Use the arrow keys to select the menu option.

Reagent Addition 1				
Select the option to be modified.				
<div style="border: 1px solid black; padding: 2px;"> Reagent Pump: Burette 1 Addition Volume: 0.000 mL Stirring Time: 2 sec Wait Time: 1 sec </div>				
Select	Escape			

Reagent Addition 1				
Select the option to be modified.				
<div style="border: 1px solid black; padding: 2px;"> Reagent Pump: Peristaltic 1 Dispensing Time: 10 sec Stirring Time: 15 sec Wait Time: 30 sec </div>				
Select	Escape			

5.5.7.1. ADDITION VOLUME (BURETTE)

Use the numeric keypad to enter the volume to be dispensed.

Addition Volume				
Enter the addition reagent volume to be added to the sample.				
5.000 mL				
Press Help to view the valid ranges for the addition volume.				
Accept	Escape	Delete Digit		

The volume dispensed must be between the limits shown below:

- 0.001 to 4.750 mL for a 5 mL Burette
- 0.001 to 9.500 mL for a 10 mL Burette
- 0.005 to 23.750 mL for a 25 mL Burette
- 0.005 to 47.500 mL for a 50 mL Burette

5.5.7.2. DISPENSING TIME (PERISTALTIC PUMP)

Option: 1 to 300 seconds

Enter the dispensing time required to add the desired amount of reagent.

Note: The user should determine this value experimentally. The approximate dispensing rate is 200 mL/min.

Dispensing Time				
Enter the period of time for running auxiliary pump.				
5 sec				
Low limit: 1 second High limit: 300 seconds				
Accept	Escape	Delete Digit		

5.5.7.3. STIRRING TIME

Option: 1 to 1800 seconds

The timer will start after the reagent has been added.

Stirring Time				
Please enter the stirring time in seconds.				
██████████ 8 sec				
Low limit: 1 second High limit: 1800 seconds				
ACCEPT	Escape	Delete Digit		

5.5.7.4. WAIT TIME

Option: 1 to 1800 seconds

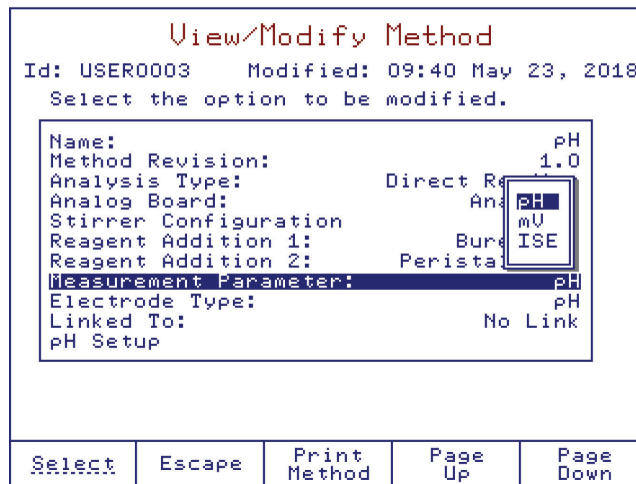
The timer will start after the stirring timer.

Wait Time				
Please enter the wait time in seconds.				
██████████ 2 sec				
Low limit: 1 second High limit: 1800 seconds				
ACCEPT	Escape	Delete Digit		

5.5.8. MEASUREMENT PARAMETER (DIRECT READING ONLY)

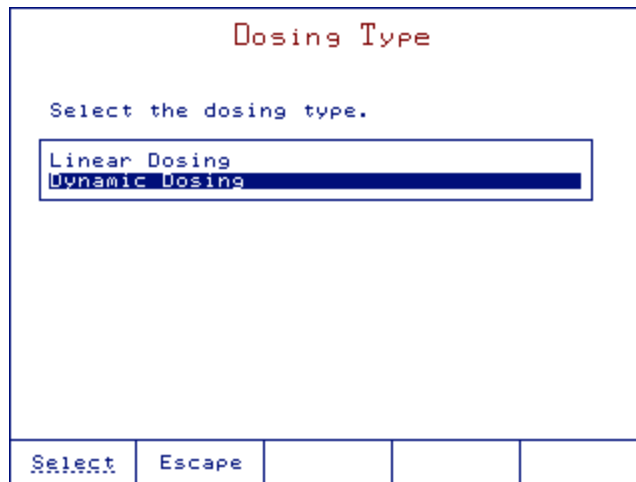
Option: pH, ISE or mV

Select the measurement parameter for the direct reading. Setup screen for the selected parameter is visible in the method options.



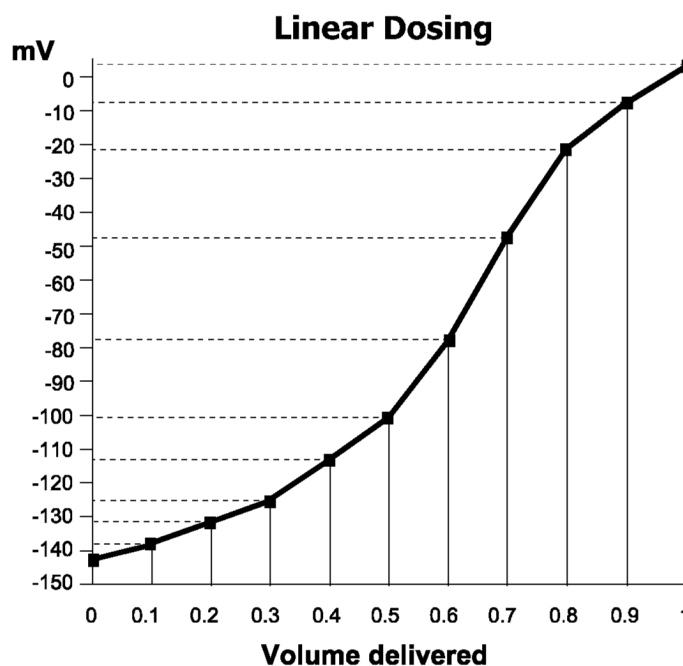
5.5.9. DOSING TYPE

Option: Linear or Dynamic



5.5.9.1. LINEAR DOSING

Linear dosing dispenses a pre-defined volume of titrant with every addition.



The *Linear Dosing* option is recommended for titrations with a slower reaction rate, difficult nonaqueous titrations, and specific applications.

Note: For steep and normal titration curves, smaller volume increments are recommended, to obtain many points around the equivalence point.

For flat titration curves, larger volume increments are recommended for equivalence point detection.

To set the dosing volume, select *Linear Dosing* and enter the optimum dose.

Dosing volume ranges are:

5 mL burette	0.001	to	4.750 mL
10 mL burette	0.001	to	9.500 mL
25 mL burette	0.005	to	23.750 mL
50 mL burette	0.005	to	47.500 mL

5.5.9.2. DYNAMIC DOSING

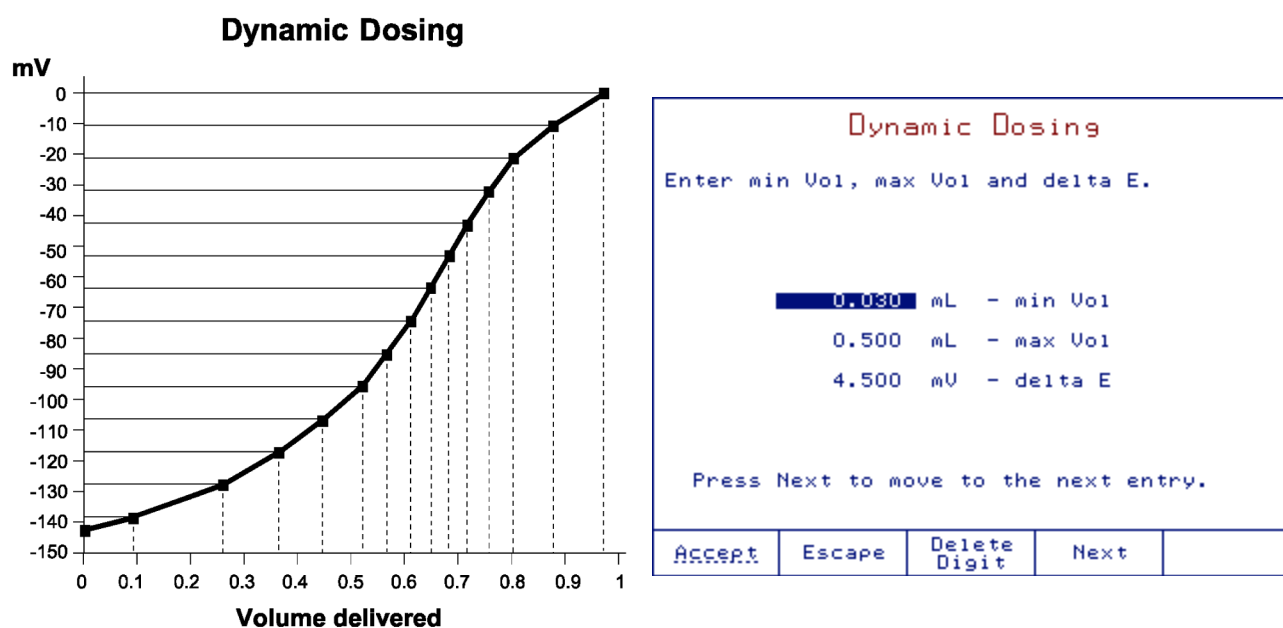
The titrator determines the titrant dose by trying to maintain a certain potential change (*delta E*) with each addition.

After a titrant dose, if the potential change is lower than the set *delta E*, the next dose will be progressively increased until *max Vol* is attained. If the potential change is still lower than the set value, the titration will continue with *max Vol* doses.

After a titrant dose, if the potential change is higher than the set *delta E*, the next dose will be progressively decreased until *min Vol* is attained. If the potential change is still higher than the set value, the titration will continue with *min Vol* doses.

The titrant is added in volumes that depend on the proximity of the end point as shown in the graph below.

Dynamic dosing allows for larger doses far from the end point, reducing the total titration time. Closer to the end point, smaller doses are made, providing more data and improved accuracy.



The following parameters must be set:

min Vol: The smallest dose to be dispensed during a titration.

The *min Vol* must be greater than or equal to:

- 0.001 mL for a 5 mL burette
- 0.001 mL for a 10 mL burette
- 0.005 mL for a 25 mL burette
- 0.005 mL for a 50 mL burette

max Vol: The largest dose to be dispensed during a titration.

The *max Vol* must be less than or equal to 4.000 mL.

delta E: Sets the fixed potential jump that has to be achieved after each titrant dose.

The allowed range is between 0.1 and 99.999 mV.

Recommendations for dosing parameters:

For steep and normal titration curves the recommended settings are:

<i>delta E</i>	3.5	to	9 mV
<i>min Vol</i>	0.010	to	0.025 mL (for a 25 mL burette)
<i>max Vol</i>	0.075	to	0.250 mL (for a 25 mL burette)

For flat titration curves the recommended settings are:

<i>delta E</i>	10	to	15 mV
<i>min Vol</i>	0.050	to	0.150 mL (for a 25 mL burette)
<i>max Vol</i>	0.400	to	0.600 mL (for a 25 mL burette)

To achieve the highest levels of accuracy and reproducibility, it is recommended that 20-80% of the nominal burette volume used for each titration is consumed. If lower volumes of titrant are required, a smaller burette can be used.

5.5.10. END POINT MODE

Option: Equivalence Point (pH or mV) or Fixed End Point (pH or mV)

Titration End Point Mode

Select the end point detection.

Equivalence End Point (pH)

Equivalence End Point (mV)

Fixed End Point (pH)

Fixed End Point (mV)

Select	Escape		
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5.5.10.1. FIXED END POINT (pH OR mV)

Fixed End Point (pH):

Option: -2.000 to 20.000 pH

The titration is terminated when the preset pH value has been exceeded. The end point volume is a calculated value based on the dispensed volume when pH is under the preset value and the dispensed volume when pH exceeded the preset value.

Preset pH End Point

Enter the end point pH value.

8.600

 pH

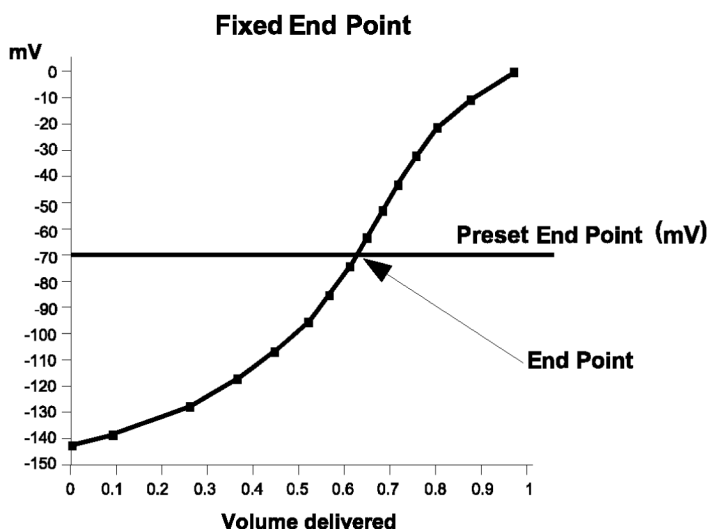
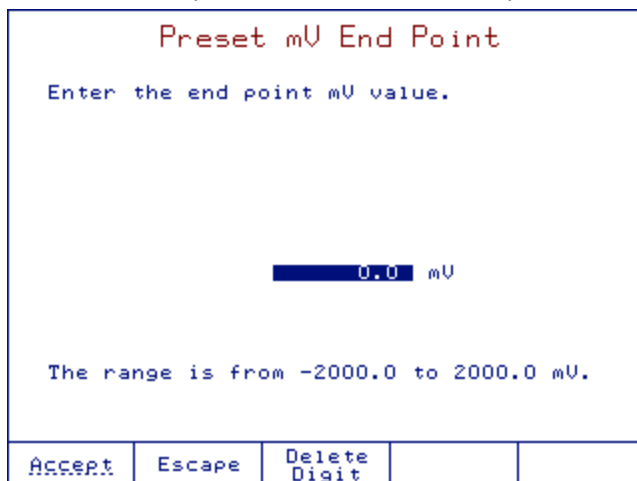
The range is from -2.000 to 20.000 pH.

ACCEPT	Escape	Delete Digit	
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Fixed End Point (mV):

Option: -2000.0 to 2000.0 mV

The end point detection algorithm is the same as for pH, but the threshold value is expressed in mV.

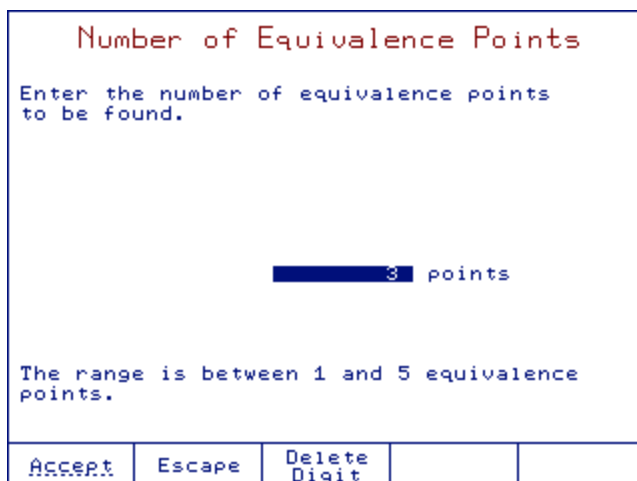


5.5.10.2. EQUIVALENCE END POINT (pH OR mV)

The titration is terminated when the equivalence point is detected (the point where the added quantity of titrant equals the quantity of analyte present in the sample).

Number of Equivalence Points:

Option: 1 to 5



End Point Determination:

Option: 1st derivative or 2nd derivative

End Point Determination

Select the end point determination.

1st derivative

2nd derivative

Select	Escape		
--------	--------	--	--

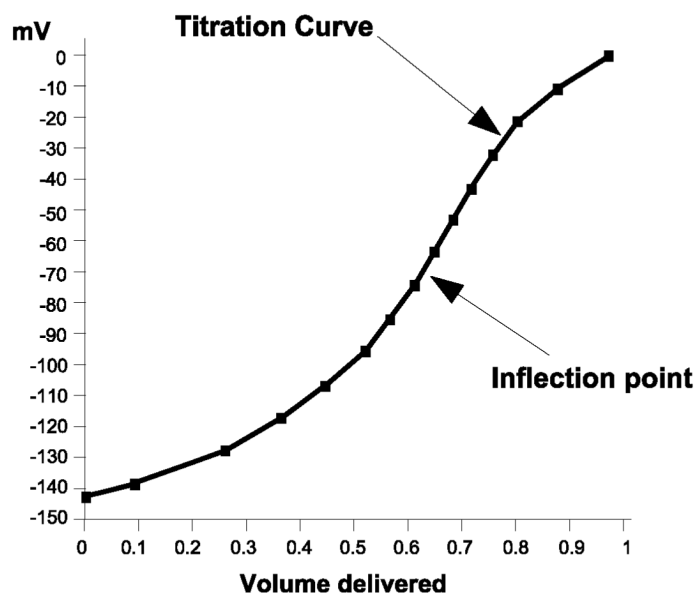
The equivalence point detection algorithm requires three additional titrant doses to be dispensed after the equivalence point is reached.

The reported end point volume is a calculated value based on a number of points around the equivalence point.

The potentiometric titration curve is the response in mV potential or pH between the indication of the electrode versus the volume of titrant added.

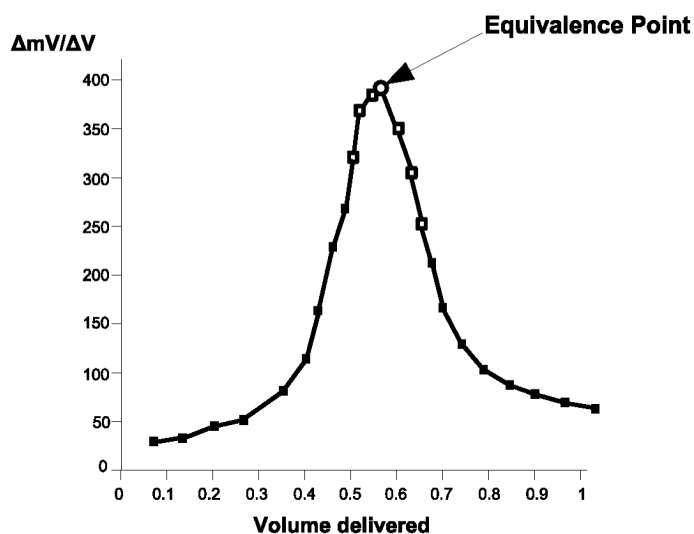
The inflection point of the titration curve is assumed to be the equivalence point of the chemical reaction.

For non-symmetric titration curves, the theoretical error can be reduced by using the dynamic dosing.



1st Derivative:

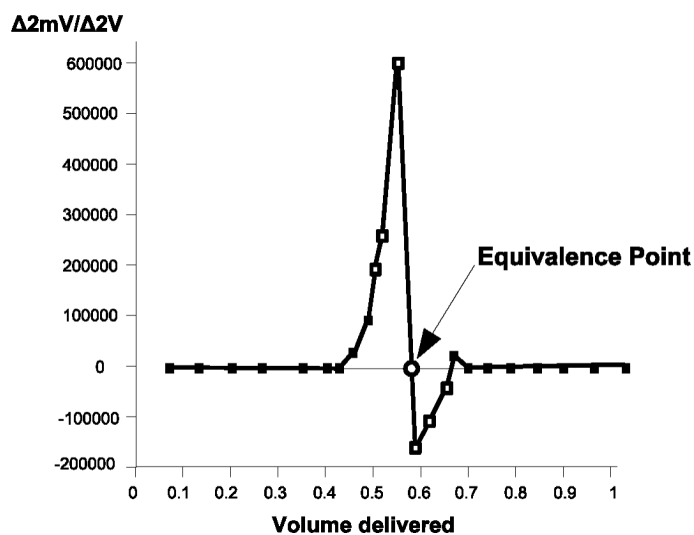
When first derivative is used to recognize the equivalence point, the titration curve inflection point (EQP) is the point where the first derivative reaches its maximum value.



The detection algorithm looks for the maximum value of the first derivative. The first derivative must be greater than the threshold value at the maximum point (see **Recognition Options** section).

2nd Derivative:

When second derivative is used to recognize the equivalence point, the titration curve inflection point (EQP) is the point where the second derivative crosses zero.



The detection algorithm looks for the point where the second derivative changes sign.

The checked point, or first derivative, must be greater than the threshold value (see **Recognition Options** section).

5.5.11. RECOGNITION OPTIONS (EQUIVALENCE END POINT ONLY)

The **Recognition Options** screen is a set of parameters used to avoid false detection of the equivalence point due to the chemical system (titrant/sample species and concentrations) and/or electrode response.

Recognition Options				
Select the options for equivalence point recognition.				
Threshold	500 mV/mL			
Range	NO			
Filtered Derivatives	NO			
Select	Escape			

5.5.11.1. THRESHOLD

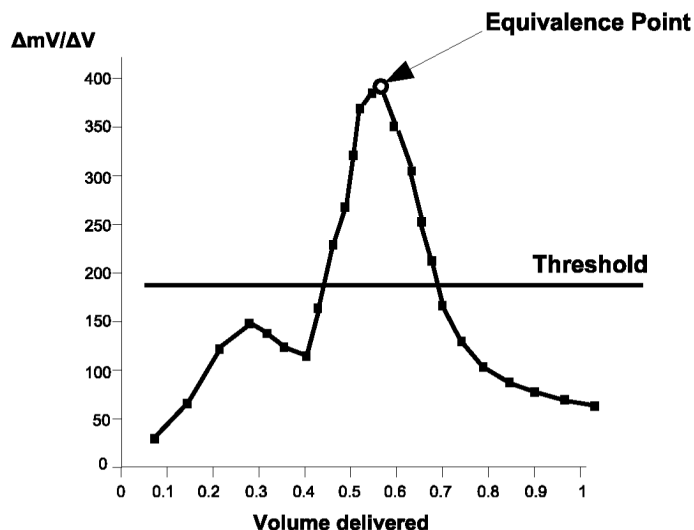
Option: 1 to 9999 mV/mL

This parameter must be set by the user according to the analysis.

The threshold represents the absolute value of the first derivative, expressed in mV/mL, below which the detection algorithm does not search for the equivalence point.

Threshold				
Enter the threshold for equivalence point detection.				
EQ 1 Threshold: 500 mV/mL				
Recommended value is between: 1 and 450 mV/mL for FLAT Curve, 450 and 1800 mV/mL for NORMAL Curve, 1800 and 9999 mV/mL for STEEP Curve.				
ACCEPT	Escape	Delete Digit		Next Threshold

The recommended value is 40% of the absolute value of the first derivative.



Depending on the titration curve profile, the following guide can be used:

TITRATION CURVE PROFILE	THRESHOLD (mV/mL)
Flat	1 to 450
Normal	50 to 1800
Steep	1800 to 9999

5.5.11.2. RANGE

Option: -2.000 to 20.000 pH or -2000.0 to 2000.0 mV

Range is an optional feature for equivalence point recognition. The titrator will only look for an equivalence point between the set values.

The Range option can be enabled by selecting "Yes" in the **Range Options** screen.

Range Options

Select option for equivalence point range.

NO

YES

"NO" - without equivalence point range.
 "YES" - with equivalence point range.

Select	Escape			
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Range Limits

Enter Limit 1 and Limit 2 for range.

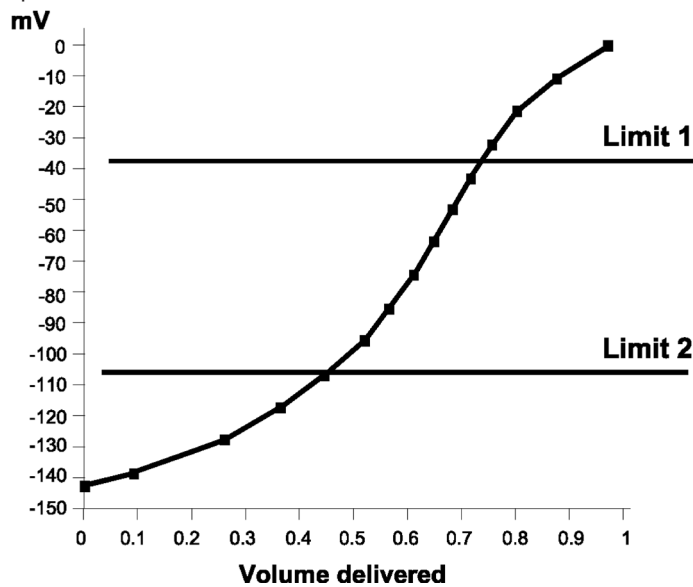
-2.0 mV - EQ 1 Limit1

20 mV - EQ 1 Limit2

Press <Next EQ Range> for the next range.

Accept	Escape	Delete Digit	Next Limit	Next EQ Range
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The Limit 2 value must not be equal to the Limit 1 value.



5.5.11.3. FILTERED DERIVATIVES

Option: Yes or No

This option adds a filtering procedure in the 1st and 2nd derivative computation algorithm that reduces the influence of pH or mV noise.

The *Filtered Derivatives* option can be enabled by selecting "Yes" in the **Filtered Derivatives Option** screen.

Filtered Derivatives Option

Select option for filtered derivatives.

NO

YES

"NO" - without filtered derivatives.
"YES" - with filtered derivatives.

Select	Escape			
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Noise can be due to:

- Chemical system properties (sample, titrant, solvent), such as slow chemical reactions or unbuffered samples such as wastewater, tap water, wine
- Electrode response
- Incorrect method parameters settings such as *Signal Stability*, *Stirring Speed*, etc.
- Insufficient titrant additions

Note: A shift in the end point volume by 1 or 2 doses may be seen due to filtering.

5.5.12. PRE-TITRATION VOLUME

During a titration, the equivalence point is reached after many titrant doses. These doses take up extra time while having no relevance for equivalence point detection.

Pre-titration volume adds a large initial dose to jump directly to the proximity of the equivalence point.

This first dose occurs after the pre-titration stir time is completed.

The ranges for pre-titration volumes are shown below:

0.001 to 4.750 mL for a 5 mL burette

0.001 to 9.500 mL for a 10 mL burette

0.005 to 23.750 mL for a 25 mL burette

0.005 to 47.500 mL for a 50 mL burette

Pre-Titration Volume				
Enter the initial titrant volume to be dispensed.				
9.000 mL				
Press Help to view the valid ranges for the pre-titration volume.				
Accept	Escape	Delete Digit		

To disable a pre-titration volume, enter 0.000 mL.

Note: A pre-titration volume is highly recommended whenever possible. Fewer doses will considerably shorten the overall titration duration.

5.5.13. PRE-TITRATION STIR TIME

Option: 0 to 180 seconds

When enabled, the sample is mixed for a set period of time before any titrant is added. This allows the sample to become homogeneous.

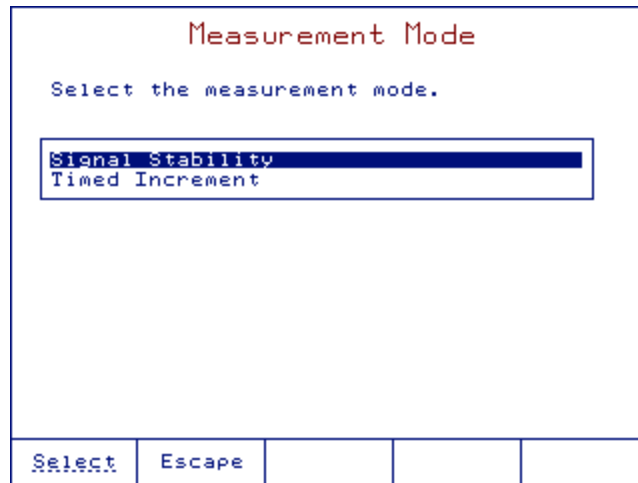
Pre-Titration Stir Time				
Enter the initial mixing time prior to the start of the titration.				
10 seconds				
The range is from 0 to 180 seconds.				
Accept	Escape	Delete Digit		

The *Pre-Titration Stir Time* option is disabled if 0 seconds is entered.

5.5.14. MEASUREMENT MODE

Option: Signal Stability or Timed Increment

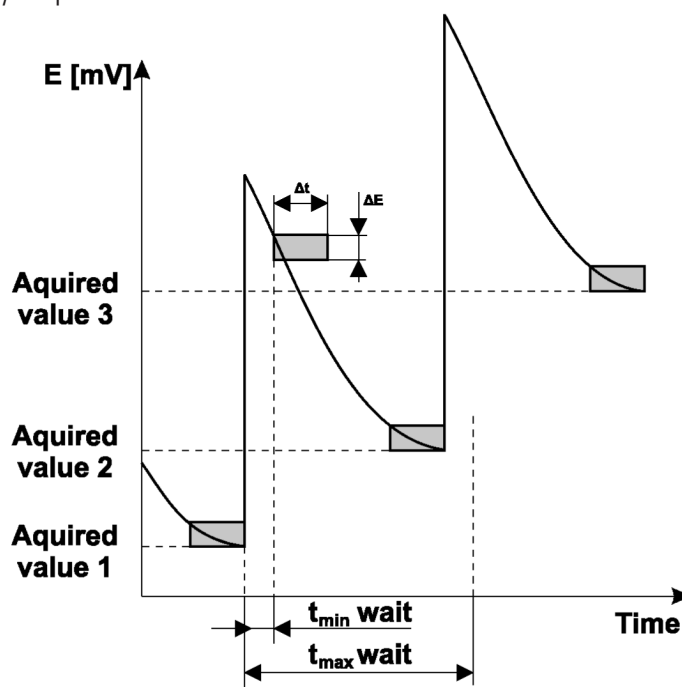
During titration, the acquisition of the potential (mV) value of the solution can be done in two ways: by using either *Signal Stability* or *Timed Increment* option.



5.5.14.1. SIGNAL STABILITY

When *signal stability* is selected, the titrator acquires the potential (mV) only when stable conditions are reached.

The principles of signal stability are plotted below:



The signal stability window (condition) represents the time interval (Δt) during which the potential measured in solution (mV) is confined inside the potential interval (ΔE).

The new signal value is acquired if the stability condition is reached after the minimum (t_{\min}) wait time.

If the stability condition is not reached and the maximum (t_{\max}) wait time has elapsed, the potential is acquired.

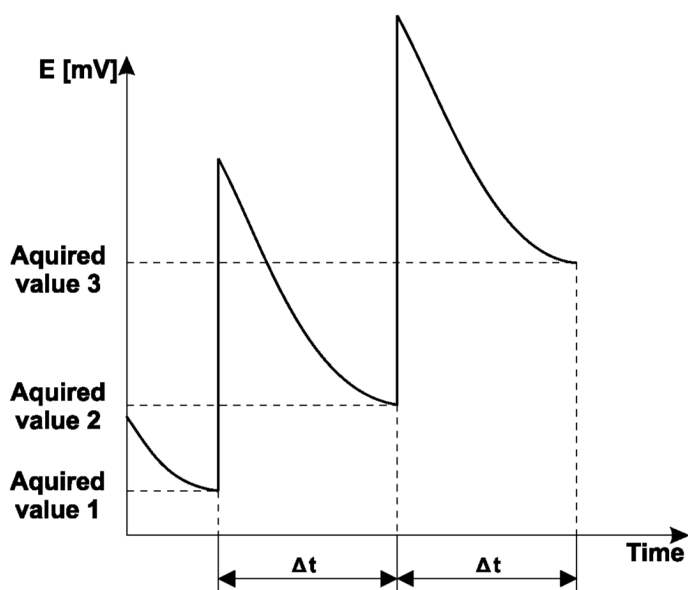
Signal Stability				
Enter mV variation (ΔE) in the time interval (Δt) min and max wait time period to the next sample measurement.				
0.3 mV		- ΔE		
2 seconds		- Δt		
3 seconds		- t min wait		
30 seconds		- t max wait		
Accept	Escape	Delete Digit	Next	

- delta E:** maximum change in potential during *delta t*
The range is from 0.1 to 99.9 mV.
- delta t:** the time interval during which the potential is measured.
The range is from 1 to 10 seconds.
- t min wait:** the minimum elapsed time before a stability check. This is also the minimum elapsed time between two doses.
The range is from 2 seconds to *t max wait* time.
- t max wait:** the maximum elapsed time between two successive doses. If the *t max wait* has elapsed, a new dose is added even if the signal stability condition is not reached.
The range is from t min wait time to 180 seconds.

5.5.14.2. TIMED INCREMENT

Option: 2 to 180 seconds

When *timed increment* is selected, the titrator acquires the potential (mV) at a fixed time interval (no signal stability check). The time period between two acquisitions must be set according to the reaction and the response time of the electrode.



Timed Increment

Enter the period of time to wait until the next dose.

5 seconds

The range is from 2 to 180 seconds.

Accept	Escape	Delete Digit		
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5.5.15. ELECTRODE TYPE

Option: Up to 20 characters

Electrode Type

Select the highlighted letter by using the arrow keys then press "Enter". Select the empty field for a space. Press Accept to save the electrode type.

<input checked="" type="checkbox"/>	A	B	C	D	E	F	G	H	I	J	K	L				
<input type="checkbox"/>	M	N	O	P	Q	R	S	T	U	V	W	X	Y			
<input type="checkbox"/>	Z	a	b	c	d	e	f	g	h	i	j	k	l			
<input type="checkbox"/>	m	n	o	p	q	r	s	t	u	v	w	x	y			
<input type="checkbox"/>	z	À	Á	Â	Ã	Ä	Å	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï
<input type="checkbox"/>	Ò	Ó	Ô	Õ	Ö	Ù	Ú	Û	Ü	Ý	À	Á	Â	Ã	Ä	Å
<input type="checkbox"/>	à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï
<input type="checkbox"/>	ù	ú	û	ü	ý	à	á	â	ã	ä	å	æ	ç	è	é	ê
<input type="checkbox"/>	ø	1	2	3	4	5	6	7	8	9	0	.	,			
<input type="checkbox"/>	?	!	()	[]	<	>	=	/	+	-				

PH

Accept	Escape	Delete Letter	Cursor Left	Cursor Right
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5.5.16. BLANK OPTION

Option: Disabled, V-Blank or Blank-V

This feature allows the user to select the procedure for the blank calculations (where V is the volume of titrant dispensed during the titration and $blank$ is the volume of titrant consumed by the blank sample).

View/Modify Method

Id: USER0003 Modified: 09:40 May 23, 2018

Select the option to be modified.

Analysis Type:	Standard Titration
Analog Board:	Analog 1
Stirrer Configuration:	
Titration pump:	Pump 1
Reagent Addition 1:	Disabled
Reagent Addition 2:	Disabled
Dosing Type:	Dynamic
End Point Mode:	mV 3EQ points, 1st Der
Recognition Options:	
Pre-Titration Volume:	U - Blank
Pre-Titration Stir Time:	Blank - U
Measurement Mode:	Sign: No Blank
Electrode Type:	
Blank Option:	No Blank

Select	Escape	Print Method	Page Up	Page Down
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If one of the options (*V-Blank* or *Blank-V*) is selected in the **View / Modify Method** screen, the *blank value* will be active on the **View/Modify Method** screen and the value of the blank can be set (in liters).

Blank Value				
Enter the blank volume in liters.				
0.00125 L				
Accept	Escape	Delete Digit		Exponent

5.5.17. CALCULATIONS

The final result is calculated using the end point volume (titrant volume at the equivalence point or at the fixed end point), and a formula selected by the user.

Calculations												
Select either the calculation to be performed or modify the variables.												
<table border="1"> <tbody> <tr><td>Edit Variable Values</td></tr> <tr><td>No Formula (mL only)</td></tr> <tr><td>No Formula (L only)</td></tr> <tr><td>Sample Calc. by Weight</td></tr> <tr><td>Sample Calc. by Volume</td></tr> <tr><td>Stdz. Titrant by Weight</td></tr> <tr><td>Stdz. Titrant by Volume</td></tr> <tr><td>Generic Formula</td></tr> </tbody> </table>					Edit Variable Values	No Formula (mL only)	No Formula (L only)	Sample Calc. by Weight	Sample Calc. by Volume	Stdz. Titrant by Weight	Stdz. Titrant by Volume	Generic Formula
Edit Variable Values												
No Formula (mL only)												
No Formula (L only)												
Sample Calc. by Weight												
Sample Calc. by Volume												
Stdz. Titrant by Weight												
Stdz. Titrant by Volume												
Generic Formula												
Select	Escape											

5.5.17.1. STANDARD TITRATION

5.5.17.1.1. EDIT VARIABLE VALUES

Edit the variables in a previously selected calculation.

For each formula, selected variables can be changed.

5.5.17.1.2. NO FORMULA (mL ONLY)

Only the volume of titrant (mL) required to reach the end point will be displayed.

5.5.17.1.3. NO FORMULA (L ONLY)

Only the volume of titrant (L) required to reach the end point is displayed.

5.5.17.1.4. SAMPLE CALCULATIONS BY WEIGHT

This calculation is used when the concentration of an analyte is determined by the weight of the sample. The results are based on the initial sample weight (in grams).

The titrator will calculate the results based on the selected units.

Titrant Units					Final Result Units				
Select the titrant unit.					Select the unit for your results.				
<div style="border: 1px solid black; padding: 2px;"> M (mol/L) N (eq/L) g/L mg/L </div>					<div style="border: 1px solid black; padding: 2px;"> ppt (g/kg) ppm (mg/kg) ppb (µg/kg) % = (g/100g) mg/g mg/kg mol/kg mmol/g eq/kg meq/kg </div>				
Select	Escape				Select	Escape			

The titrator will provide the results based on the titrant and sample units selected.

Titrant Units:

M (mol/L)	moles/liter
N (eq/L)	equivalents/liter
g/L	grams/liter
mg/L	milligrams/liter

Final Result Units:

ppt (g/kg)	parts per thousand (grams/kilogram)
ppm (mg/kg)	parts per million (milligrams/kilogram)
ppb (µg/kg)	parts per billion (micrograms/kilogram)
% (g/100 g)	percentage in weight (grams/100 grams)
mg/g	milligrams/gram
mg/kg	milligrams/kilogram
mol/kg	moles/kilogram
mmol/g	millimoles/gram
eq/kg	equivalents/kilogram
meq/kg	milliequivalents/kilogram

A formula example is shown below using M (mol/L) as the titrant unit and ppt (g/kg) as the final result unit:

Calculating Sample Concentration

M (mol/L) --> ppt (g/kg)

The calculation is:

$$\frac{U \times \frac{\text{mol}}{\text{L}} \times \frac{\text{mol}}{\text{mol}} \times \frac{\text{g}}{\text{mol}}}{\frac{\text{g}}{\text{kg}} \times 1000\text{g}}$$

Select the variables to change value.
U = volume dispensed in liters.

1.000 mol/L -> titrant conc.

1.000 mol/mol -> (sample/titrant)

1.000 g/mol -> mw of sample

1.000 g -> sample weight

Select	Escape	Save / Exit	
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Variables can be set according to the amount of sample and titrant used.

5.5.17.1.5. SAMPLE CALCULATIONS BY VOLUME

This calculation is used when the concentration of an analyte is determined in terms of the volume of sample. The results are based on the initial sample volume (in milliliters).

The titrator will calculate the results based on the selected units.

Titrant Units

Select the titrant unit.

M (mol/L)

N (eq/L)

g/L

mg/L

Select	Escape		
--------	--------	--	--

Final Result Units

Select the unit for your results.

% = (g/100g)

mg/g

mg/kg

mol/kg

mmol/g

eq/kg

meq/kg

ppt (g/L)

ppm (mg/L)

ppb (µg/L)

M (mol/L)

N (eq/L)

g/L

mg/L

Select	Escape	Page Up	Page Down
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Titrant Units:

- | | |
|-----------|-------------------|
| M (mol/L) | moles/liter |
| N (eq/L) | equivalents/liter |
| g/L | grams/liter |
| mg/L | milligrams/liter |

Final Result Units:

ppt (g/L)	parts per thousand (grams/liter)
ppm (mg/L)	parts per million (milligrams/liter)
ppb (µg/L)	parts per billion (micrograms/liter)
M (mol/L)	Molarity (moles/liter)
N (eq/L)	Normality (equivalents/liter)
mg/L	milligrams/liter
µg/L	micrograms/liter
mmol/L	millimoles/liter
mg/mL	milligrams/milliliter
mg/100 mL	milligrams/100 milliliters
g/100 mL	grams/100 milliliters
eq/L	equivalents/liter
meq/L	milliequivalents/liter

A formula example is shown below using N (eq/L) as the titrant units and g/L as the final result units:

Calculating Sample Concentration

N (eq/L) --> g/L

The calculation is:

$$\frac{U \times \frac{\text{eq}}{\text{L}} \times \frac{\text{mol}}{\text{eq}} \times \frac{\text{g}}{\text{mol}}}{\text{mL} \times \frac{\text{L}}{1000\text{mL}}}$$

Select the variables to change value.
U = volume dispensed in liters.

1.000 eq/L -> titrant conc.

1.000 mol/eq -> (sample/titrant)

1.000 g/mol -> mw of sample

1.000 mL -> sample volume

Select	Escape	Save / Exit		
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Variables can be set according to the amount of sample and titrant used.

5.5.17.1.6. STANDARDIZE TITRANT BY WEIGHT

This calculation is used when the concentration of the titrant is determined using a solid standard. Determination of the titrant concentration is based on the primary standard weight (in grams).

The calculation is based on the selected titrant unit. If the titrant unit is M (mol/L), the formula used to calculate the result is displayed below:

Titrant 1 Units					Calculating Titrant Concentration				
Select the titrant 1 unit.					The titrant concentration unit is M (mol/L).				
<div style="border: 1px solid black; padding: 2px;"> M (mol/L) N (eq/L) g/L mg/L </div>					The calculation is: $\frac{g \times \frac{\text{mol}}{g} \times \frac{\text{mol}}{\text{mol}}}{U}$				
					Select the variables to change value. U = volume dispensed in liters.				
					<div style="border: 1px solid black; padding: 2px;"> 0.200 g -> standard weight 204.23 g/mol -> mw of standard 1.000 mol/mol -> (titrant/standard) </div>				
Select	Escape				Select	Escape	Save / Exit		

5.5.17.1.7. STANDARDIZE TITRANT BY VOLUME

This calculation is used when the concentration of the titrant is determined using a primary standard solution. Determination of the titrant concentration is based on the primary standard volume (in milliliters).

The calculation is based on the selected titrant unit. If the titrant unit is N (eq/L), the formula used to calculate the result is displayed below:

Titrant Units					Calculating Titrant Concentration				
Select the titrant unit.					The titrant concentration unit is N (eq/L).				
<div style="border: 1px solid black; padding: 2px;"> M (mol/L) N (eq/L) g/L mg/L </div>					The calculation is: $\frac{\text{mL} \times \frac{\text{L}}{1000 \text{ mL}} \times \frac{\text{eq}}{\text{L}}}{U}$				
					Select the variables to change value. U = volume dispensed in liters.				
					<div style="border: 1px solid black; padding: 2px;"> 1.684 mL -> standard volume 2.375 eq/L -> standard conc. </div>				
Select	Escape				Select	Escape	Save / Exit		

5.5.17.1.8. GENERIC FORMULA

The user can define their own calculation formula based on the final result units in a solid or liquid sample.

Final Result Units:

ppt (g/kg)	parts per thousand (grams/kilogram)
ppt (g/L)	parts per thousand (grams/liter)
ppm (mg/kg)	parts per million (milligrams/kilogram)
ppm (mg/L)	parts per million (milligrams/liter)
ppb (µg/kg)	parts per billion (micrograms/kilogram)
ppb (µg/L)	parts per billion (micrograms/liter)
% (g/100 g)	percentage in weight (grams/100 grams)
M (mol/L)	Molarity (moles/liter)
mg/g	milligrams/gram
N (eq/L)	Normality (equivalents/liter)
g/L	gram/liter
mg/kg	milligrams/kilogram
mg/L	milligrams/liter
mol/kg	moles/kilogram
µg/L	micrograms/liter
mol/L	moles/liter
mmol/g	millimoles/gram
eq/kg	equivalents/kilogram
mmol/L	millimoles/liter
meq/kg	milliequivalents/kilogram
mg/mL	milligrams/milliliter
mg/100 mL	milligrams/100 milliliters
g/100 mL	grams/100 milliliters
eq/L	equivalents/liter
meq/L	milliequivalents/liter
No Unit	No result unit

The titrator will calculate the results based on the selected unit.

The formula can be either for titrant standardization or sample analysis.

Final Result Units

Select the unit for your results.

∞ = (g/100g)

mg/g

mg/kg

mol/kg

mmol/g

eq/kg

meq/kg

ppt (g/L)

ppm (mg/L)

ppb (µg/L)

M (mol/L)

N (eq/L)

g/L

mg/L

Select	Escape		Page Up	Page Down
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Calculating Sample Concentration

Final unit is mg/L.

The calculation is:

$$C \times U \times \frac{F1 \times F2 \times F3}{S}$$

Select the variables to change value.
U = volume dispensed in liters.

1.000 C -> (titrant conc.)

1.000 F1 -> (general factor)

1.000 F2 -> (general factor)

1.000 F3 -> (general factor)

Select	Escape	Save / Exit		
--------	--------	-------------	--	--

Where:

C = the concentration of the titrant

$F1$ = general factor

$F2$ = general factor

$F3$ = general factor

S = sample size, in grams or milliliters

V = the volume delivered, in liters, to reach the preset or equivalence end point (determined by the titrator)

General factors:

Weight Conversion:

One of the general factors should be a weight conversion factor.

Examples of concentration units:

mol/L	moles/Liter
eq/L	equivalents/Liter
g/L	grams/Liter
mg/L	milligram/Liter

Reaction Ratio:

The reaction ratio is the ratio between the analyte and titrant or standard and titrant.

Examples of ratios:

mol/mol	moles of sample/moles of titrant
mol/eq	moles of sample/equivalents of titrant
eq/mol	equivalents of sample/moles of titrant
mol/mol	moles of titrant/moles of standard
eq/mol	equivalents of titrant/moles of standard

Example: 2 moles of NaOH react with 1 mole of H_2SO_4

Unit Conversion factor:

Used to convert between various measurement units.

Examples: L/1000 \longrightarrow mL

g/1000 \longrightarrow mg

Weight Conversion factor:

Used to convert between weight measurement bases (kg, g, mg, μ g, mole or mmole).

Example: g \longrightarrow mol

5.5.17.2. BACK TITRATIONS

Calculations				
Select either the calculation to be performed or modify the variables.				
<div style="border: 1px solid black; padding: 2px;"> Sample Calc. by Weight Sample Calc. by Volume Generic Formula </div>				
Select	Escape			

5.5.17.2.1. SAMPLE CALCULATIONS BY WEIGHT

Select the titrant 1 unit, titrant 2 unit, and final result unit.

Titrant 1 Units				
Select the titrant 1 unit.				
<div style="border: 1px solid black; padding: 2px;"> M (mol/L) N (eq/L) g/L mg/L </div>				
Select	Escape			

Titrant 2 Units				
Select the titrant 2 unit.				
<div style="border: 1px solid black; padding: 2px;"> M (mol/L) N (eq/L) g/L mg/L </div>				
Select	Escape			

Final Result Units				
Select the unit for your results.				
<div style="border: 1px solid black; padding: 2px;"> ppt (g/kg) ppm (mg/kg) ppb ($\mu\text{g}/\text{kg}$) % = (g/100g) mg/g mg/kg mol/kg mmol/g eq/kg meq/kg </div>				
Select	Escape			

A formula example is shown below using M (mol/L) as the titrant 1 units, M (mol/L) as the titrant 2 units, mg/g and the final result units. This formula is used to calculate the amount of titrant 1 to dispense:

Calc. Direct Titr. Volume

Titr1 Unit: M (mol/L)-->Result Unit: L

The calculation is:

$$\frac{\frac{\text{g} \times \frac{\text{mol}}{\text{g}} \times f}{\frac{\text{mol}}{\text{L}} \times \frac{\text{mol}}{\text{mol}}}}$$

Select the variables to change value.

1.000 g -> sample weight
1.000 g/mol -> mw of sample
1.000 f ->(excess factor)
1.000 mol/L -> titrant 1 conc.

Select	Escape		Next
--------	--------	--	------

The formula is based on the assumption that the sample concentration is 100% w/w.

The titrator will calculate the volume of titrant 1 needed to consume the sample and multiply it with the excess factor in order to raise or lower the amount of titrant 1 dispensed.

Variables can be set according to the amount of sample and titrant used.

Press Next to proceed to the next formula.

If you do not want the titrator to calculate the volume of titrant 1 to add, see [Titrant 1 Entry](#) section.

The remaining volume of titrant 1 needs to be calculated.

The following formula is used to calculate the remaining volume of titrant 1 after the reaction with the sample:

Calc. Excess Volume Of Titr1.

M (mol/L) + M (mol/L) --> L

The calculation is:

$$\frac{U2 \times \frac{\text{mol}}{\text{L}} \times \frac{\text{mol}}{\text{mol}}}{\frac{\text{mol}}{\text{L}}}$$

U1 = U1tot - U1 excess
 Select the variables to change value.
 U2 = backtitr. vol. dispensed in liters.

1.000 mol/L -> titrant 2 conc.
1.000 mol/mol -> (titrant 1/titrant 2)
1.000 mol/L -> titrant 1 conc.

Select	Escape		Next
--------	--------	--	------

When all of the variables are set, press Next to proceed with the “Calculating Sample Concentration” formula:

Calculating Sample Concentration

Final unit is g/L:
The calculation is:

$$\frac{U1 \times \frac{\text{mol}}{\text{L}} \times \frac{\text{mol}}{\text{mol}}}{\frac{\text{mL}}{\text{L}} \times \frac{\text{mol}}{1000\text{mL}} \times \frac{\text{mol}}{\text{g}}}$$

Select the variables to change value.
U1 = volume dispensed in liters

1.000 mol/L -> titrant 1 conc.
1.000 mol/mol -> (sample/titrant 1)
1.000 mL -> sample volume
1.000 g/mol -> mw of sample

Select	Escape	Save / Exit	
--------	--------	----------------	--

5.5.17.2.2. SAMPLE CALCULATIONS BY VOLUME

Select the titrant 1 unit, titrant 2 unit, and the final result unit.

Titrant 1 Units

Select the titrant 1 unit.

M (mol/L)
N (eq/L)
g/L
mg/L

Select	Escape		
--------	--------	--	--

Titrant 2 Units

Select the titrant 2 unit.

M (mol/L)
N (eq/L)
g/L
mg/L

Select	Escape		
--------	--------	--	--

Final Result Units

Select the unit for your results.

ppt (g/L)
ppm (mg/L)
ppb (µg/L)
M (mol/L)
N (eq/L)
g/L
mg/L
µg/L
mol/L
mmol/L
mg/mL
mg/100mL
g/100 mL
eq/L

Select	Escape	Page Up	Page Down
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After you have selected the titrant 1, titrant 2, and the final result units, the titrator will display a screen with a formula used to calculate the amount of titrant 1 (used in the first stage of back titration) to be dispensed.

Calc. Direct Titr. Volume

Titr1 Unit: M (mol/L)-->Result Unit: L

The calculation is:

$$\frac{\text{mL} \times \frac{\text{L}}{1000\text{mL}} \times \frac{\text{g}}{\text{L}} \times \frac{\text{mol}}{\text{g}} \times f}{\frac{\text{mol}}{\text{L}} \times \frac{\text{mol}}{\text{mol}}}$$

Select the variables to change value.

1.000 mL -> sample volume
1.000 g/L -> sample max conc.
1.000 g/mol -> mw of sample
1.000 f ->(excess factor)

Select	Escape	Next	
--------	--------	------	--

The formula is based on the assumption that the sample concentration is 100% v/v. The titrator will calculate the volume of titrant 1 needed to consume the sample and multiply it with the excess factor in order to raise or lower the amount of titrant 1 dispensed.

Variables can be set according to the amount of sample and titrant used.

Press Next to proceed to the next formula.

If you do not want the titrator to calculate the volume of titrant 1 to add, see [Titrant 1 Entry](#) section.

The following formula is used to calculate the remaining volume of titrant 1 after the reaction with the sample.

Calc. Excess Volume Of Titr1.

M (mol/L) + M (mol/L) --> L

The calculation is:

$$\frac{V2 \times \frac{\text{mol}}{\text{L}} \times \frac{\text{mol}}{\text{mol}}}{\frac{\text{mol}}{\text{L}}}$$

V1 = V1tot - V1 excess
Select the variables to change value.
V2 = backtitr. vol. dispensed in liters.

1.000 mol/L -> titrant 2 conc.
1.000 mol/mol -> (titrant 1/titrant 2)
1.000 mol/L -> titrant 1 conc.

Select	Escape	Next	
--------	--------	------	--

When all the variables are set, press Next to proceed with the "Calculating Sample Concentration" formula:

Calculating Sample Concentration

Final unit is g/L:

The calculation is:

$$\frac{V1 \times \frac{\text{mol}}{\text{L}} \times \frac{\text{mol}}{\text{mol}}}{\frac{\text{mL}}{1000\text{mL}} \times \frac{\text{mol}}{\text{g}}}$$

Select the variables to change value.
V1 = volume dispensed in liters

1.000 mol/L -> titrant 1 conc.
1.000 mol/mol -> (sample/titrant 1)
1.000 mL -> sample volume
1.000 g/mol -> mw of sample

Select	Escape	Save / Exit	
--------	--------	----------------	--

5.5.17.2.3. GENERIC FORMULA

The user can define their calculation formula for the “Direct Titration Volume”, “Calculating Excess Volume of Titrant 1” and “Final Sample Concentration” in a solid or liquid sample.

5.5.18. DILUTION OPTION

Option: Enabled or Disabled

When the initial sample is diluted, a titration is made with an aliquot of the diluted sample, dilution calculations can be used. The calculations are based on the original sample weight (volume) in order to express the results for the initial sample.

Dilution Parameters

Select the option.

Final Dilution Volume:	100.000 mL
Aliquot Volume:	10.000 mL
Analyte size to be diluted:	1.0000 mL

Select	Escape		
--------	--------	--	--

- Final Dilution Volume: The volume of the sample after dilution
- Aliquot Volume: Volume of sample taken from the dilution for titration
- Analyte size to be diluted: The initial sample weight (volume)

5.5.19. TITRANT NAME

Option: Up to 15 characters

Titrant1 Name

Select the highlighted letter by using the arrow keys then press "Enter".
Select the empty field for a space.
Press Accept to save the entered text.

■	A	B	C	D	E	F	G	H	I	J	K	L				
	M	N	O	P	Q	R	S	T	U	V	W	X	Y			
	Z	a	b	c	d	e	f	g	h	i	j	k	l			
	m	n	o	p	q	r	s	t	u	v	w	x	y			
	z	À	Á	Â	Ã	Ä	Å	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï
	Ð	Ó	Ô	Õ	Ö	Ù	Ú	Û	Ü	Ý	à	á	â	ã	ä	å
	ä	ç	è	é	ê	ë	ì	í	î	ï	ò	ó	ô	õ	ö	ø
	ù	ú	û	ü	¿	¡	¢	£	¥	¦	§	¨	©	ª	«	¬
	0	1	2	3	4	5	6	7	8	9	÷	.	,			
	?	!	()	[]	<	>	=	/	+	-				

■ 0.1N NaOH

Accept	Escape	Delete Letter	Cursor Left	Cursor Right
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Note: For back titrations the name of titrant 1 and titrant 2 can be entered.

5.5.20. TITRANT CONCENTRATION

Enter the concentration of the titrant to be used. When determining the titrant concentration, only the concentration unit is displayed.

<p style="color: red;">Titrant1 Conc.</p> <p>Enter the titrant 1 concentration.</p> <p style="text-align: center;">0.10676 M (mol/L)</p>				
Accept	Escape	Delete Digit		Exponent

Note: For back titration the concentration of titrant 1 and titrant 2 can be entered.

5.5.21. ANALYTE SIZE

Option: 0.001 to 250.0

Enter the size of the sample (for sample concentration determinations) or standard (for titrant concentration determination).

<p style="color: red;">Sample Volume</p> <p>Enter the initial sample volume in milliliters.</p> <p style="text-align: center;">1.0000 mL</p> <p>This volume will be used when fixed sample size is selected.</p>				
Accept	Escape	Delete Digit		Exponent

5.5.22. ANALYTE ENTRY

Option: Fixed, Manual or Same as Previous (linked methods only)

<p style="color: red;">Analyte Entry</p> <p>Select the entry mode of analyte.</p> <table border="1" style="margin: 10px auto;"> <tr> <td>Fixed Weight or Volume</td> <td>Manual Weight or Volume</td> </tr> </table> <p>Verify the correct formula is being used, i.e. weight or volume analyte type.</p>					Fixed Weight or Volume	Manual Weight or Volume
Fixed Weight or Volume	Manual Weight or Volume					
Select	Escape					

<p style="color: red;">Analyte Entry</p> <p>Select the entry mode of analyte.</p> <table border="1" style="margin: 10px auto;"> <tr> <td>Fixed Weight or Volume</td> <td>Manual Weight or Volume</td> <td>Same as Previous</td> </tr> </table> <p>Verify the correct formula is being used, i.e. weight or volume analyte type.</p>					Fixed Weight or Volume	Manual Weight or Volume	Same as Previous
Fixed Weight or Volume	Manual Weight or Volume	Same as Previous					
Select	Escape						

5.5.22.1. FIXED WEIGHT OR VOLUME

Each titration will use a set weight or volume in the calculations.

5.5.22.2. MANUAL WEIGHT OR VOLUME

Each titration, the exact weight or volume can be entered. The titrator will prompt for the analyte weight or volume at the beginning of each titration.

5.5.22.3. SAME AS PREVIOUS (LINKED METHOD ONLY)

The same weight or volume is used for both methods.

5.5.23. TITRANT 1. ENTRY (BACK TITRATION ONLY)

Select the mode for evaluating the necessary quantity of titrant 1 used in the back titration process (phase 1).

Titrant 1 Entry						
Select the entry mode of titrant 1.						
<table border="1"> <tr> <td>Calculated By Formula</td> </tr> <tr> <td>Fixed By User</td> </tr> </table>					Calculated By Formula	Fixed By User
Calculated By Formula						
Fixed By User						
Select	Escape					

5.5.23.1. CALCULATED BY FORMULA

The volume of titrant 1 to be dispensed in the phase 1 of back titration will be calculated by the titrator (see [Back Titrations](#) section).

5.5.23.2. FIXED BY USER

A fixed volume of titrant 1 will be used during the first phase of back titration process (direct titration).

Direct Titration Volume					
Enter the volume of titrant which will be dispensed during direct titration.					
<table border="1"> <tr> <td>10.000 mL</td> </tr> </table>					10.000 mL
10.000 mL					
This volume will be dispensed when Fixed By User option is selected.					
ACCEPT	Escape	Delete Digit			

5.5.24. MAXIMUM TITRANT VOLUME

Option: 0.100 to 100.000 mL

The maximum titrant volume used in the titration must be set according to the analysis.

If the titration end point (fixed or equivalence End Point) is not reached, the titration will be terminated after the maximum titrant volume has been dispensed. The error message ("Limits Exceeded") will appear on the display.

Maximum Titrant Volume				
Enter the maximum titrant volume to be dispensed.				
<div style="border: 1px solid black; display: inline-block; padding: 2px;">15.000</div> mL				
Recommend the total volume of the burette.				
Accept	Escape	Delete Digit		

5.5.25. POTENTIAL RANGE

Option: -2000.0 to 2000.0 mV

The input potential range can be set by the user. The titration will be terminated and an error message will appear if the potential is outside these limits.

These limits provide protection against a titration that does not generate an end point due to potential over-range.

Potential Range				
Enter the upper and lower potential.				
<div style="border: 1px solid black; display: inline-block; padding: 2px;">2000.0</div> mV - Upper Limit -2000.0 mV - Lower Limit				
Press Next to move to the next entry.				
Accept	Escape	Delete Digit	Next	

5.5.26. VOLUME/FLOW RATE

The flow rate for the dosing system can be set by the user in an interval of 0.3 to two times the burette volume:

- 0.3 to 10 mL/min for a 5 mL burette
- 0.3 to 20 mL/min for a 10 mL burette
- 0.3 to 50 mL/min for a 25 mL burette
- 0.3 to 100 mL/min for a 50 mL burette

Flow Rate

Enter the titrant/reagent flow rate.

50.0 mL/min

The range is from 0.1 to twice the total volume of the burette.

Accept	Escape	Delete Digit		
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Note: The titrator will automatically detect the burette size and display the correct high limit volume.

The flow rate is set for all burette operations.

5.5.27. SIGNAL AVERAGING

Option: 1,2,3 or 4 readings

This option enables filtering on the mV/pH reading.

If 1 Reading is selected, the filtering is disabled. The titrator will take the last reading and place it into a “moving window” along with the last 2, 3 or 4 readings (depending on the selected option). The average of those readings is displayed and used for calculations.

Averaging more readings is helpful when a noisy signal is received from the electrode.

View/Modify Method

Id: USER0001 Modified: 15:58 Jun 28, 2018

Select the option to be modified.

Electrode Type:	pH
Blank Option:	No Blank
Calculations:	Sample Calc. by Volume
Dilution Option:	Disabled
Titrant Name:	0.1N NaOH
Titrant Conc.:	0.
Analyte Size:	<div style="border: 1px solid black; padding: 2px; display: inline-block;"> 1 Reading 2 Readings 3 Readings 4 Readings </div>
Analyte Entry:	
Maximum Titrant Volume:	
Potential Range:	-2000.0
Volume/Flow Rate:	25 mL
Signal Averaging:	1 Reading
Significant Figures:	XXXXX
Linked To:	No Link

Select	Escape	Print Method	Page Up	Page Down
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5.5.28. SIGNIFICANT FIGURES

Option: Two (XX), Three (XXX), Four (XXXX) or Five (XXXXX)

This option allows you to set the format for displaying the final titration result.

View/Modify Method

Id: USER0005 Modified: 10:18 May 23, 2018
Select the option to be modified.

Pre-Titration Stir Time:	60 sec
Measurement Mode:	Signal Stability
Electrode Type:	pH
Blank Option:	No Blank
Calculations:	Stdz. Titrant by Weight
Dilution Option:	Disabled
Titrant Name:	0.1N NaOH
Analyte Size:	0
Analyte Entry:	XX
Maximum Titrant Volume:	15 XXX
Potential Range:	-2000.0 to 20 XXXX
Volume/Flow Rate:	25 mL / 50.0 XXXXX
Signal Averaging:	1
Significant Figures:	XXXXX

Select	Escape	Print Method	Page Up	Page Down
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5.5.29. LINKED METHOD

This option allows the user to link two titration methods. If No Link is selected, only the current method will run. If a method is selected, it will run after the current method.

Link Titration Method

Select the method to be linked.

----- No Link
USER0001 Acidity of Water
USER0009 Free acidity
USER0010 Wine acidity

Select	Escape			
--------	--------	--	--	--

5.5.30. START LINKED METHOD (LINKED METHOD ONLY)

Option: Manually or Automatically

Selecting Manually will stop the titration temporarily between the methods. This break allows you to perform a task related to the analysis (e.g.: boiling the sample to remove carbon dioxide).

Start Linked Method

Select the start linked method mode.

Automatically
Manually

Select Escape

5.6. PRINTING

To print method parameters, press Method Options from the main screen.

Press Print Method and wait a few seconds until the printer completes the job.

If no printer is connected to the dedicated socket, or if the printer is offline, an error message will appear on the display (see **Connecting a Printer** section, for information about connecting a printer to the titrator).

CHAPTER 6. TITRATION/DIRECT READING MODE

6.1. RUNNING A TITRATION/DIRECT READING	6-3
6.1.1. STARTING A TITRATION/DIRECT READING.....	6-3
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6.2. STOPPING A TITRATION/DIRECT READING	6-5

6.1. RUNNING A TITRATION/DIRECT READING

Before beginning a titration, make sure that the following conditions are met:

- At least one pump is properly installed.
- A burette is inserted in the pump and filled with titrant.
- The aspiration tube is inserted in the titrant bottle and primed. The dispensing tube is over the titration beaker.
- The tubes are installed on the peristaltic pump and filled with reagent.
- The standard or sample has been carefully weighed/measured into the beaker.
- The electrode(s) and the temperature probe are submersed in the beaker.
- The desired method is selected and the parameters are set to the optimal values.

6.1.1. STARTING A TITRATION/DIRECT READING

To start a new analysis, press  from the main screen.

When an analysis begins:


- The stirrer will turn on (if enabled).
- The pre-titration stir time starts, if enabled (see [Titration Methods](#) section).
- After the pre-titration stir time is complete the pre-titration volume will be displayed, if enabled. (see [Titration Methods](#) section).
- If *Reagent Addition* is enabled the quantity of reagent will be entered according to the parameters set in the method.
- The titrator will start the analysis and continue to deliver titrant until the end point is detected or the titration is terminated.

6.1.2. SUSPENDING A TITRATION/DIRECT READING

While a titration/analysis is in progress, you can temporarily stop it by pressing . This will stop the dosing pump if it is running.

To continue the titration/analysis press .

6.1.3. VIEWING THE TITRATION CURVE

During a titration, the potentiometric curve and the derivative curve (equivalence point only) can be displayed on the **Titration Graph** screen by pressing .

The potentiometric curve and the derivative curve are scaled to fit simultaneously inside the display.

When a titration end point is successfully detected, the volume is displayed on the graph and marked with an "x".

The contents of the graph as related to an end point type are as follows:

Equivalence End Point (pH): The pH readings and the selected derivative vs. volume of titrant are displayed (see Figure 1).

Equivalence End Point (mV): The mV readings and the selected derivative vs. volume of titrant are displayed (see Figure 2).

Fixed End Point (pH): The pH readings vs. volume of titrant are displayed (see Figure 3).

Fixed End Point (mV): The mV readings vs volume of titrant are displayed (see Figure 4).

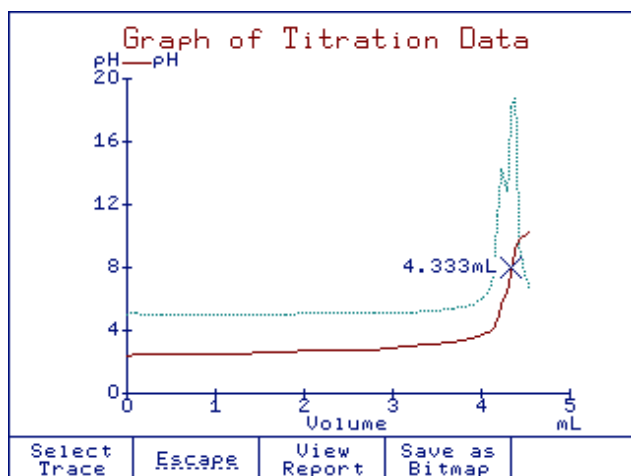


Figure 1

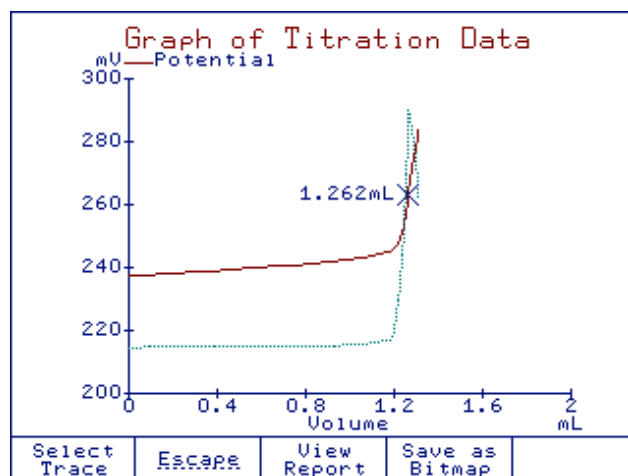


Figure 2

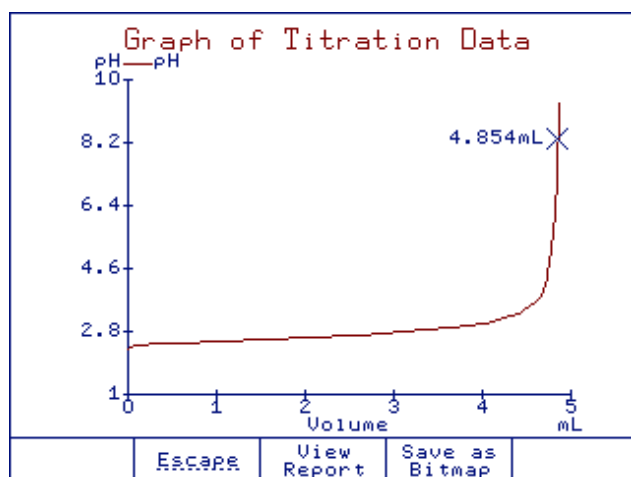


Figure 3

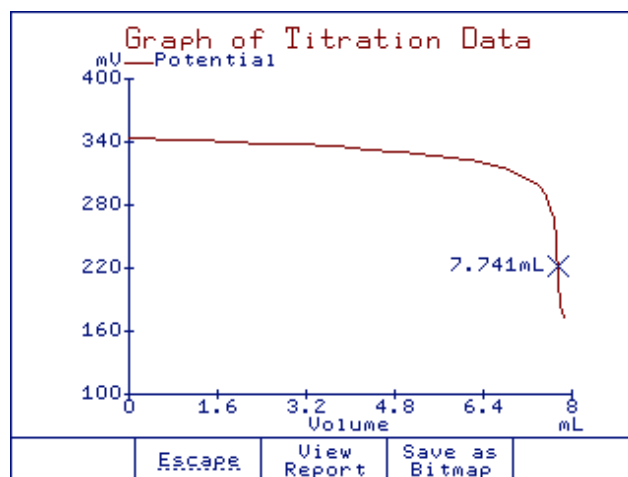


Figure 4

Select Trace - Changes the y-axis scale to either the mV (or pH) readings or the selected derivative values (of mV or pH). Available only for titrations with equivalence end points.

Save as Bitmap - Allows you to save the graph as a bitmap file. Available only when the titration is finished.

6.2. STOPPING A TITRATION/DIRECT READING

The titration/analysis is terminated when one of the following conditions is met:

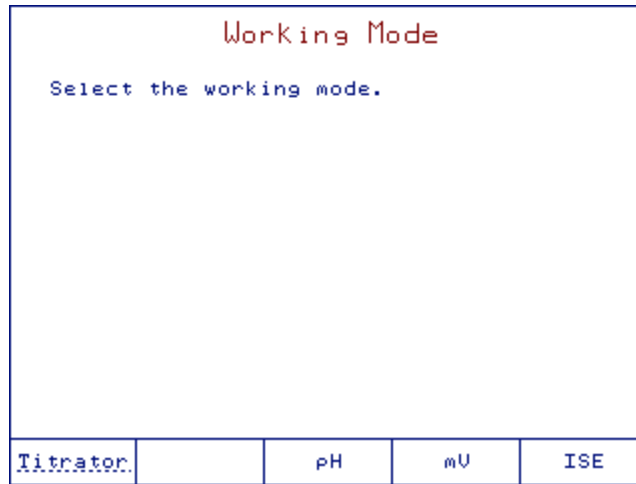
- **Analysis Completed:** This is the only mode with valid final result values. The end point/stable reading was successfully detected, the final results will be displayed.
- **Manually Terminated:** The current titration/analysis terminated by the user before the end point was detected.
- **Limits Exceeded:** The maximum titrant volume was delivered without reaching the end point. An error message is displayed on the screen.
- **Critical Error:** A critical error occurred and the titration was stopped. These errors are typically related to the dosing system. An error message is displayed on the screen.
- **Potential Out of Range:** The measured values from the electrode are outside the potential range. An error message is displayed on the screen.

CHAPTER 7. pH MODE

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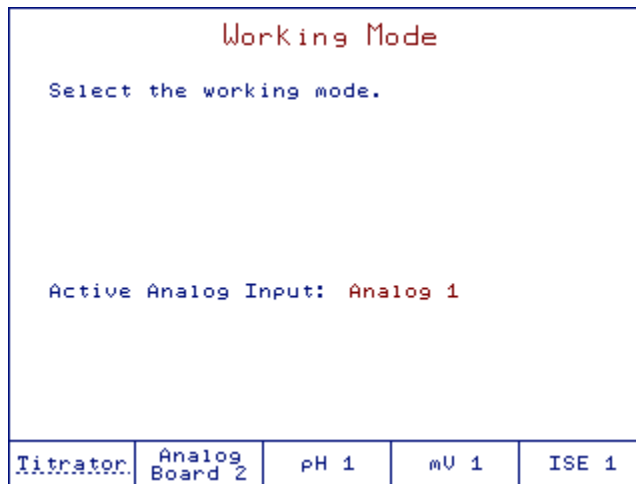
By pressing **Mode** from the main screen, the titrator can be switched to **Titration**, **pH**, **mV** or **ISE** modes.

One Analog Board



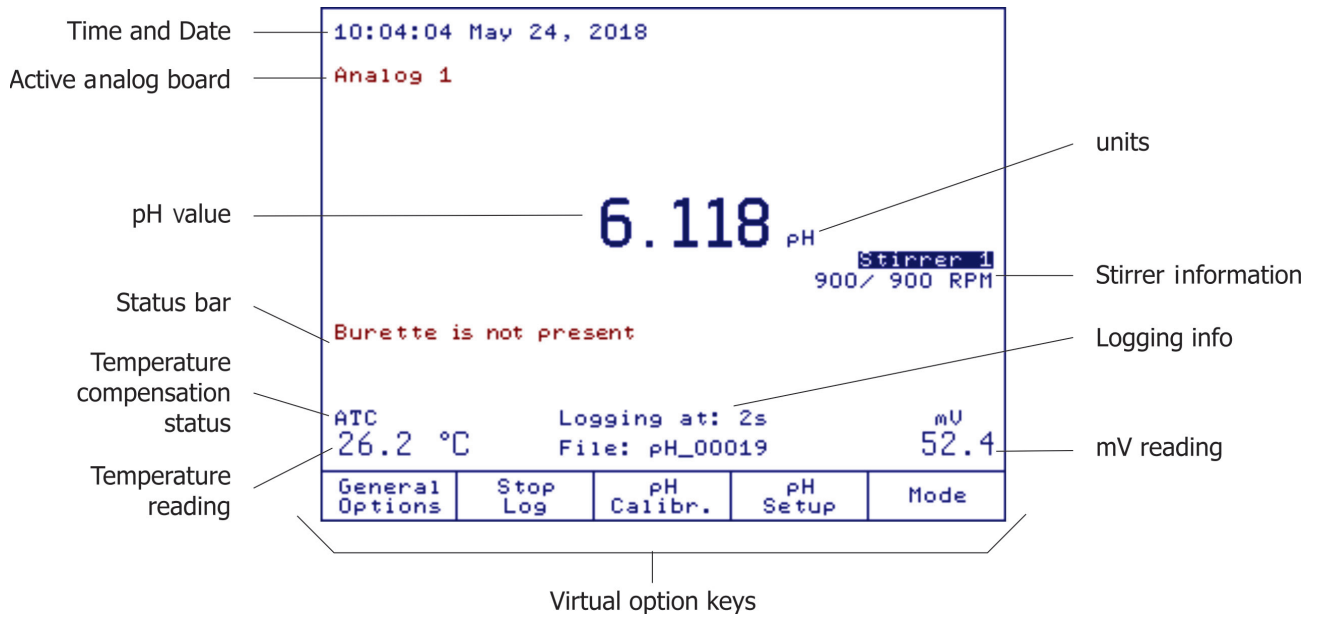
- Titration** Switches to **Titration** mode.
- pH** Switches to **pH** mode.
- mV** Switches to **mV** mode.
- ISE** Switches to **ISE** mode.

Two Analog Boards



- Titration** Switches to **Titration** mode.
- Analog Board 1** or **Analog Board 2** Switches the Analog Input for **pH**, **mV** and **ISE** mode.
- pH 1** or **pH 2** Switches to **pH** mode.
- mV 1** or **mV 2** Switches to **mV** mode.
- ISE 1** or **ISE 2** Switches to **ISE** mode.

7.1. DISPLAY

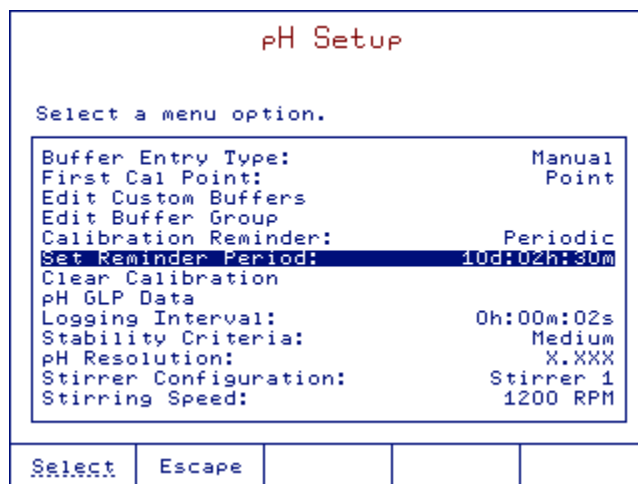


pH Mode Option keys:

- General Options The General Options screen gives access to options that are not directly related to the measurement process (see [General Options](#) section).
- Save Reading Stores the current pH reading (see [Manual Logging](#) section).
- or
- Start Log Starts the interval log (see [Automatic Logging](#) section).
- pH Calibr. Enter the pH calibration screen (see [pH Calibration](#) section).
- pH Setup Enter the pH setup screen, parameters are associated with pH measurements and calibration (see [pH Setup](#) section).
- Mode Allow the user to switch between the available measurement modes: **Titrat**or, **pH**, **mV** or **ISE** mode.

7.2. pH SETUP

To access pH Setup, press pH Setup option key while in pH mode.

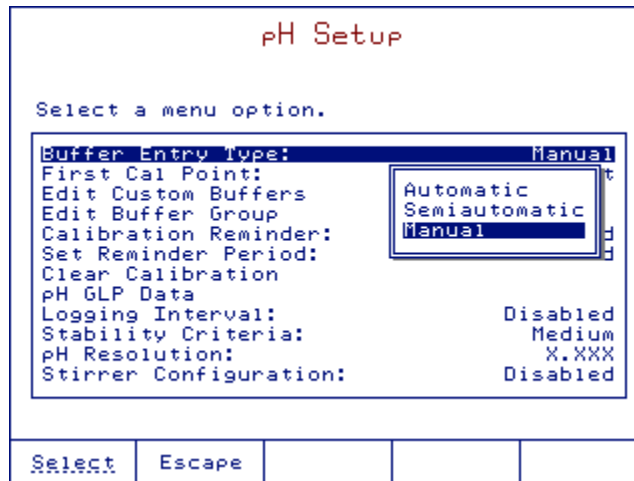


Use ▲ and ▼ keys to highlight the desired option.

Press Select or enter to access the selected option.

7.2.1. BUFFER ENTRY TYPE

Option: Automatic, Semiautomatic or Manual



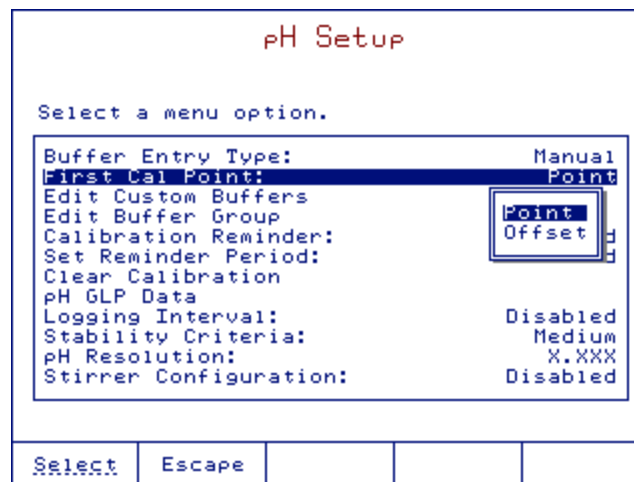
Automatic: The instrument automatically selects the pH calibration point as the closest buffer from the predefined buffer group (see [Edit Buffer Group](#) section).

Semiautomatic: The instrument automatically selects the closest buffer from the available buffers (standard and custom buffers).

Manual: The calibration buffer must be manually selected by the user during calibration from the available buffer list (standard and custom buffers).

7.2.2. FIRST CALIBRATION POINT

Option: Point or Offset



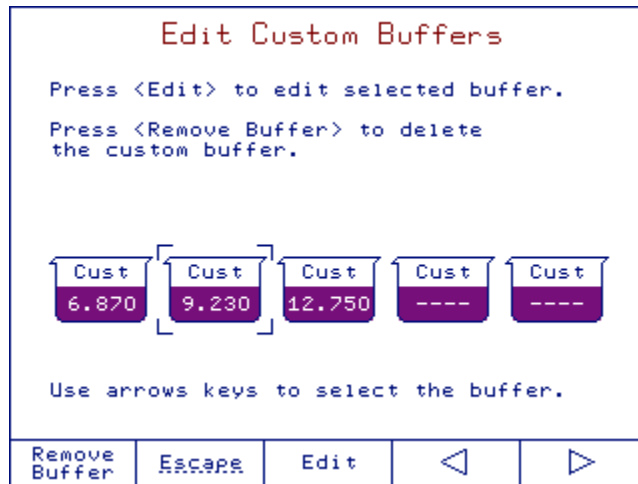
If *Point* is selected, the slope values adjacent to the calibration points will be reevaluated (normal calibration).





If *Offset* is selected the existing slope values will not be changed.

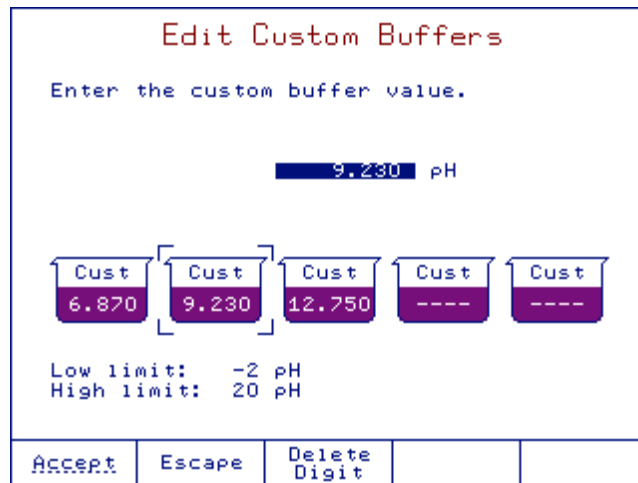
7.2.3. EDIT CUSTOM BUFFERS



If you wish to use buffers other than the standard ones, use the *Edit Custom Buffers* option to set the desired pH value, up to five pH custom buffers can be set.

Note: Custom buffers are not temperature compensated, enter the value of the buffer at the calibration temperature.



- Use  and  keys to select the desired buffer.
- Press  to delete the selected buffer.
- Press  to edit the selected buffer.



- Use the numeric keypad to enter the pH buffer value.
- Press  to save the value.
- Press  to return to pH Setup menu.

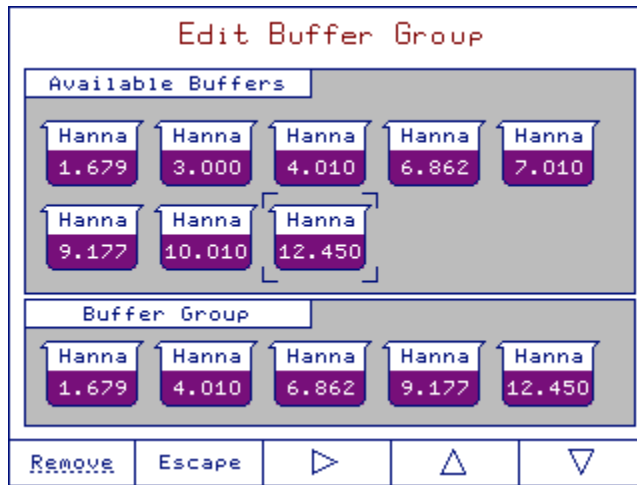
7.2.4. EDIT BUFFER GROUP

Option: Up to five

Select up to five buffers from the available buffers (Hanna or Custom) to be used for automatic buffer recognition.

Within the buffer group, pH values must be at least 1.5 pH far apart.

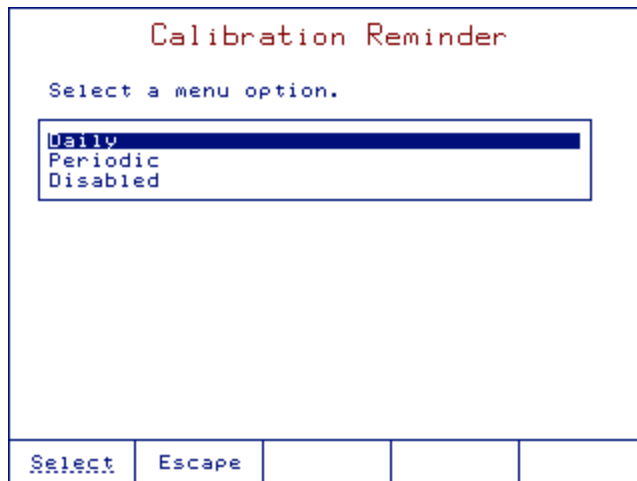
If the buffer group already contains five pH buffers, at least one pH buffer has to be removed in order to add another buffer.



- Use the arrow keys to select the pH buffer to be included/removed in/from the buffer group.
- Press or to add/remove the selected pH buffer to/from buffer group.
- Press to return to pH Setup menu.

7.2.5. CALIBRATION REMINDER

Option: Daily, Periodic or Disabled



Daily: The calibration reminder will appear daily at a specified time.

Periodic: The calibration reminder will appear after the set time has elapsed since the last calibration.

Disabled: The calibration reminder will not appear.

7.2.6. SET REMINDER PERIOD

If *Daily* or *Periodic* option was selected for the calibration reminder, the reminder period must also be set.

For a daily reminder period, the time of day can be set.

For a periodic reminder period, the number of days, hours and minutes can be set.

Periodic Calibration Reminder Enter the time period that must be passed since the last calibration, whereafter the calibration reminder appears. <div style="display: flex; justify-content: space-around;"> 10 days 2 hours 30 minutes </div> Press Next to move to the next entry.				
Accept	Escape	Delete Digit	Next	Off

- Press Next to move the cursor to the next field.
- Press Accept to save the changes or Escape to return to the previous screen.
- Press Off to disable the calibration reminder and return to pH setup.

7.2.7. CLEAR CALIBRATION

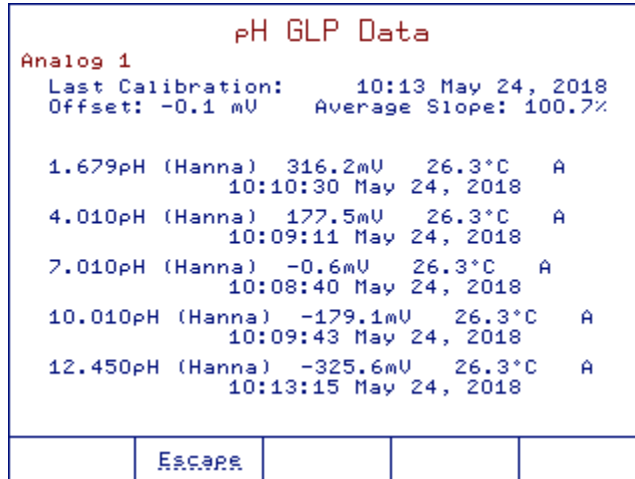
This option clears the existing pH calibration for the selected channel. If the calibration is cleared, the factory calibration will be used.

- Press Clear to clear the previous calibration or Escape to return to the previous screen without clearing the calibration.

Clear Calibration Press <Clear> to clear all calibration points. Press <Escape> to return without clearing the calibration points.				
Clear	Escape			

7.2.8. pH GLP DATA

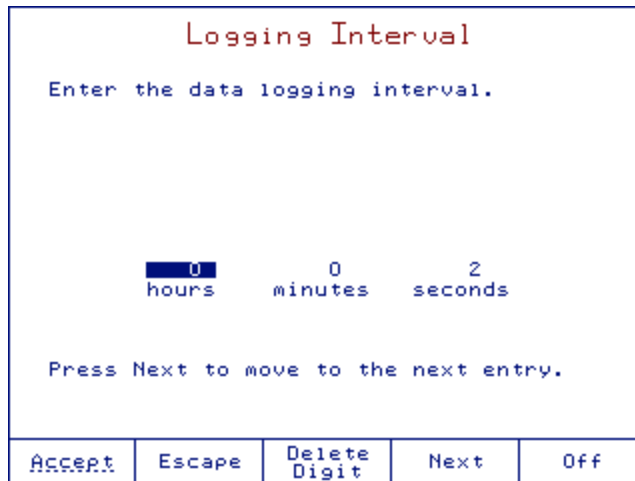
Displays the pH calibration data.



7.2.9. LOGGING INTERVAL

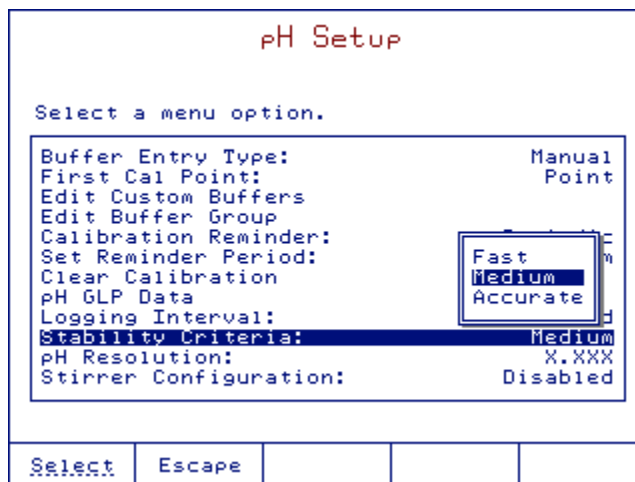
Option: 2 seconds to 8h 59 min 59 sec

Set the logging interval to be used for automatic logging.



7.2.10. STABILITY CRITERIA

Option: Fast, Medium, Accurate



Select the signal stability criteria:

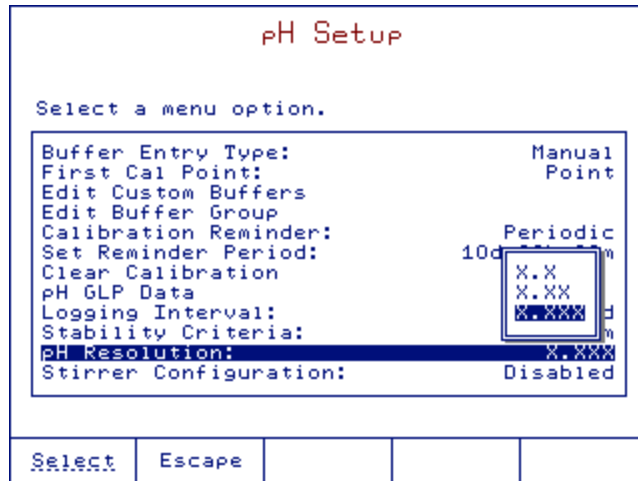
Fast: Quicker results with less accuracy

Medium: Medium speed results with medium accuracy

Accurate: Slower results with high accuracy

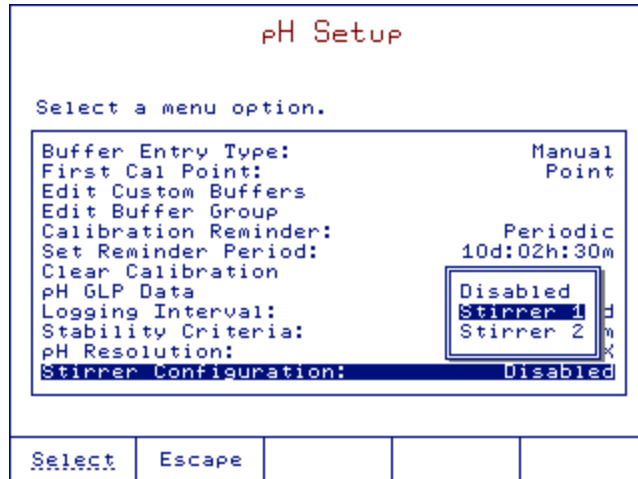
7.2.11. pH RESOLUTION

Option: One (X.X), Two (X.XX) or Three (X.XXX) decimal places



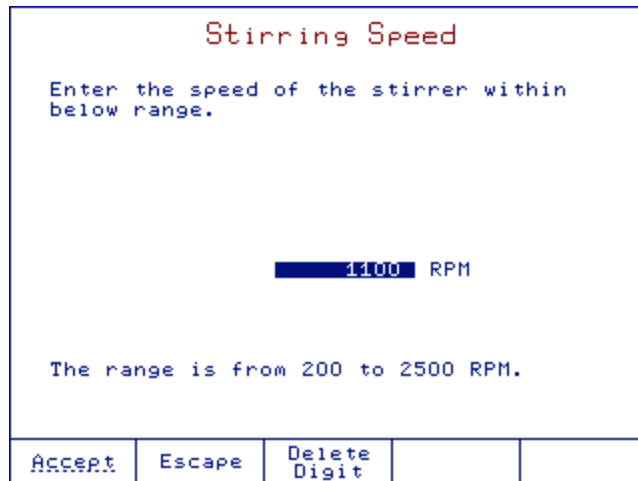
7.2.12. STIRRER CONFIGURATION

Option: Stirrer 1, Stirrer 2 (if available) or Disabled



7.2.13. STIRRING SPEED

Option: 200 to 2500 RPM

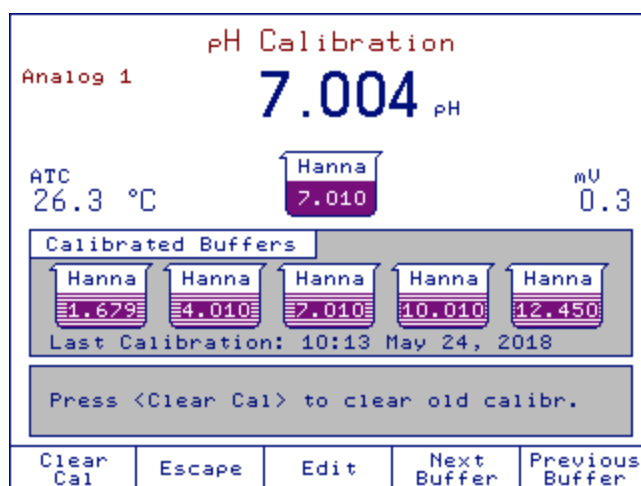


7.3. pH CALIBRATION

Calibrate the instrument often, especially if high accuracy is required.

The instrument should be recalibrated:

- Whenever the pH electrode is replaced.
- At least once a week.
- After testing aggressive chemicals.
- When “No pH Calibration” or “pH Calibration Expired” message appears on the display.



PREPARATION

Pour small quantities of the buffer solutions into clean beakers. If possible, use plastic beakers to minimize any EMC interferences.

For accurate calibration and to minimize cross-contamination, use two beakers for each buffer solution: one for rinsing the electrode and one for calibration. If you are measuring in the acidic range, use pH 7.01 or 6.86 as the first buffer and pH 4.01/3.00 or 1.68 as the second buffer. If you are measuring in the alkaline range, use pH 7.01 or 6.86 as the first buffer and pH 10.01/9.18 or 12.45 as the second buffer.

For extended range measurements (acidic and alkaline), perform a five-point calibration by selecting five buffers across the entire pH range.

CALIBRATION PROCEDURE

During calibration, the user has a choice of 8 standard buffers: (pH 1.68, 3.00, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and up to 5 custom buffers.

For accurate measurements it is recommended to perform a five-point calibration. However, at least a two-point calibration is suggested. For pH titrations, the selected buffers should bracket your end point (e.g.: if your end point value is at 8.5, use 7.01 or 6.86 and 9.18 or 10.01 for calibration).

To begin calibration:

- Press . If the instrument was calibrated before the old calibration can be cleared by pressing .

Note: It is very important to clear calibration history when a new electrode is used.

- Immerse the pH electrode and the temperature probe approximately 4 cm (1.5") into a buffer solution and stir gently.
- If necessary, select the pH calibration buffer value with or .
- Once the reading has stabilized press to update the calibration. The calibration buffer will be added to the Calibrated Buffers section.
- Rinse the pH electrode and the temperature probe, then immerse them into the next buffer solution and follow the above procedure or press to exit the calibration.

Notes:

- The new calibration points will replace old ones if the difference between them is ± 0.2 pH.
- Buffers used in older calibrations will not have a solid background.
- If calibrating with a standard buffer in MTC mode, the pH value and temperature can be modified by pressing . The values can be adjusted using the numeric keys. Press to save the new values.

Manual Edit				
Edit pH buffer and manual temperature.				
Buffer: <input type="text" value="7.010"/> pH				
Temperature: 25.0 °C				
Low limit: 6.990 pH				
High limit: 7.030 pH				
Press Next to move to the next entry.				
<input type="button" value="Accept"/>	<input type="button" value="Escape"/>	<input type="button" value="Delete Digit"/>	<input type="button" value="Next"/>	

- In ATC mode, the pH value for custom buffers can be modified by pressing .
- If the Automatic Buffer entry type was selected for the calibration procedure, the titrator will automatically select the closest buffer to the measured pH value from the buffer group.
- If the Semiautomatic Buffer entry type was selected use the or to select the buffer. Only buffers in the buffer group will be displayed.

CALIBRATION MESSAGES:

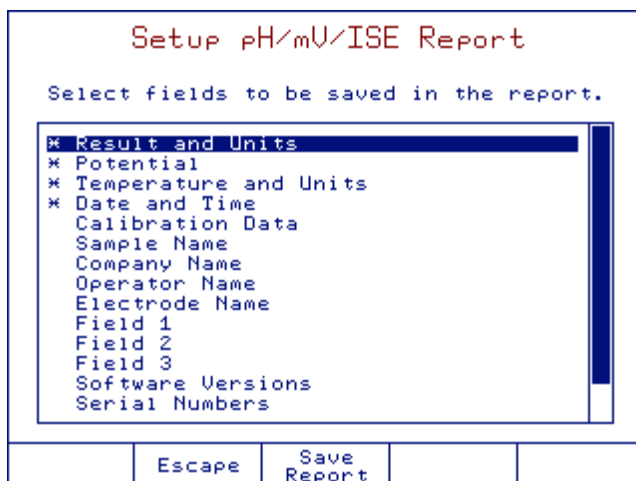
- **Wrong Buffer. Please check the buffer:** This message appears when the difference between the pH reading and the value of the selected calibration buffer is significant. If the message is displayed, check if you have selected the appropriate calibration buffer.
- **Wrong buffer temperature:** This message appears if the buffer temperature is out of the defined temperature range.
- **Clean the electrode or check the buffer. Press to update calibration:** This message alerts the user that some dirt or deposits could be on the electrode, or the buffer is contaminated.
- **Slope too low. Please check the buffer:** This message appears if the current slope is under 80% of the default slope. Recalibrate the instrument using fresh buffers.
- **Slope too high. Press to clear the old calibration:** This message appears as a result of an erroneous slope condition.

7.4. LOGGING

Data logging is available in pH mode. It can be logging on demand (Manual Logging) or automatically (Interval Logging) at predefined time intervals.

To customize the logging report:

- Press **results** to display the Data Parameters screen.
- Highlight the *Setup pH/mV/ISE* Report option and press **Select** to display the *Setup pH/mV/ISE* Report screen.



- Use the **▲** and **▼** keys to highlight the data field that you want to show/hide in the pH/mV/ISE report and then press **Select** to activate/deactivate it.
- Each field marked by "*" is an active field selected for the report.
- Press **Save Report** to save the customized report.

7.4.1. INTERVAL LOGGING

The logging interval is set in the pH setup screen.

Press **Start Log** to start the log.

The logging interval and name of logging file will be displayed on the **pH measurement** screen.

To stop the automatic logging, press **Stop**.

7.4.2. MANUAL LOGGING

To manually log pH readings, press **Save Reading** from the **pH measurement** screen.

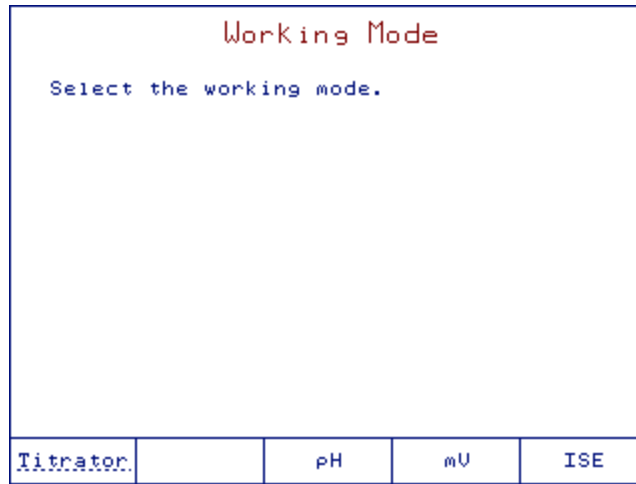
A new record will be added to the report every time **Save Reading** is pressed.

CHAPTER 8. mV MODE

8.1. DISPLAY	8-4
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8.2.3. STABILITY CRITERIA	8-5
8.2.4. STIRRER CONFIGURATION	8-6
8.2.5. STIRRING SPEED	8-6
8.3. RELATIVE mV CALIBRATION	8-6
8.4. LOGGING	8-7
8.4.1. INTERVAL LOGGING.....	8-7
8.4.2. MANUAL LOGGING	8-7

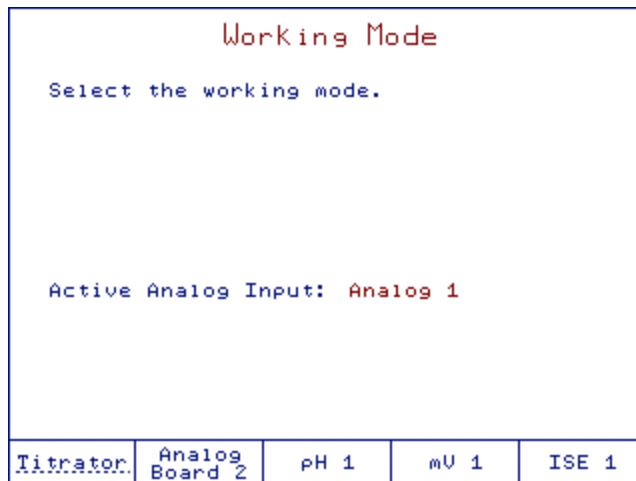
By pressing **Mode** from the main screen, the Titrator can be switched to **Titration, pH, mV** or **ISE** modes.

One Analog Board



- Titration** Switches to **Titration** mode.
- pH** Switches to **pH** mode.
- mV** Switches to **mV** mode.
- ISE** Switches to **ISE** mode.

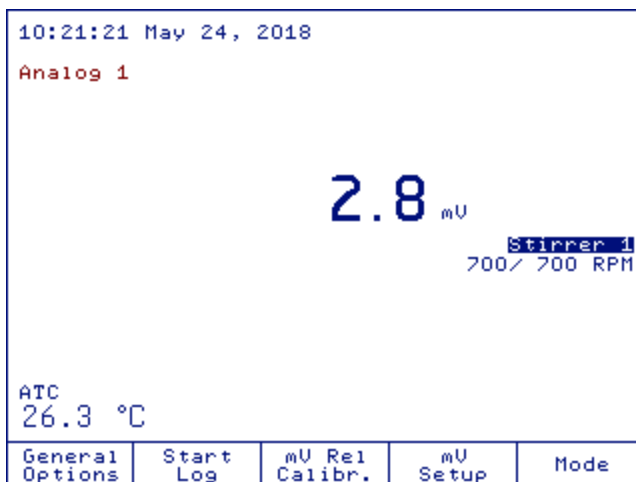
Two Analog Boards



- Titration** Switches to **Titration** mode.
- Analog Board 1** or **Analog Board 2** Switches the **Analog Input** for **pH, mV** and **ISE** mode.
- pH 1** or **pH 2** Switches to **pH** mode.
- mV 1** or **mV 2** Switches to **mV** mode.
- ISE 1** or **ISE 2** Switches to **ISE** mode.

8.1. DISPLAY

The mV screen is shown below.



mV Mode Option Keys:

General Options

The General Options screen gives access to options that are not directly related to the measurement process (see [General Options](#) section).

Save Reading

Stores the current mV reading (see [Manual Logging](#) section).

OR

Start Log

Starts the mV interval log (see [Automatic Logging](#) section).

mV Rel Calibr.

Enter the mV calibration screen (see [pH Calibration](#) section).

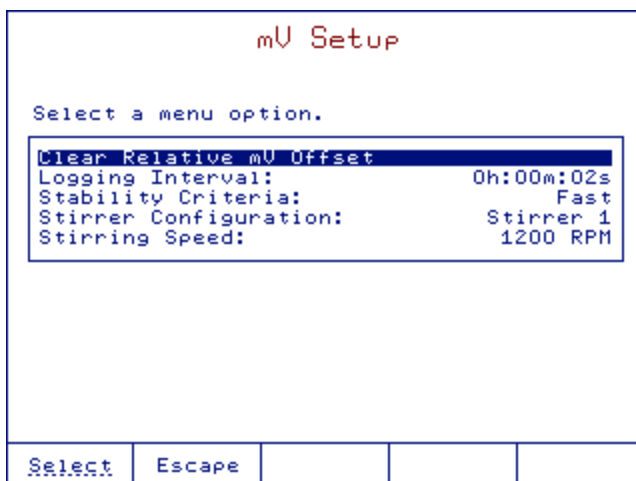
mV Setup

Enter the mV setup screen, parameters are associated with pH measurements and calibration (see [pH Setup](#) section).

Mode

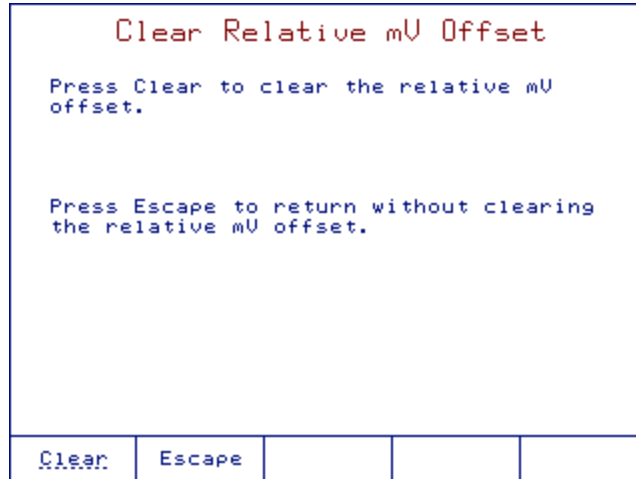
Allow the user to switch between the available measurement modes: **Titration**, **pH**, **mV** or **ISE** mode.

8.2. mV SETUP



8.2.1. CLEAR RELATIVE mV OFFSET

Press **Clear** to clear the relative mV offset or **Escape** to return to the previous screen.



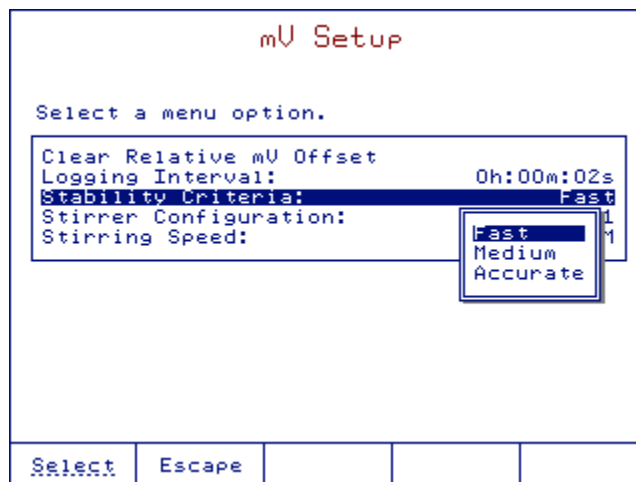
8.2.2. LOGGING INTERVAL

Option: 2 seconds to 8h 59min 59sec



8.2.3. STABILITY CRITERIA

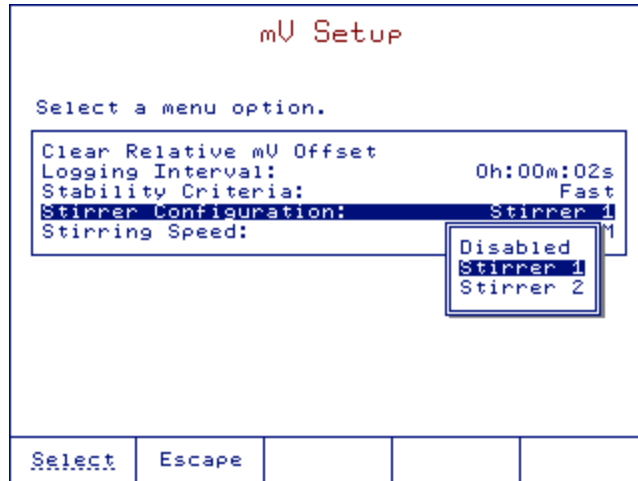
Option: Fast, Medium or Accurate:



- Fast:** Quicker results with less accuracy
- Medium:** Medium speed results with medium accuracy
- Accurate:** Slower results with high accuracy

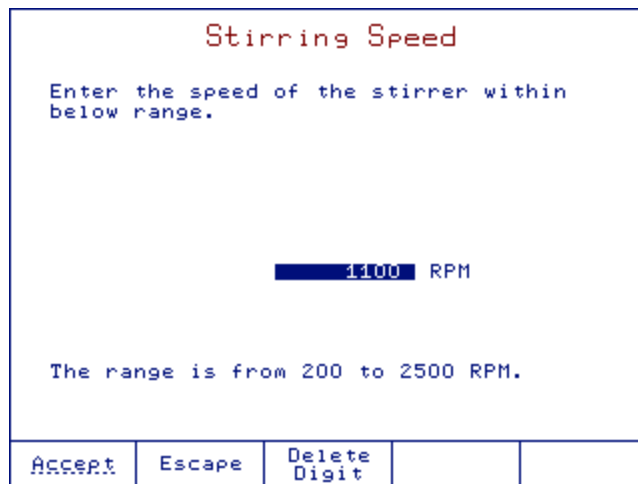
8.2.4. STIRRER CONFIGURATION

Option: Stirrer 1, Stirrer 2 (if available) or Disabled

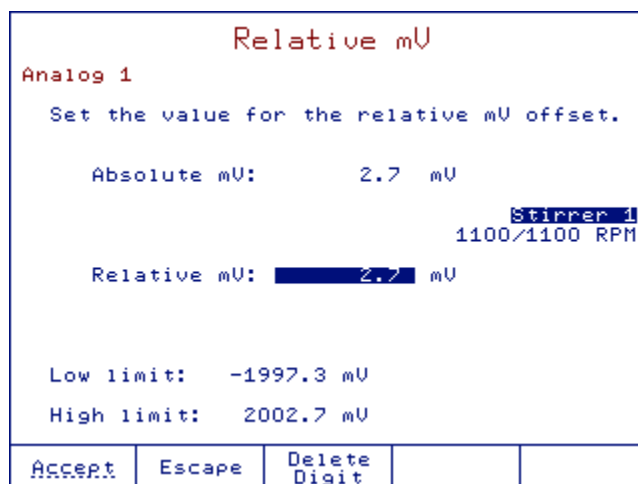





8.2.5. STIRRING SPEED

Option: 200 to 2500 RPM



8.3. RELATIVE mV CALIBRATION



- Press  to accept the value.
- Press  to cancel this operation and return to the previous screen.
- Press  to delete the last digit.

8.4. LOGGING

Data logging is available in mV mode. It can be logging on demand (Manual Logging) or automatically (Interval Logging) at predefined time intervals.

To customize the logging report:

- Press **results** to display the **Data Parameters** screen.
- Highlight the *Setup pH/mV/ISE* Report option and press **Select** to display the **Setup pH/mV/ISE Report** screen.

Setup pH/mV/ISE Report

Select fields to be saved in the report.

- * Result and Units
- * Potential
- * Temperature and Units
- * Date and Time
- * Calibration Data
- Sample Name
- Company Name
- Operator Name
- Electrode Name
- Field 1
- Field 2
- Field 3
- Software Versions
- Serial Numbers

Select Escape Save Report Page Up Page Down

- Use the **▲** and **▼** keys to highlight the data field that you want to show/hide in the pH/mV/ISE report and then press **Select** to activate/deactivate it.
- Each field marked by "*" is an active field selected for the report.
- Press **Save Report** to save the customized report.

8.4.1. INTERVAL LOGGING

The logging interval is set in the mV Setup screen.

Press **Start Log** to start the log.

The logging interval and name of logging file will be displayed on the measure screen.

To stop the automatic logging, press **Stop** again.

8.4.2. MANUAL LOGGING

To manually log mV readings, press **Save Reading** from the **mV** measurement screen.

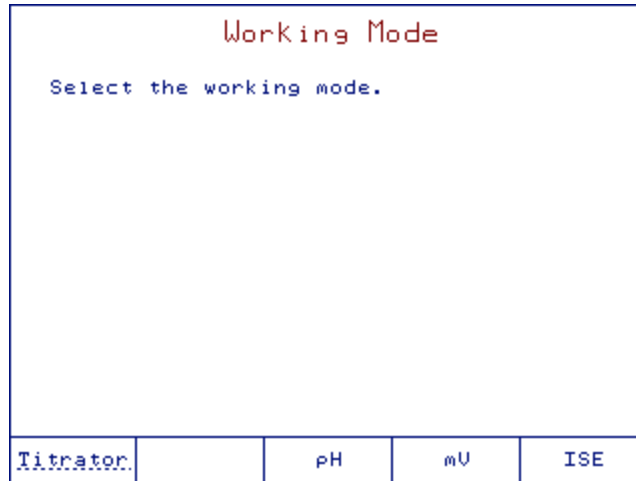
A new record will be added to the report every time **Save Reading** is pressed.

CHAPTER 9. ISE MODE

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9.4. LOGGING	9-13
9.4.1. INTERVAL LOGGING.....	9-14
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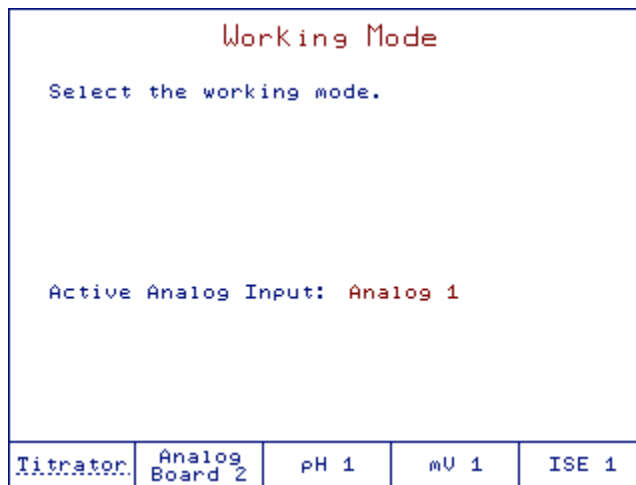
By pressing Mode from the main screen, the Titrator can be switched to **Titrator**, **pH**, **mV** or **ISE** modes.

One Analog Board



- Titrator Switches to **Titrator** mode.
- pH Switches to **pH** mode.
- mV Switches to **mV** mode.
- ISE Switches to **ISE** mode.

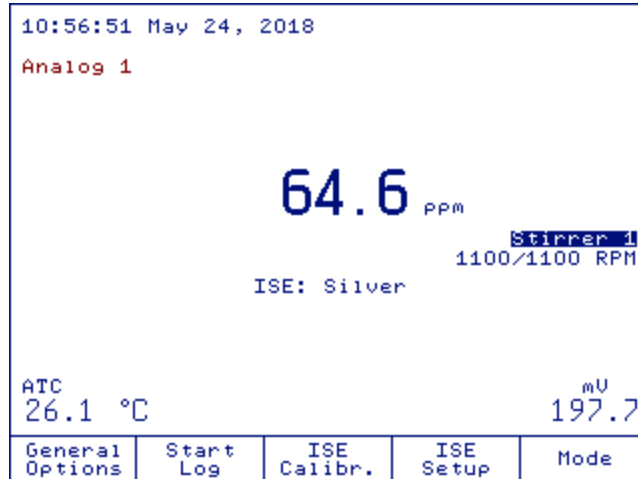
Two Analog Boards









- Titrator Switches to **Titrator** mode.
- Analog Board 1 OR Analog Board 2 Switches the **Analog Input** for **pH**, **mV** and **ISE** mode.
- pH 1 OR pH 2 Switches to **pH** mode.
- mV 1 OR mV 2 Switches to **mV** mode.
- ISE 1 OR ISE 2 Switches to **ISE** mode.

9.1. DISPLAY


The ISE screen is shown below.

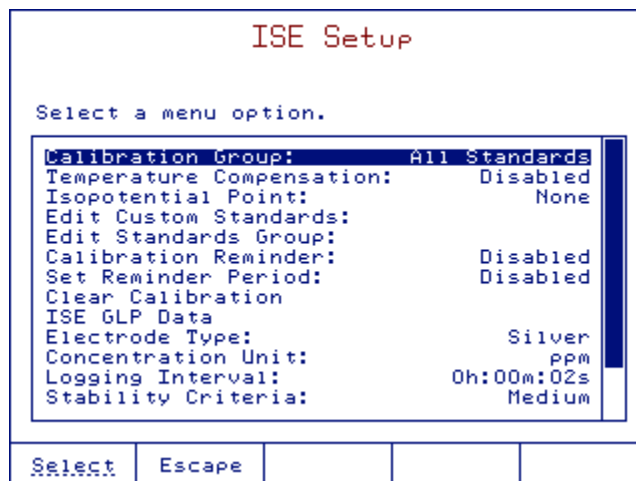


ISE Mode option keys:

-  The General Options screen gives access to options that are not directly related to the measurement process (see [General Options](#) section).
-  Stores the current concentration reading (see [Manual Logging](#) section).
- or
-  Starts the ISE interval log (see [Interval Logging](#) section).
-  Enter the ISE calibration screen (see [ISE Calibration](#) section).
-  Enter the ISE setup screen. Parameters are associated with ISE measurements and calibration.
-  Allows the user to switch between the available measurement modes: **Titration**, **pH**, **mV** and **ISE** mode.

9.2. ISE SETUP

To access the ISE Setup, press  option key in ISE mode.



9.2.1. CALIBRATION GROUP

Option: All Standards or Standards Group

The screenshot shows the 'ISE Setup' menu with the following options and values:

Calibration Group:	All Standards
Temperature Compensation:	All Standards
Isopotential Point:	Standards Group
Edit Custom Standards:	
Edit Standards Group:	
Calibration Reminder:	Disabled
Set Reminder Period:	Disabled
Clear Calibration	
ISE GLP Data	
Electrode Type:	Silver
Concentration Unit:	ppm
Logging Interval:	0h:00m:02s
Stability Criteria:	Medium

At the bottom of the screen, there are five buttons: 'Select', 'Escape', and three empty buttons.

All Standards: The set of available standards includes the Standard solutions and Custom solutions.

Standards Group: The set of available standards includes only the standards selected by the user.

9.2.2. TEMPERATURE COMPENSATION

Option: Enabled or Disabled

The screenshot shows the 'ISE Setup' menu with the following options and values:

Calibration Group:	All Standards
Temperature Compensation:	Disabled
Isopotential Point:	Disabled
Edit Custom Standards:	Enabled
Edit Standards Group:	
Calibration Reminder:	Disabled
Set Reminder Period:	Disabled
Clear Calibration	
ISE GLP Data	
Electrode Type:	Silver
Concentration Unit:	ppm
Logging Interval:	0h:00m:02s
Stability Criteria:	Medium

At the bottom of the screen, there are five buttons: 'Select', 'Escape', and three empty buttons.

Note: If you enabled Temperature Compensation, then the isopotential point must be set.

9.2.3. ISOPOTENTIAL POINT (TEMPERATURE COMPENSATION)

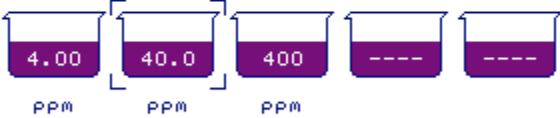
Option: 1.00 E⁻² to 1.00 E⁺⁵ ppm

This option allows the user to set an isopotential point for the selected electrode when temperature compensation is enabled. The isopotential point is edited in ppm units only. The isopotential point will vary for different electrodes, if measurements are going to be made at several temperatures, the value should be entered if it is known.

Isopotential Point				
Enter the value for isopotential point.				
20.0 ppm				
Low limit: 1.00E-2 ppm				
High limit: 1.00E+5 ppm				
Accept	Escape	Delete Digit		Exponent

9.2.4. EDIT CUSTOM STANDARDS

Option: Up to five

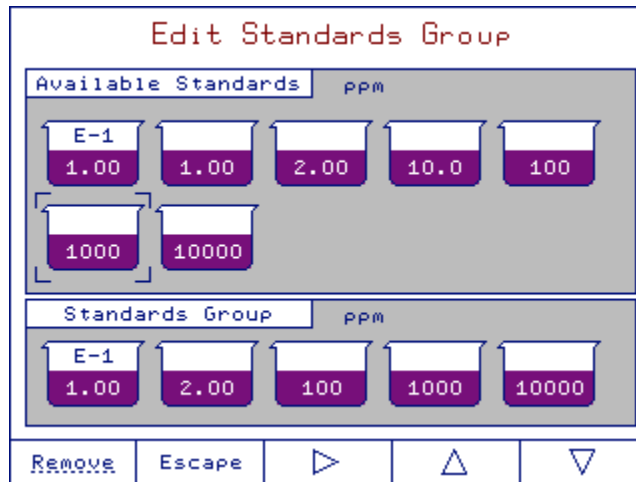
Edit Custom Standards				
Press <Edit> to edit selected standard.				
Press <Remove Standard> to delete the custom standard.				
				
Use arrows keys to select the standard.				
Remove Standard	Escape	Edit	<	>

- Use the < and > keys to select the standard.
- Press Remove Standard to delete the standard.
- Press Edit to edit the selected custom standard; use the numeric keys to edit the standard.

9.2.5. EDIT STANDARD GROUP

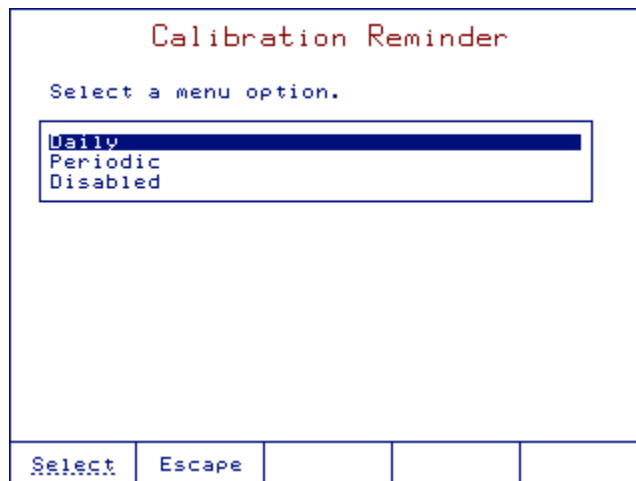
Option: Up to 5 standards

- Use the arrow keys to select the standard to be included/removed in/from the standard group.
- Press **Add** or **Remove** to add/remove the selected standard to/from standard group.
- Press **Escape** to return to ISE Setup menu.



9.2.6. CALIBRATION REMINDER

Option: Daily, Periodic or Disabled



Daily: The calibration reminder will appear daily at specified time.

Periodic: The calibration reminder will appear after the set time has elapsed since the last calibration.

Disable: The calibration reminder will not appear.

9.2.7. SET REMINDER PERIOD

If Daily or Periodic option was selected for the calibration reminder, the reminder period must also be set.

For a daily reminder period the time of day can be set.

For a periodic reminder period the number of days, hours and minutes can be set.

Periodic Calibration Reminder				
Enter the time period that must be passed since the last calibration, whereafter the calibration reminder appears.				
10 days		2 hours		30 minutes
Press Next to move to the next entry.				
Accept	Escape	Delete Digit	Next	Off

- Press to move the cursor to the next field.
- Press to save the changes or to return to the previous screen.
- Press to disable the calibration reminder and return to ISE setup menu.

9.2.8. CLEAR CALIBRATION

This option clears the existing ISE calibration. If the calibration is cleared, a new calibration must be done in order to take measurements.

- Press to clear the previous calibration or to return to the previous screen.

Clear Calibration				
Press <Clear> to clear all calibration points.				
Press <Escape> to return without clearing the calibration points.				
Clear	Escape			

9.2.9. ISE GLP DATA

Displays the ISE calibration data

ISE GLP Data				
Analog 1				
Last Calibration:		13:42 May 24, 2018		
Slope: 100.8%		ISE: Silver		
Isopotential Point: 20.0 ppm				
1.00E-1 ppm,	0.1mV	28.1°C	A	
		13:39:43 May 24, 2018		
1.00 ppm,	59.5mV	28.1°C	A	
		13:40:39 May 24, 2018		
2.00 ppm,	77.6mV	28.1°C	A	
		13:41:25 May 24, 2018		
10.0 ppm,	120.0mV	28.1°C	A	
		13:41:45 May 24, 2018		
100 ppm,	181.0mV	28.2°C	A	
		13:42:17 May 24, 2018		
Escape				

9.2.10. ELECTRODE TYPE

Option: Ammonia, Bromide, Cadmium, Calcium, Carbon Dioxide, Chloride, Cupric, Cyanide, Fluoride, Iodide, Lead, Nitrate, Potassium, Silver, Sodium, Sulfate, Sulfide or five custom electrodes

Electrode Type				
Select a menu option.				
<div style="border: 1px solid black; padding: 5px;"> Ammonia Bromide Cadmium Calcium Carbon Dioxide Chloride Cupric Cyanide Fluoride Iodide Lead Nitrate Potassium Silver </div>				
Select	Escape	View	Page Up	Page Down

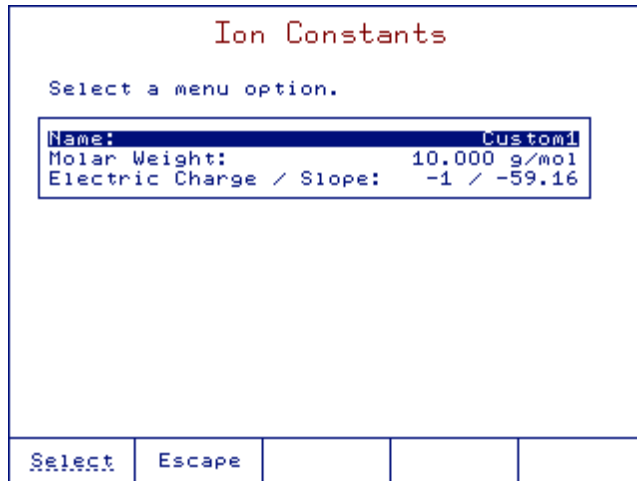
For Standard ISE:

- Press Select to see the ion constants (name, molar weight, electric charge/slope), press Escape to return to the setup screen.

Ion Constants				
View Ion constants.				
<div style="border: 1px solid black; padding: 5px;"> Name: Silver Molar Weight: 107.868 g/mol Electric Charge / Slope: 1 / 59.16 </div>				
Escape				

For Custom ISE:

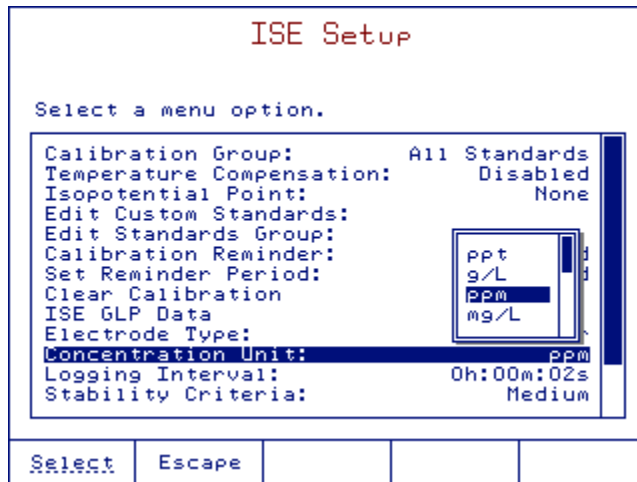
- Press View to edit the Ion constants for the selected custom ISE.



- Use the ^ and v keys to highlight the desired ion constant and press Select to edit the value.
- Set the Ion Name (up to 10 characters can be entered).
- Set the appropriate Molecular Weight (in g/mol) using the numeric keys. Press Accept to save the value or press Escape to return to the previous screen.
- Select the appropriate Electric Charge/Slope. Use the ^ and v keys to select the value and then press Select. If the electric charge is none, manually set the slope by pressing Edit. Press Accept to save the value or press Escape to return to the previous screen.

9.2.11. CONCENTRATION UNIT

Options: ppt (g/L), ppm (mg/L), ppb ($\mu\text{g/L}$), mg/mL, M (mol/L), mmol/L, %w/v or user defined



9.2.12. LOGGING INTERVAL

Option: 2 seconds to 8h 59 min 59 sec

Logging Interval

Enter the data logging interval.

0 0 2
 hours minutes seconds

Press Next to move to the next entry.

Accept	Escape	Delete Digit	Next	Off
--------	--------	--------------	------	-----

9.2.13. STABILITY CRITERIA

Option: Fast, Medium, Accurate

ISE Setup

Select a menu option.

Calibration Group:	All Standards
Temperature Compensation:	Enabled
Isopotential Point:	20.0 ppm
Edit Custom Standards:	
Edit Standards Group:	
Calibration Reminder:	Disabled
Set Reminder Period:	Disabled
Clear Calibration	
ISE GLP Data	
Electrode Type:	
Concentration Unit:	
Logging Interval:	
Stability Criteria:	Medium

Select	Escape			
--------	--------	--	--	--

Fast: Quicker results with less accuracy

Medium: Medium speed results with medium accuracy

Accurate: Slower results with high accuracy

9.2.14. ISE SIGNIFICANT DIGITS

Option: One (X), Two (XX) or Three (XXX).

ISE Setup

Select a menu option.

Temperature Compensation:	Enabled
Isopotential Point:	20.0 ppm
Edit Custom Standards:	
Edit Standards Group:	
Calibration Reminder:	Disabled
Set Reminder Period:	Disabled
Clear Calibration	
ISE GLP Data	
Electrode Type:	
Concentration Unit:	
Logging Interval:	0h:0
Stability Criteria:	
ISE Significant Digits:	XXX

Select	Escape			
--------	--------	--	--	--

9.2.15. STIRRER CONFIGURATION

Option: Stirrer 1, Stirrer 2 (if available) or Disabled

ISE Setup	
Select a menu option.	
Isopotential Point:	20.0 ppm
Edit Custom Standards:	
Edit Standards Group:	
Calibration Reminder:	Disabled
Set Reminder Period:	Disabled
Clear Calibration	
ISE GLP Data	
Electrode Type:	
Concentration Unit:	Disabled
Logging Interval:	Stirrer 1
Stability Criteria:	Stirrer 2
ISE Significant Digits:	
Stirrer Configuration:	Stirrer 1

Select	Escape			
--------	--------	--	--	--

9.2.16. STIRRING SPEED

Option: 200 to 2500 RPM

Stirring Speed	
Enter the speed of the stirrer within below range.	
2500 RPM	
The range is from 200 to 2500 RPM.	

Accept	Escape	Delete Digit		
--------	--------	--------------	--	--

9.3. ISE CALIBRATION

It is recommended to calibrate the instruments frequently if high accuracy is required. The instrument should also be recalibrated whenever the "Calibrate Electrode" message appears on the LCD.

Due to electrode conditioning time, the electrode must be immersed for several seconds to stabilize. The user will be guided step by step during calibration with easy-to-follow messages on the display. This will make the calibration a simple and error-free procedure.

PREPARATION:

Pour small quantities of the standard solution into clean beakers. If possible, use plastic beakers to minimize any EMC interferences.

For accurate calibration and to minimize cross-contamination, use two beakers for each standard solution: one for rinsing the electrode and one for calibration.

Note: For accurate measurements, add the appropriate ISA (Ionic Strength Adjustment) to the calibration standards.

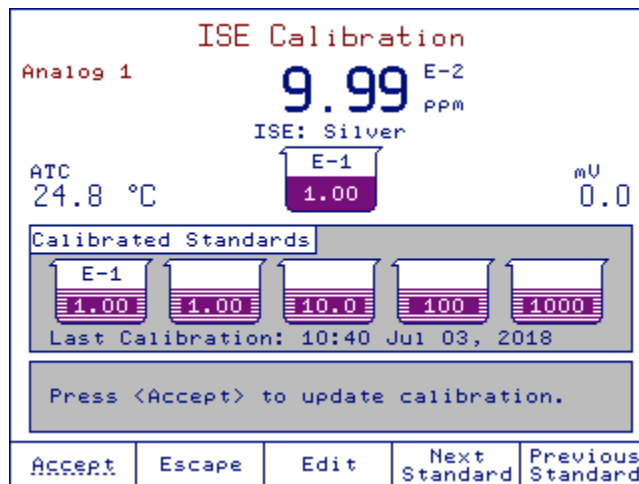
CALIBRATION PROCEDURE:

Before calibrating, make sure that the electrode type and concentration unit has been selected in ISE Setup.

Up to a five points calibration is possible using any combination of five standard solutions and five custom solutions.

The ISE calibration and measurement can be performed with or without temperature compensation. If the temperature compensation option is enabled, the isopotential point of the electrode must be set in ISE Setup.

- Press **ISE Calibr.** from the main screen. If the instrument was calibrated before and the calibration was not cleared, the old calibration can be cleared by pressing **Clear Cal**.
- Immerse the ISE and the temperature probe approximately 2 cm into the standard with the lowest concentration.



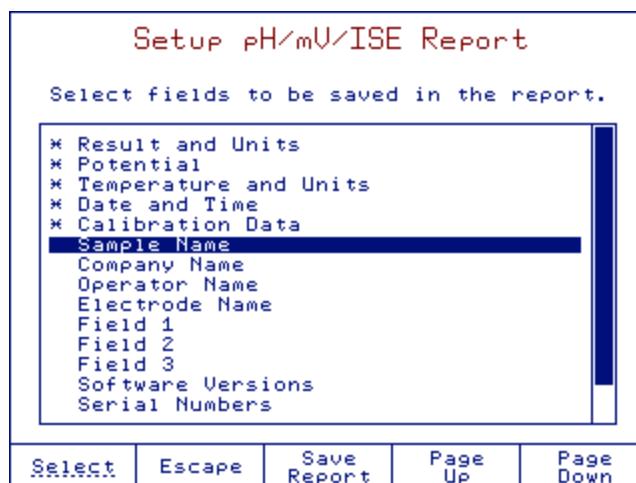
- Select the standard concentration with **Next Standard** or **Previous Standard**.
- When the reading has stabilized, press **Accept** to update the calibration. The calibration point value will be added to the Calibrated Standard list.
- Select **Next Standard** and repeat the procedure with all of the available standards.
- Press **Escape** to exit the calibration.

9.4. LOGGING

Data logging is available in ISE mode. It can be logging on demand (Manual Logging) or automatically (Interval Logging) at predefined time intervals.

To customize the logging report:

- Press **results** to display the **Data Parameters** screen.
- Highlight the *Setup pH/mV/ISE Report* option and press **Select** to display the **Setup pH/mV/ISE Report** screen.



- Use the **▲** and **▼** keys to highlight the data field that you want to show/hide in the pH/mV/ISE report and then press **Select** to activate/deactivate it.
- Each field marked by "*" is an active field selected for the report.
- Press **Save Report** to save the customized report.

9.4.1. INTERVAL LOGGING

The logging interval is set in the ISE Setup screen.

Press  to start the log.

The logging interval and name of logging file will be displayed on the measure screen.

To stop the automatic logging, press  again.

9.4.2. MANUAL LOGGING

To manually log ISE readings, press  from the ISE screen.

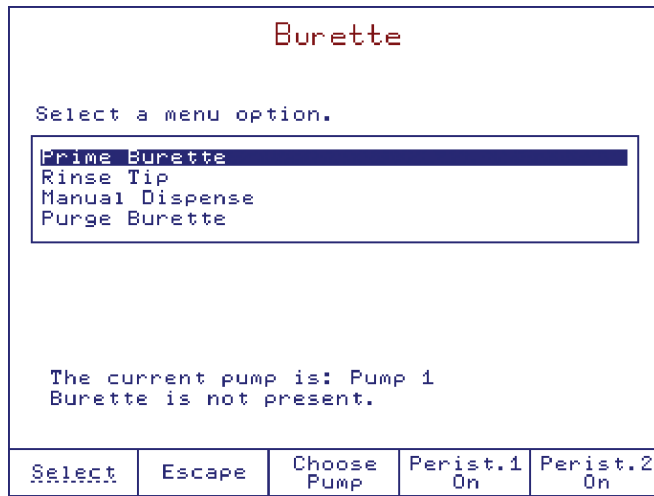
A new record will be added to the report every time  is pressed.

CHAPTER 10. AUXILIARY FUNCTIONS

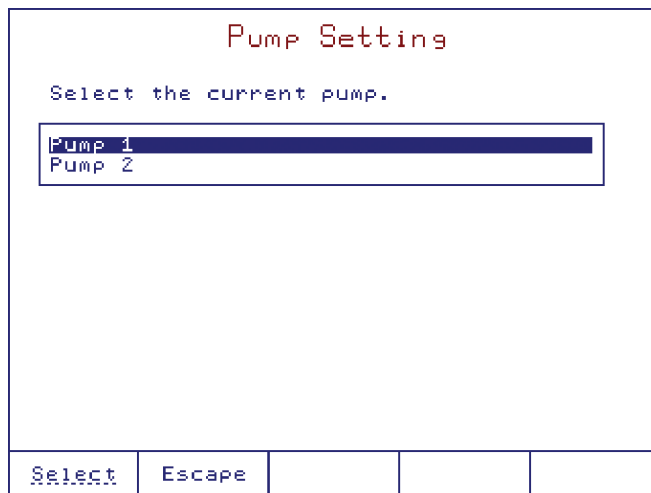
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10.1.3. MANUAL DISPENSE.....	10-4
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10.1. BURETTE

To access the **Burette** screen, press **Burette** from the main titration screen.
 Highlight the desired option and then press **Select**.



Choose Pump allows you to select the desired pump for burette operations (it is only active if two pumps are connected).

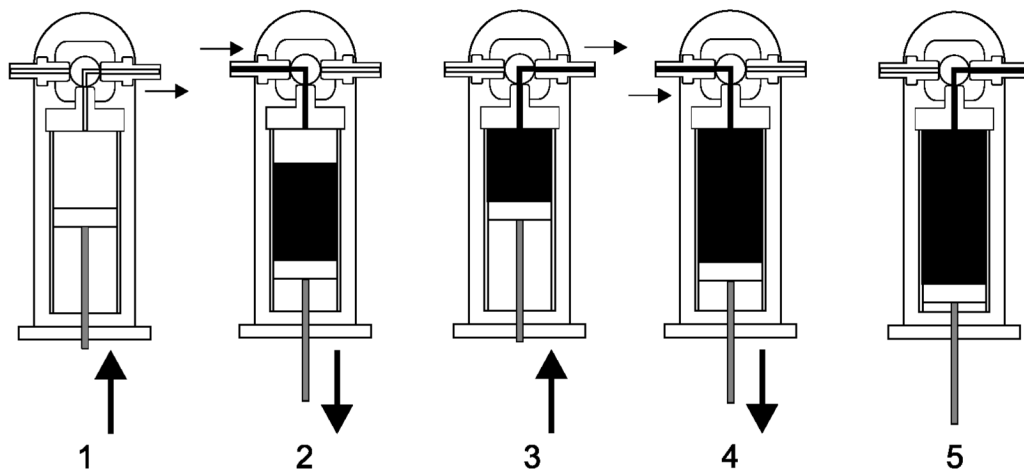


10.1.1. PRIME BURETTE

Option: Up to 5

The *Prime Burette* option is used to fill the burette with titrant or reagent before starting a titration. The priming process consists of several cycles of filling and emptying the burette with titrant.

Two rinse cycles of burette are shown in the figure below. The dispensing tube is connected on the right side and the aspiration tube on the left side.



Note: Before starting this operation, the aspiration tube must be inserted in the titrant bottle. A waste container should be placed under the dispensing tip to collect the waste solution.

To prime the burette, select *Prime Burette*, enter the number of rinses and press .

We recommend at least three rinses to assure that the air bubbles are completely removed.

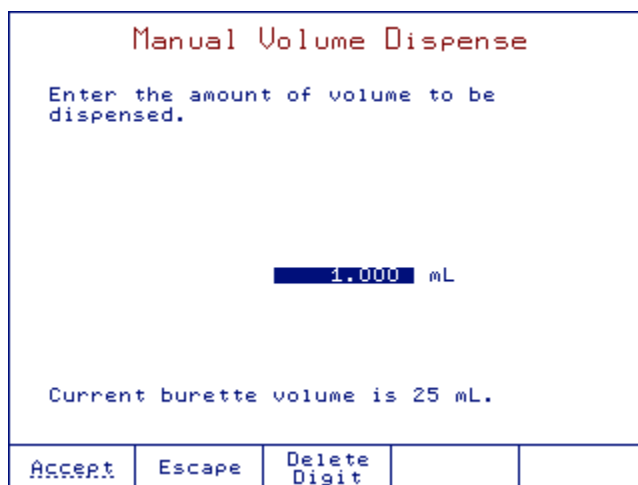
Total Burette Rinses				
Enter the total number of burette rinses.				
<div style="border: 1px solid black; display: inline-block; padding: 2px 10px;">3</div>				
A minimum of three rinses is recommended.				
Accept	Escape	Delete Digit		

10.1.2. RINSE TIP

A 2 mL dose of titrant will be dispensed from the burette when this operation is selected, this will eliminate any air in the dispensing tip.

10.1.3. MANUAL DISPENSE

Manual Dispense option allows a defined titrant volume to be dosed. Select the *Manual Dispense* option and press .



Use the numeric keypad to enter the volume to be dispensed.

The manual dispense volume must be between the limits shown below:

0.001 to 4.750 mL for a 5 mL burette

0.001 to 9.500 mL for a 10 mL burette

0.005 to 23.750 mL for a 25 mL burette

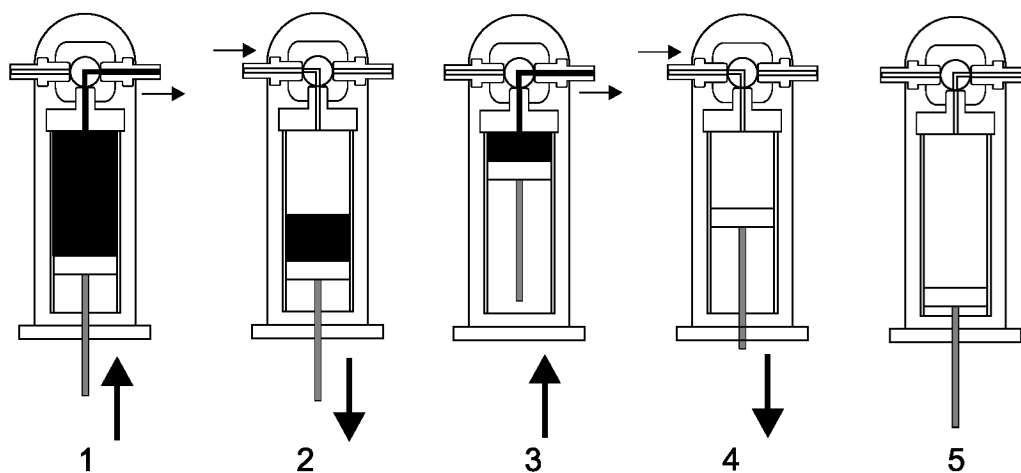
0.005 to 47.500 mL for a 50 mL burette

10.1.4. PURGE BURETTE

This option allows the burette to be emptied before cleaning and/or storing the burette. The burette is flushed twice.

Note: Before starting this operation, remove the aspiration tube from the titrant bottle.

The figures below show the steps in a purge burette operation.



10.1.5. PERISTALTIC PUMP

To manually control the peristaltic pump, press **Burette** from the main titration screen.

Press **Perist.1 On** or **Perist.2 On** to turn on the selected peristaltic pump.

Press **Perist.1 Off** or **Perist.2 Off** to turn off the selected peristaltic pump.

Burette				
Select a menu option.				
<div style="border: 1px solid black; padding: 5px;"> Prime Burette Rinse Tip Manual Dispense Purge Burette </div>				
The current pump is: Pump 1 Current burette volume is 25 mL.				
Select	Escape	Choose Pump	Perist.1 Off	Perist.2 On

Note: If the peristaltic pump is not turned off, it will turn off automatically after 10 minutes.

10.2. STIRRER

The stirrer can be turned on and off by pressing **stir**.

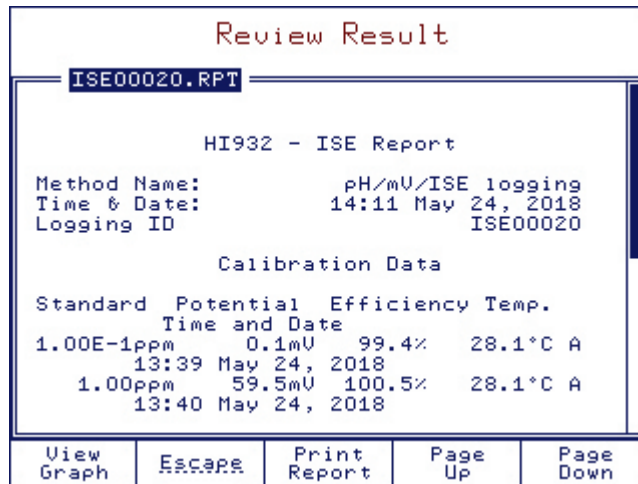
During the titration process, the stirring speed can be manually adjusted using the **▲** and **▼** keys.

10.3. RESULTS

From the **Data Parameters** screen, you can access the following options:

Data Parameters				
Select a menu option.				
<div style="border: 1px solid black; padding: 5px;"> Review Last Analysis Report Review Available Reports GLP Data Meter Information Setup pH/mU/ISE Report Setup Titration Report </div>				
Select	Escape			

10.3.1. REVIEW LAST ANALYSIS REPORT



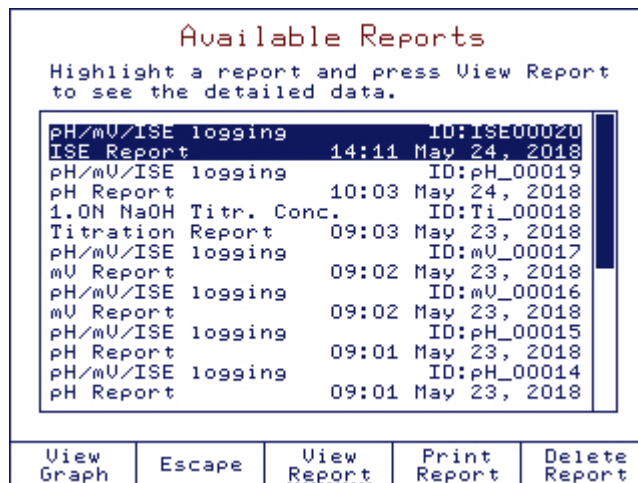
The information seen in the report is based on the selections made in the **Setup Titration Report** and **Setup ISE/pH/mV Report** screen.

The following option keys are available:

- View Graph Review the graph.
- Print Report Print the titration report.
- Escape Return to the previous screen.
- Page Up Page Down Keys can be used to scroll through the pages.

10.3.2. REVIEW AVAILABLE REPORTS

Up to 100 reports can be saved on the titrator. To view one of the saved reports, highlight a report and then press View Report.



The report contains only the information selected in the **Setup Titration Report** and **Setup pH/mV/ISE Report** screens during report configuration.

The following option keys are available:

- View Graph Review the selected graph.
- View Report Review the selected report.
- Print Report Print the selected report.
- Delete Report Delete the selected report.
- Escape Return to the previous screen.

10.3.3. GLP DATA

Option: Up to 20 characters

GLP Data

Select a menu option.

Sample Name:

Company Name:

Operator Name:

Electrode Name:

Field 1:

Field 2:

Field 3:

Select	Escape			
--------	--------	--	--	--

Sample Name: Allows the sample name to be recorded in each report. The sample name will increase by one, with each new titration or logging report, if the last character is a number.

Company Name: Allows the company name to be recorded in each report.

Operator Name: Allows the operator name to be recorded in each report.

Electrode Name: Allows the electrode name to be recorded in each report.

Fields 1, 2, 3: Allows any additional information to be recorded in each report.

The fields must be selected from **Setup Titration Report** screen (see [Setup Titration Report](#) section) in order to be displayed in the titration report.

10.3.4. METER INFORMATION

Displays titrator configuration data.

```

Meter Information
SERIAL NUMBER 932 Titrator
Titrator Serial Number:      12133404404
Analog Board1 Serial Number: 30134202202
Analog Board2 Serial Number: 30000000000
Pump 1 Serial Number:        70094513513
Stirrer 1 Serial Number:     70091703703

SOFTWARE VERSION
Titrator Software Version:    v1.00
Base Board Software Version:  v1.00
Pump 1 Software Version:      v1.00
Stirrer 1 Software Version:   v1.00

Analog 1 Calibration Date:    May 22, 2018
Analog 2 Calibration Date:    May 10, 2018

Escape Print
```

Titrator Serial Number: The serial number of the titrator base board.

Analog Board 1 (and/or 2) Serial Number: The serial number of the analog board.

Pump 1 (and/or 2) Serial Number: The serial number of the connected pump.

Titrator Software Version: The current software version installed on the titrator.

Base Board Software Version: The current software version present on the base board of the titrator.

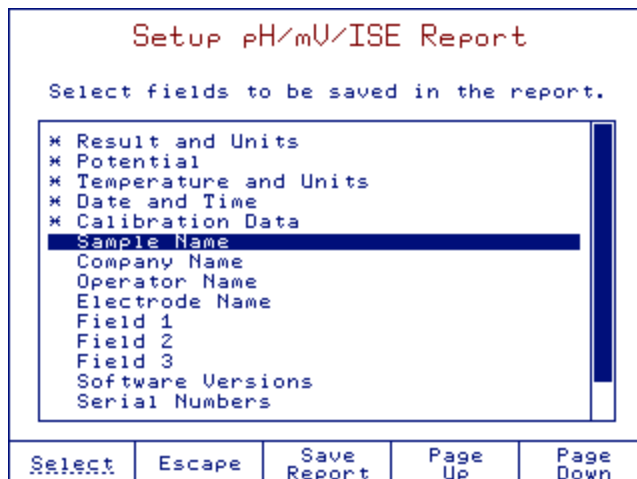
Pump 1 (and/or 2) Software Version: The current software version for the pump.

Analog 1 (and/or 2) Calibration Date: Manufacturer calibration date of the analog board.

Note: *If more than 1 year elapsed from the calibration date of the analog board 1 and/or 2, the message **Analog 1 Calibration Due** and/or **Analog 2 Calibration Due** will appear on the main screen. The analog board(s) need to be recalibrated.*

10.3.5. SETUP pH/mV/ISE REPORT

Customize a unique report to record the pH, mV, and ISE measurements. An asterisk means that it will be included in the report.



Select

Adds the highlighted information to the report.

Unselect

Removes the highlighted information from the report.

Escape

Returns to the Data Parameter Screen. Report is not updated.

Save Report

Update the report with the select items. Report previously saved will not be updated.

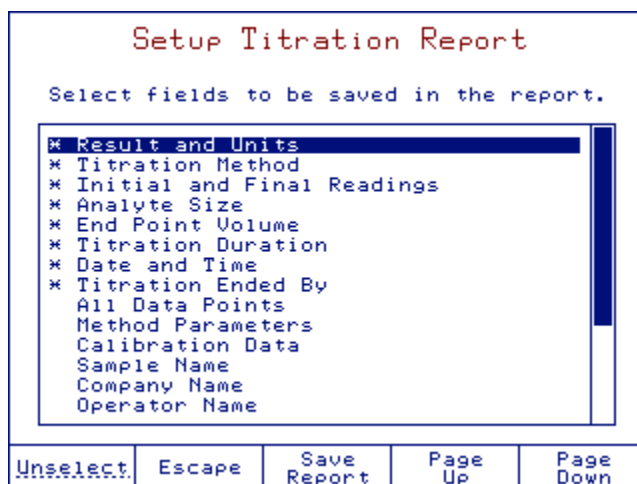
Page Up

Page Down

Scroll through the options.

10.3.6. SETUP TITRATION REPORT

Customize a unique report to record the titration results. An asterisk means that it will be included in the titration report.



Select

Adds the highlighted information to the report.

Unselect

Removes the highlighted information from the report.

Escape

Returns to the Data Parameter Screen. Report is not updated.

Save Report

Update the report with the select items. Report previously saved will not be updated.

Page Up

Page Down

Scroll through the options.

CHAPTER 11. MAINTENANCE, PERIPHERALS

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11.1.1. BURETTE ASSEMBLY 11-3

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11.2.1. CONNECTING TO A PRINTER..... 11-6

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11.2.3. CONNECTING TO A COMPUTER..... 11-8

The 25-mL burette included with the titrator exceeds the ISO 8655 standard for accurate delivery of liquids by a motor-driven piston burette.

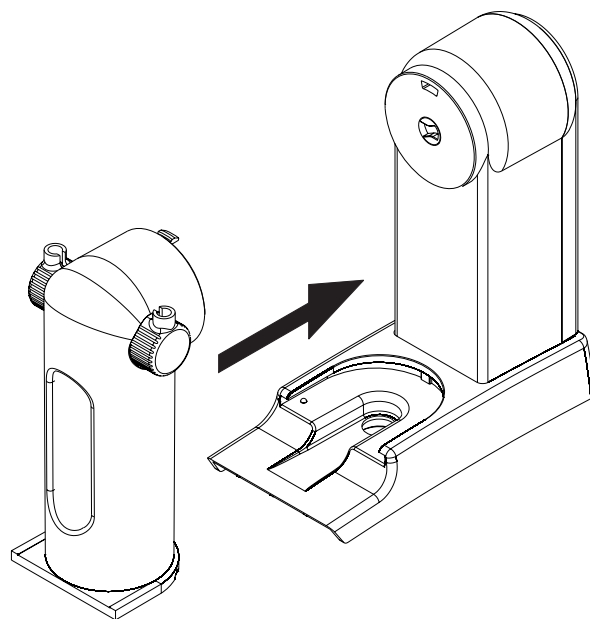
11.1. BURETTE MAINTENANCE

11.1.1. BURETTE ASSEMBLY

The burette is delivered with a 25-mL syringe inside and with all of the accessories mounted (see [Setup](#) chapter). The burette assembly consists of a rigid housing which holds the glass syringe, a 3-way valve and titrant tubing.

11.1.2. CHANGING THE BURETTE

Remove the burette from the pump assembly by sliding it forward and then slide the new burette into place.

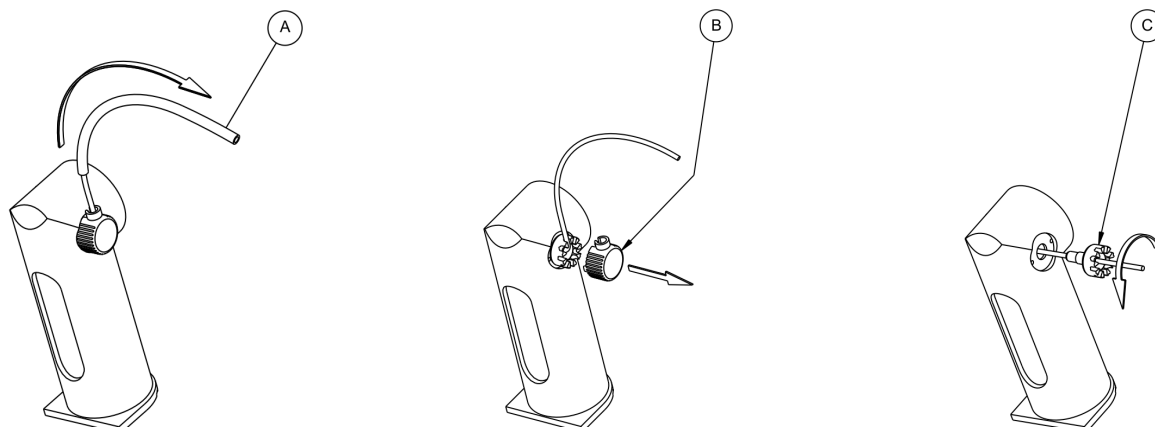


11.1.3. DISASSEMBLING THE BURETTE

The aspiration and the dispensing tubes have fittings and tube protectors. The aspiration tube is mounted in the left side and the dispensing tube is mounted in the right side of the burette.

To remove the dispensing tube and the aspiration tube follow these steps:

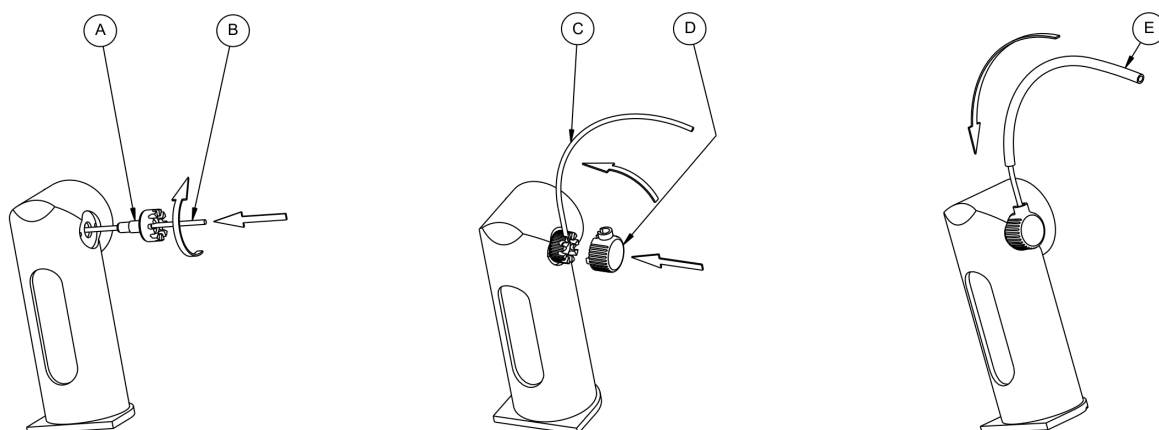
- Remove the blue tube protector (A) by sliding it off the clear titrant tubing.
- Remove the tube lock (B) from the burette holder.
- Turn the fitting (C) counter-clock wise to remove it from the burette holder.
- Slide the clear titrant tubing through the fitting.



11.1.4. ASSEMBLING THE BURETTE

To attach the dispensing tube and the aspiration tube, follow these steps:

- Insert the flat-shaped end of the titrant tubing into the valve outlet (A) and screw the fitting clock-wise to tighten. The highest of the 9 cuts should be vertical in the final position.
- Bend the tube up into the vertical position to enter the highest cut of the fitting (C).
- Replace the tube lock fitting (D).
- Replace the blue tube protector (E) by sliding it over the clear titrant tubing, the protector will sit in the tube lock fitting.



11.1.5. CLEANING THE BURETTE

To clean the burette, follow these steps:

- If the burette is filled with titrant, remove the aspiration tube from the titrant bottle and purge burette (see [Auxiliary Functions](#) chapter).
- Insert the aspiration tube into cleaning solution, deionized water or titrant solvent.
- Prime burette to fill the burette (use 2 rinses) (see [Auxiliary Functions](#) chapter).
- During second cycle remove the aspiration tube from the cleaning solution, deionized water or solvent and allow the air to replace the liquid in the burette. This will clean the aspiration tube.

If this simple cleaning procedure is not adequate, continue with these steps:

- Remove the burette assembly from the pump.
- Remove the dispensing and aspiration tubes. Clean them separately or insert new ones.
- Remove the protective cap from the bottom of the burette assembly by using the burette removal tool.
- Remove the syringe from the burette assembly by unscrewing it with your fingers.
- Extract the piston from the syringe.
- Clean both the piston and the syringe with appropriate cleaning solution. Rinse with deionized water.
- Remove the excess liquid.

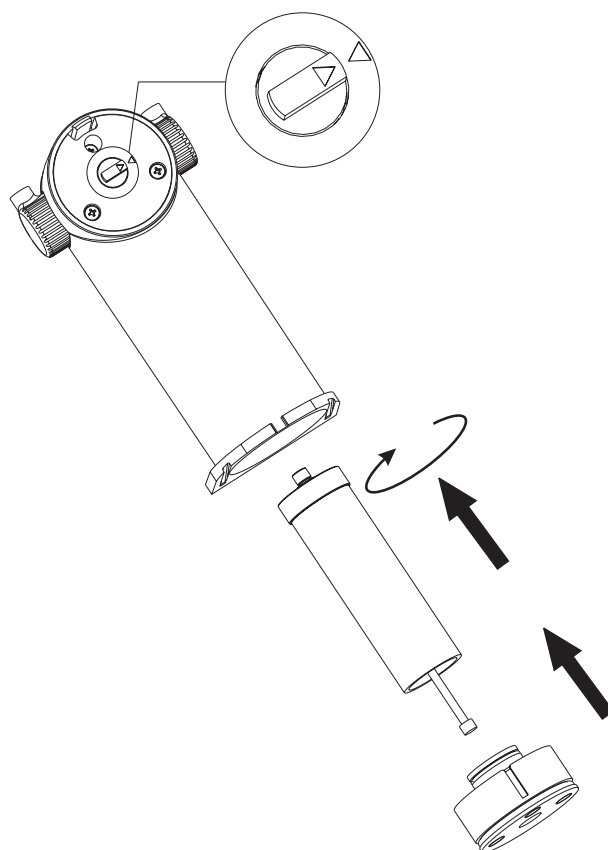
Warning: *Avoid contacting the titrant with bare hands.*

Avoid spilling titrant.

Clean the external side of the syringe and piston to remove aggressive chemicals.

Do not touch the white PTFE part of the piston or internal walls of the burette with bare hands or greasy materials.

- Reinsert the piston into the syringe.
- Reinsert the syringe by screwing it in the valve with your fingers.
- Reinsert the protective cap to the bottom of the burette assembly. Carefully position the cap into the burette.
- Slide the burette into the burette stand. Notice the position of the piston shaft to the pump couple.
- Priming the burette three times with new titrant is recommended.



11.1.6. BURETTE PREPARATION (TITRANT FILLING)

Before starting a titration, the burette must be properly filled with titrant in order to obtain an accurate and repeatable result. To fill the burette, follow the next steps and recommendations:

- If necessary, clean the burette and make sure it is empty.
- From the main screen press .
- Highlight *Prime Burette* option and press .
- Enter the number of times the burette needs to be rinsed (minimum three rinses are recommend allowing air bubbles to be evacuated).
- Press .

To avoid the presence of the air bubbles inside the burette, make sure to have a continuous liquid flow inside the burette. A little air just above the liquid level at the first filling is normal. The next filling will evacuate all of the air; no air will be left in the valve.

Sometimes during this process, slight finger tapping on the tubes is helpful to remove any residual air bubbles from the tubes.

If air bubbles are still present:

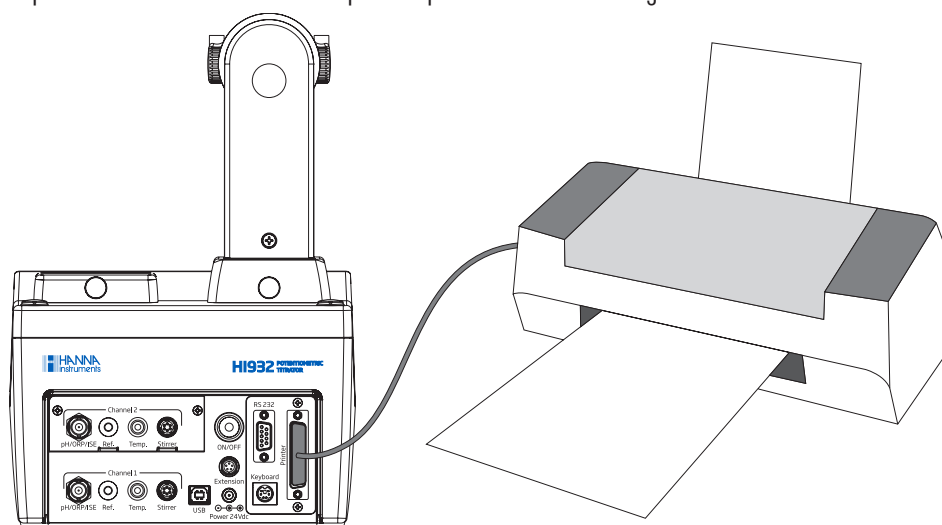
- Remove the aspiration tube from the titrant bottle.
- Repeat burette preparation procedure.
- If this is not successful, clean the burette again.

11.2. PERIPHERALS

Warning! Connection/disconnection of POWER, PUMP ASSEMBLY, PRINTER, RS232 INTERFACE or AUTOSAMPLER must only be done when Titrator and external devices are turned off.

11.2.1. CONNECTING TO A PRINTER

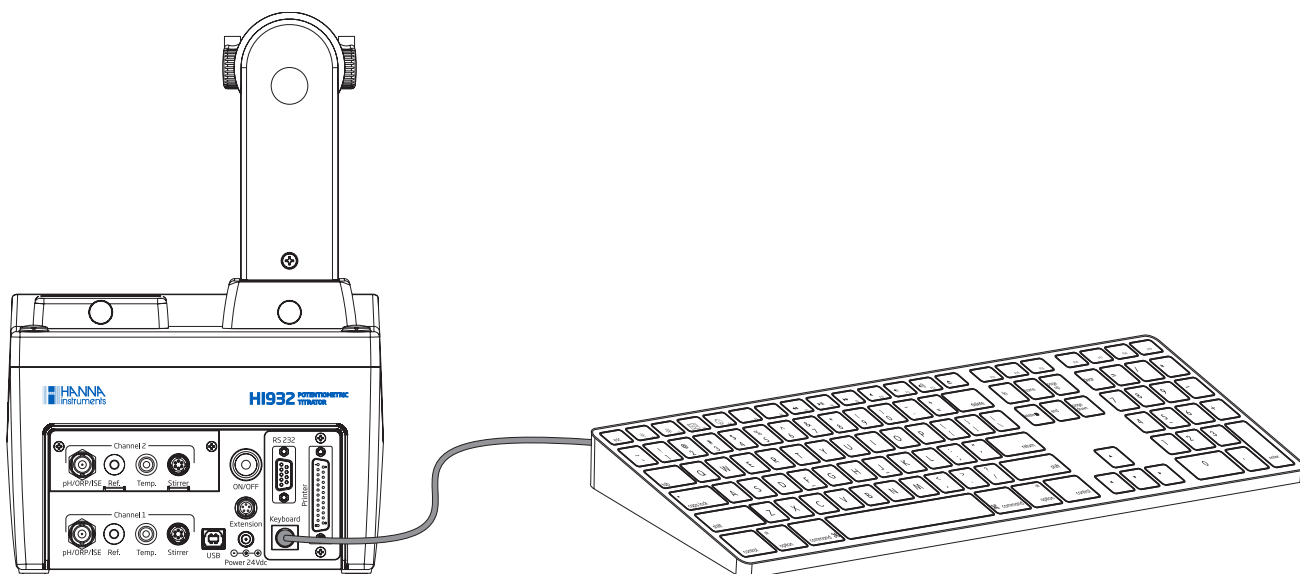
A variety of parallel printers can be connected to the parallel port of the titrator using a DB25 cable.














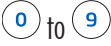

Warning: The titrator and the external printer must be both turned OFF before they are connected.

11.2.2. CONNECTING AN EXTERNAL PC KEYBOARD

This connection allows you to use an external PS/2 PC Keyboard in addition to the titrator's keypad.

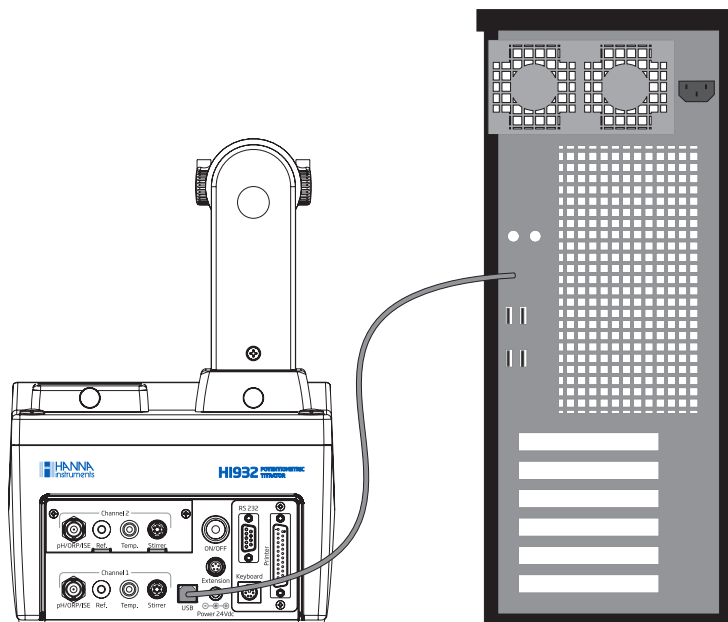


The correspondence between the titrator's keypad and the United States 101-type external keyboard are:

External PC Keyboard (United States 101)	Titrator Keypad
Function Key F-1	
Function Key F-2	
Function Key F-3	
Function Key F-4	
Function Key F-5	Option Key 1 (from left to right)
Function Key F-6	Option Key 2 (from left to right)
Function Key F-7	Option Key 3 (from left to right)
Function Key F-8	Option Key 4 (from left to right)
Function Key F-9	Option Key 5 (from left to right)
Function Key F-10	
Arrow Key: Up	
Arrow Key: Down	
Arrow Key: Left	
Arrow Key: Right	
Page Up	
Page Down	
Numeric Keys: 0 to 9	
Enter	
Alphanumeric Keys	Allow alphanumeric entries.

11.2.3. CONNECTING TO A COMPUTER

The titrator can be connected to a computer using a USB cable. **HI900** PC application needs to be installed on the PC.

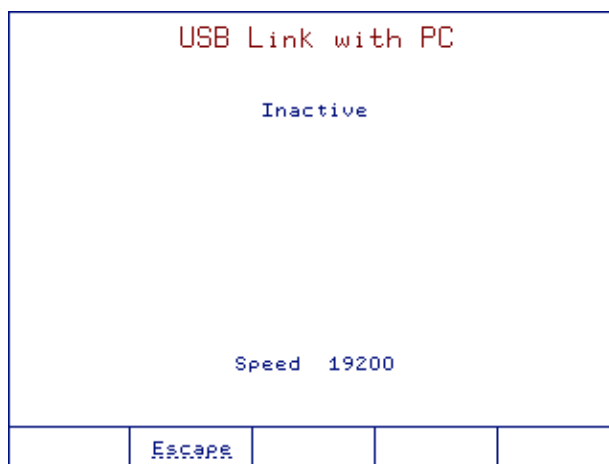


Connect the cable to the USB port on the rear panel of the titrator.

Connect the cable to the USB port on the PC.

Open the **USB Communication** screen on the titrator (see **General Options** chapter)

Launch the **HI900** PC application and then select the appropriate USB Port on the PC.



The **HI900** PC application allows the transfer of methods and reports between the titrator and PC.

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12.1. START UP

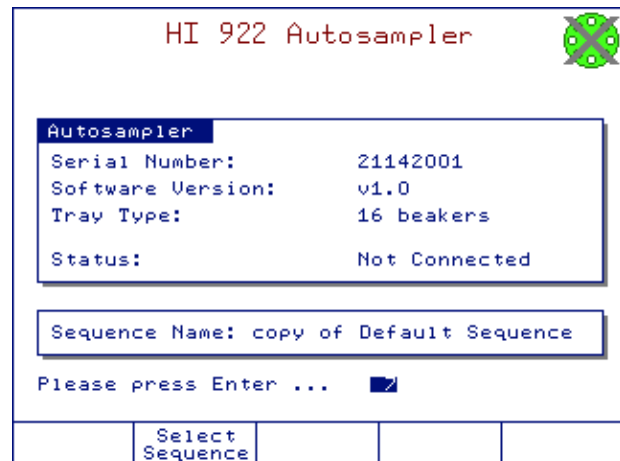
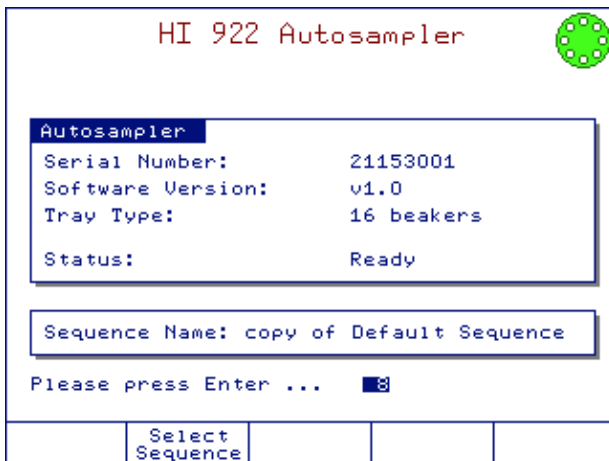
Once the instrument is assembled and installed, follow the steps below to start the titrator and access the autosampler.

- Connect the titrator to a power outlet with the supplied power adapter.
- Connect the autosampler to the titrator using the **HI920-933** communication cable.
- Turn on the autosampler then the titrator with the power switches located on the back of each instrument.
- Wait until the titrator finishes the initialization process.
- When prompted, press **device** to enter the autosampler interface.

The autosampler information screen will be displayed.

If the autosampler has not been detected an **X** will appear over the autosampler symbol located in the top right corner.

Note: The **HI932** titrator is compatible with the **HI921** and **HI922** autosamplers.



Note: The autosampler can be accessed from the titrator's main screen by pressing **device**.

The sample table screen will be displayed.

#	Name	Size(g)	Result
1	----		
2	----		
3	----		
4	----		
5	----		
6	----		
7	----		
8	----		
9	----		
10	----		
11	----		
12	----		

15:04:28 May 24, 2018
Default Sequence
 Last Seq.: TRAY0002, 16:16 Apr 04, 2018

Add Sample AutoSmp. Setup

To view the autosampler's main screen press AutoSmp. Setup

#	Name	Size(g)	Result
1	----		
2	----		
3	----		
4	----		
5	----		
6	----		

15:04:27 May 24, 2018
Default Sequence
 Method: 0.1N Sodium Hydroxide
 Analog 1

Pump 1 Selected

AutoSmp. Options Select Sequence Sequence Options Aux Commands Sample Table

12.2. AUXILIARY COMMANDS

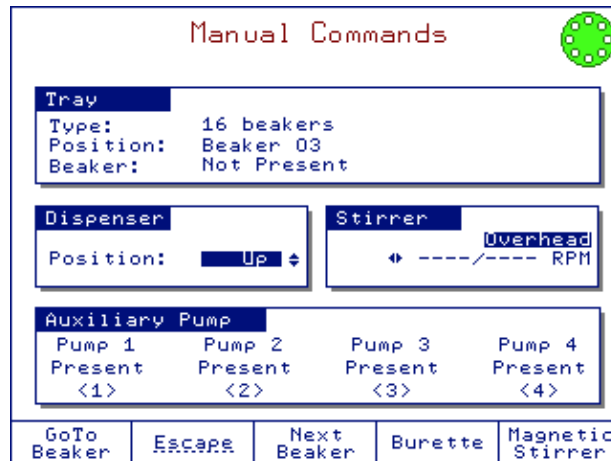
The auxiliary commands menu can be accessed from the main screen by pressing Aux Commands. From this screen you are able to calibrate your electrode and perform manual operations (i.e. running the pumps, moving the tray, etc).

Use the < and > to select the analog input to be used for calibration.

Auxiliary Commands				
Select the option.				
Use <Left> and <Right> arrows to select current active analog board.				
Active Analog Input: Analog 1				
Manual Commands	Escape	pH Calibr.	mV Calibr.	ISE Calibr.

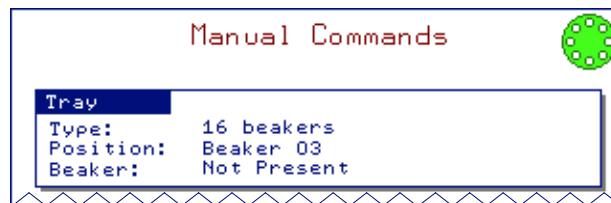
12.2.1. MANUAL COMMANDS

The manual commands screen is used to manually operate the autosampler dispenser, beaker position, auxiliary pumps, burette and stirrers.



12.2.1.1. TRAY

To move the tray use , or the or arrow keys on the autosampler keypad.



Type: Is the tray size currently detected by the autosampler. The tray size can be manually selected, if necessary (see [General Options](#)).

Position: Refers to the beaker located under the dispenser.

Beaker: Is the status (present or not present) of the beaker located under the dispenser. Beaker detection can be disabled, if necessary (see [General Options](#)).

12.2.1.2. DISPENSER

The position (up or down) of the dispensing head will be displayed.

To move the dispenser use the and keys on the autosampler or titrator keypad.



12.2.1.3. STIRRER

Use the / to toggle between the stirrer type.

Press on the titrator keypad to turn on the stirrer. When active use the and on the titrator keypad to change the stir speed.



12.2.1.4. AUXILIARY PUMPS

To run an active pump press and hold the corresponding number key on the autosampler keypad or titrator keypad. (e.g. press numeric key 1 for auxiliary pump 1, 2 for auxiliary pump 2, etc.).

Auxiliary Pump			
Pump 1	Pump 2	Pump 3	Pump 4
Present	Present	Present	Present
<1>	<2>	<3>	<4>

12.2.1.5. BURETTE

To access the Burette screen, press **Burette** from the manual commands screen. Highlight the desired option and then press **Select**. See [Auxiliary Function, Burette](#) section for additional information.

Burette								
Select a menu option.								
<table border="1"> <tr> <td>Prime Burette</td> </tr> <tr> <td>Rinse Tip</td> </tr> <tr> <td>Manual Dispense</td> </tr> <tr> <td>Purge Burette</td> </tr> </table>					Prime Burette	Rinse Tip	Manual Dispense	Purge Burette
Prime Burette								
Rinse Tip								
Manual Dispense								
Purge Burette								
The current pump is: Pump 1 Current burette volume is 25 mL.								
Select	Escape	Choose Pump	Perist.1 On	Perist.2 On				

12.2.2. pH CALIBRATION

From the Auxiliary Commands screen, press **pH Calibr.** to view pH calibration screen. See [pH mode, pH Calibration](#) section for additional information.

pH Calibration				
Analog 1				
6.904 pH				
ATC	Hanna	mV		
25.0 °C	7.010	5.76		
Calibrated Buffers				
Hanna	Hanna	Hanna	Hanna	Hanna
1.679	4.010	7.010	10.010	12.450
Last Calibration: 10:13 May 24, 2018				
Press <Clear Cal> to clear old calibr.				
Clear Cal.	Escape	Edit	Next Buffer	Previous Buffer

12.2.3. RELATIVE mV CALIBRATION

Press  to view mV calibration screen.

See **mV mode**, **Relative mV Calibration** section for additional information.

Relative mV				
Analog 1				
Set the value for the relative mV offset.				
Absolute mV:	3.1	mV		
			Overhead	
			1400/1400 RPM	
Relative mV:	3.1	mV		
Low limit:	-1996.9	mV		
High limit:	2003.1	mV		
Accept	Escape	Delete Digit		


12.2.4. ISE CALIBRATION

Press  to view ISE calibration screen.

See **ISE mode**, **ISE Calibration** section for additional information.

ISE Calibration				
Analog 1				
9.99		E-2		
		ppm		
ISE: Silver				
ATC	E-1		mV	
24.8 °C	1.00		0.0	
Calibrated Standards				
E-1				
1.00	1.00	10.0	100	1000
Last Calibration: 10:40 Jul 03, 2018				
Press <Accept> to update calibration.				
Accept	Escape	Edit	Next Standard	Previous Standard

12.3. AUTOSAMPLER OPTIONS

The Autosampler Options screen gives access to options that are not directly related to the autosampler sequences. To access this screen, press  from the autosampler main screen.

Autosampler Options				
Select the menu option:				
Save to USB				
Restore from USB				
Administration:	Unlocked			
Titrant 1 Volume Alert:	Off			
Titrant 1 Age Reminder:	0 days			
Titrant 2 Volume Alert:	Off			
Titrant 2 Age Reminder:	0 days			
Wash Type:	Auto Detect			
Beaker Detection:	18 beakers			
USB Link with PC	16 beakers			
Setup Balance	12 beakers			
Restore Autosampler Setting	Auto Detect			
Select	Escape			

12.3.1. SAVE TO USB STORAGE DEVICE

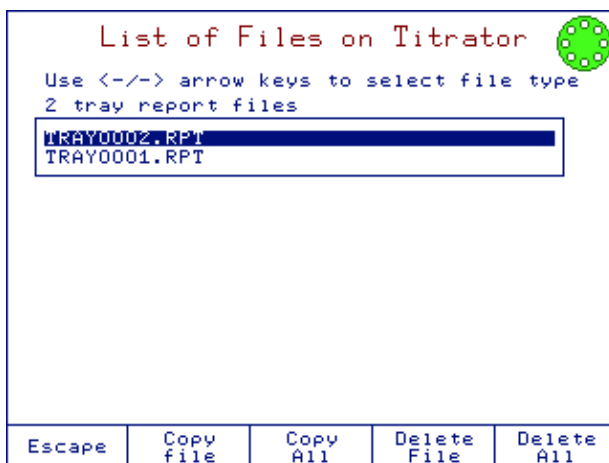
This option allows the user to save files from titrator to a USB storage device.

From the autosampler options, the available file types are:

- Standard Method Files - HIXXXYY.MTD (e.g.: HI1001EN.MTD, HI1004EN.MTD)
- User Method Files - USERXXX.MTD (e.g.: USER0001.MTD)
- Sequence Files - SEQXXX.MTD (e.g.: SEQ0001.MTD)
- Autosampler Report Files - TRAYXXX.RPT (e.g.: TRAY0001.RPT)

Note: Autosampler Report Files contain the individual titration reports for all samples run on that tray.

Use the < and > keys to select the file type. The number of files and the file name on the titrator will be displayed.



The option keys allow the following operations:

- Delete File** Deletes the highlighted file.
- Delete All** Deletes all currently displayed files.
- Copy File** Copies the highlighted file from the titrator to a USB storage device
- Copy All** Copies all currently displayed files from the titrator to a USB storage device
- Escape** Returns to the **Autosampler Options** screen

The status of the transfer ("Successful"/"Unsuccessful") and the file name of the currently processed file are displayed during copying or deleting.

Note: The saved files will be stored on the USB storage device in the **HI932** Folder, as follows:

- **Methods:** USB Drive:\HI932\Methods*.mtd
- **Sequences:** USB Drive:\HI932\Sequence*.mtd
- **Reports:** USB Drive:\HI932\ASReport*.rpt

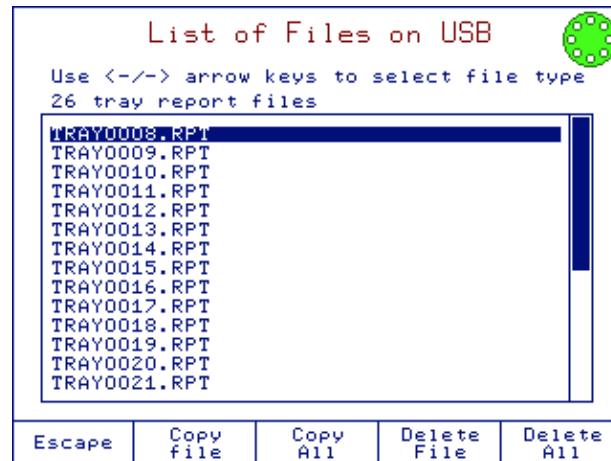
12.3.2. RESTORE FILES FROM USB STORAGE DEVICE

This screen allows the user to transfer files from a USB storage device to the titrator. The file types that can be transferred are:

- | | |
|--------------------------|--|
| Standard Method Files | - HIXXXYY.MTD (e.g.: HI1001EN.MTD, HI1004EN.MTD) |
| User Method Files | - USERXXX.MTD (e.g.: USER0001.MTD) |
| Sequence Files | - SEQXXX.MTD (e.g.: SEQ0001.MTD) |
| Autosampler Report Files | - TRAYXXX.RPT (e.g.: TRAY0001.RPT) |

Note: Autosampler Report Files contain the individual titration reports for all samples run on that tray.

Use the < and > keys to select the file type. The number of files and the file name on the titrator will be displayed.



The option keys allow the following operations:

- | | |
|--------------------|---|
| Delete File | Deletes the highlighted file from the USB storage device. |
| Delete All | Deletes all currently displayed files from the USB storage device. |
| Copy File | Copies the highlighted file from the USB storage device to the titrator. |
| Copy All | Copies all currently displayed files from the USB storage device to the titrator. |
| Escape | Returns to the Autosampler Options screen |


Note: The saved files will be stored on the USB storage device in the **HI932** Folder, as follows:

- **Methods:** USB Drive:\HI932\Methods*.mtd
- **Sequences:** USB Drive:\HI932\Sequence*.mtd
- **Reports:** USB Drive:\HI932\ASReport*.rpt

12.3.3. ADMINISTRATION

A 4-digit numeric PIN can be set to prevent unauthorized changes from being made.


See [General Options, Administration](#) section for additional information.

Titrator Administration 				
Titrator is LOCKED.				
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> Unlock Titrator Enter PIN: ***- </div>				
Accept	Escape	Delete Digit		

12.3.4. TOTAL VOLUME ALERT

This screen allows a programmable reminder to appear when the titrant reservoir is below 100 mL. The titrant volume will decrease as the titrant is used.


See [General Options, Total Volume Alert](#) section for additional information.

Titrant 1 Volume Alert 				
Enter the amount of titrant available to the titration/reagent system from its reservoir. The mLs will decrease as the titrant/reagent is depleted.				
<div style="background-color: black; color: white; padding: 2px 10px; display: inline-block;">0.0 mL</div>				
A reminder will appear when less than 100 mLs of titrant volume is left.				
Accept	Escape	Delete Digit		Off

12.3.5. TITRANT AGE REMINDER

A programmable reminder will appear when it is time to verify the titrant concentration or to change the titrant.

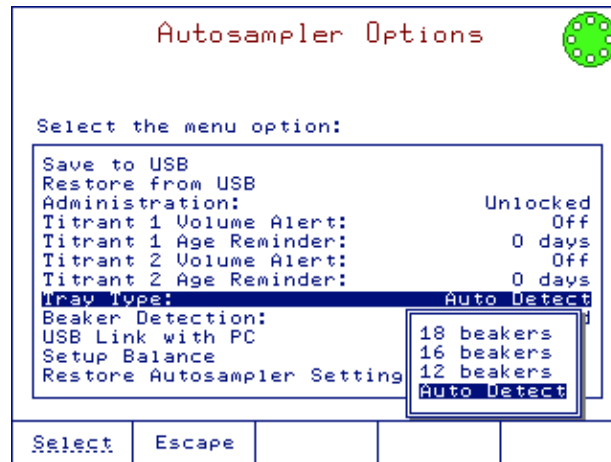
See [General Options, Titrant Age Reminder](#) section for additional information.

Titrant 1 Age Reminder 				
Enter the number of days to pass since the last Titr. Vol. updating or the last Start pressing, whereafter the reminder appears.				
<div style="background-color: black; color: white; padding: 2px 10px; display: inline-block;">5 days</div>				
The range is from 0 to 31 days.				
Start	Escape	Delete Digit		Off

12.3.6. TRAY TYPE

Option: Auto Detect, 18 beakers, 16 beakers or 12 beakers

The autosampler trays have a built in RFID tag that transmits the tray size and serial number directly to the titrator. The tray size can also be selected manually.

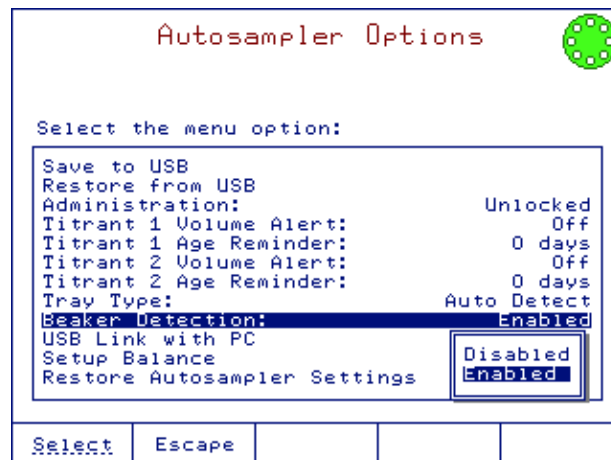


12.3.7. BEAKER DETECTION

Option: Enabled or Disabled

The autosampler can detect the presence of a beaker when it is under the dispenser. This prevents titrations from occurring when no beaker is present.

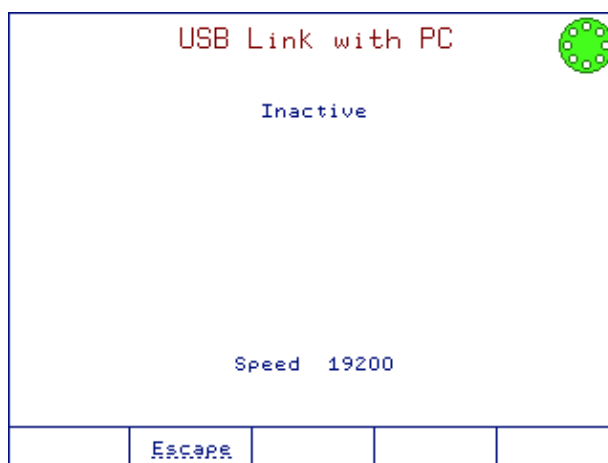
WARNING: If you disable this feature, the autosampler will titrate in any spot on the tray a sample has been entered. Please ensure all beakers are present in the correct positions before starting the sequence. Serious injury could result.



12.3.8. USB LINK WITH PC

In order to use this feature, the USB cable needs to be connected from the titrator to the PC. Make sure that the [HI900](#) PC application is running on the PC.

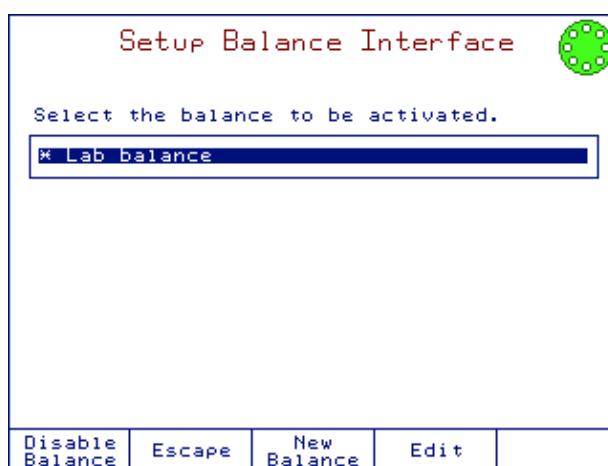
See [General Options, USB Link with PC](#) section for additional information.



12.3.9. SETUP BALANCE

This screen allows the users to connect an analytical balance for automatic acquisition of sample mass prior to titration or standardization.

See [General Options, Setup Balance Interface](#) section for additional information.



12.3.10. RESTORE AUTOSAMPLER SETTINGS

This option restores the manufacturer settings for the autosampler interface only!

Note: This will delete all user created sequences, tray reports, etc.



12.4. AUTOSAMPLER SEQUENCES

All of the parameters required to complete an analysis on the autosampler are grouped into a sequence.

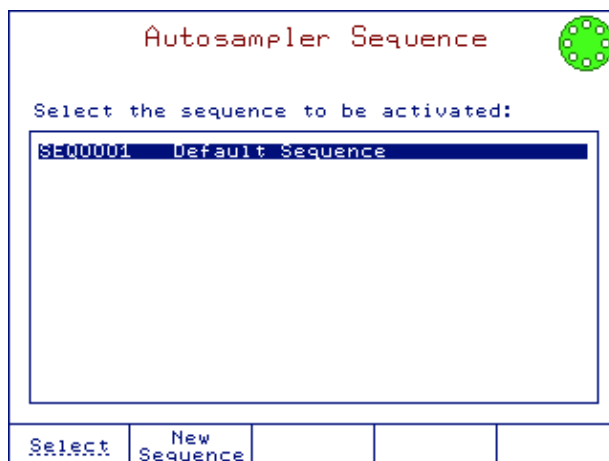
A default sequence is provided; this sequence is used as a starting point for creating user defined sequences. Up to 30 sequences can be created and stored on the titrator.

User defined sequences allow the user to customize reagent additions and rinsing cycles to suit specific applications. New sequences are created in the select sequence screen.

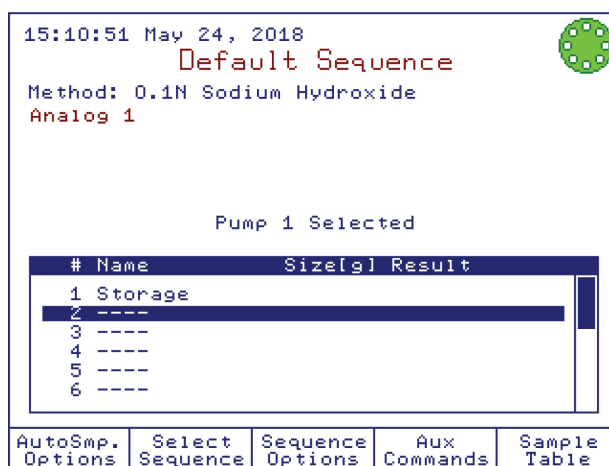
12.4.1. SELECTING A SEQUENCE

To select a sequence, press  from the main screen. A list of available sequences will be displayed.

In the **Autosampler Sequence** screen, you can view the list of all available sequences.








To select a sequence, highlight the sequence and press . The name of the selected sequence will be displayed on the main screen.

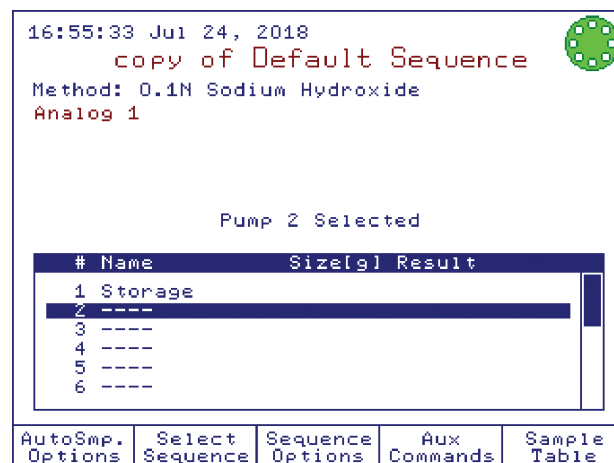
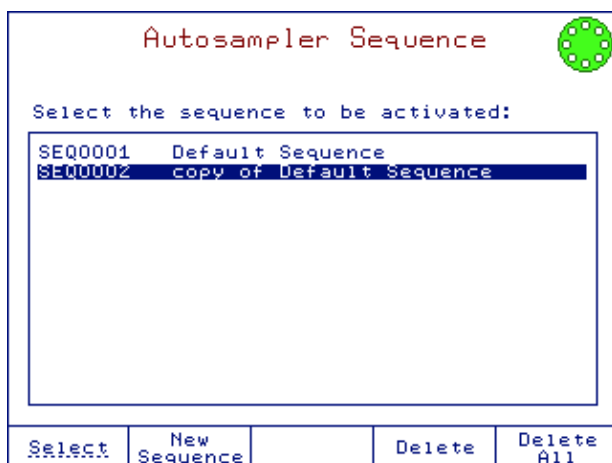


12.4.2. CREATING A SEQUENCE

Sequences are developed by the users in accordance with the analysis requirements. All sequence parameters can be modified by the user.

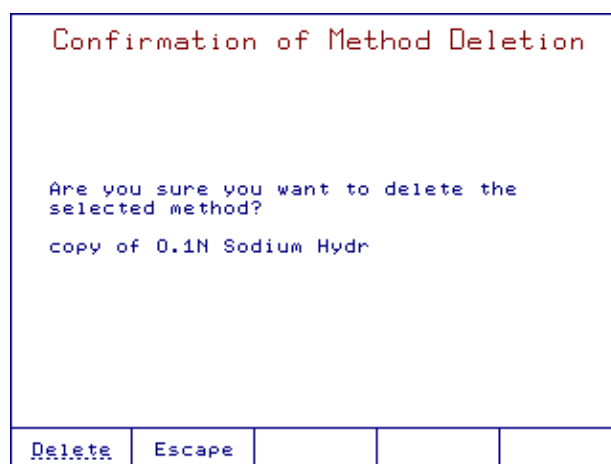
To create a new sequence, start from the default sequence or a previous created sequence and follow these steps:

- Press  from the main screen.
- Using the  and  keys, highlight an existing sequence from the list.
- Press . A new sequence will be generated.
- Press  to activate the new sequence.



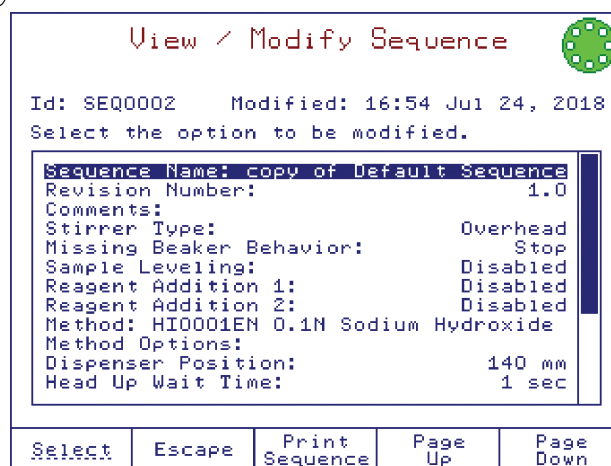
12.4.3. DELETING A SEQUENCE

Unnecessary sequences can be removed from the titrator. To remove a sequence press **Select Sequence** from the main screen then highlight the sequence you want to delete and press **Delete**. A screen will appear in order to confirm the deletion. Press **Delete** again to confirm, or press escape to cancel the operation.



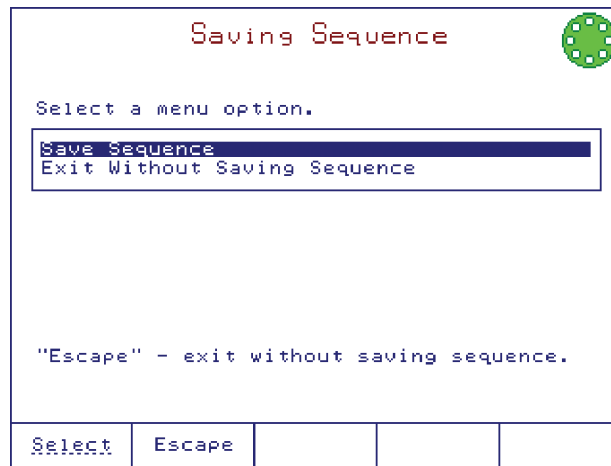
12.4.4. VIEW/MODIFY A SEQUENCE

To modify the sequence options, press **Sequence Options** from the main screen. A list of all the parameters for the selected sequence will be displayed. Using the **Up** and **Down** keys, highlight the option you want to modify and press **Select**.



To exit the **View/Modify Sequence** screen press **Escape**.

You can choose to save the modifications or to discard them.

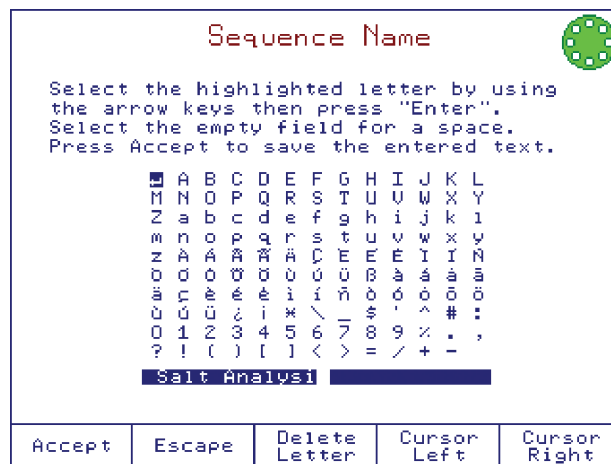


12.4.5. SEQUENCE OPTIONS

All of the parameters required to complete an analysis are grouped into a sequence. The sequence options screen is arranged as they occur during the sequence.

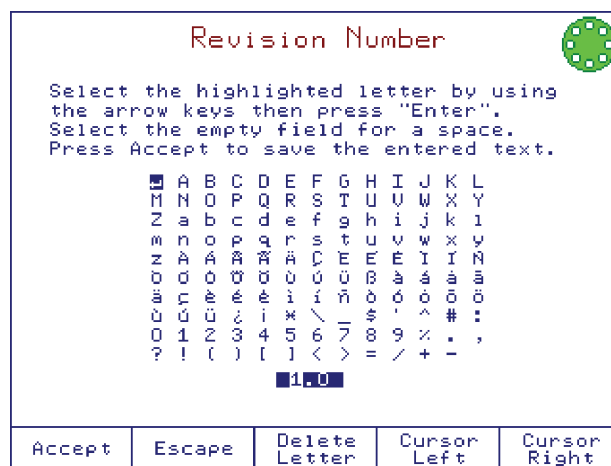
12.4.5.1. SEQUENCE NAME

Option: Up to 24 characters



12.4.5.2. SEQUENCE REVISION

Option: Up to 3 characters



12.4.5.3. COMMENTS

Option: Up to 20 characters

Comments

Select the highlighted letter by using the arrow keys then press "Enter".
Select the empty field for a space.
Press Accept to save the entered text.

A	B	C	D	E	F	G	H	I	J	K	L	
M	N	O	P	Q	R	S	T	U	V	W	X	Y
Z	a	b	c	d	e	f	g	h	i	j	k	l
m	n	o	p	q	r	s	t	u	v	w	x	y
z	À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë
Ì	Í	Î	Ï	Ñ	Ò	Ó	Ô	Õ	Ö	×	Ù	Ú
Û	Ü	Ý	à	á	â	ã	ä	å	æ	ç	è	é
ê	ë	ì	í	î	ï	ñ	ò	ó	ô	õ	ö	÷
ø	ù	ú	û	ü	ý	ÿ	€	£	¥	¢	¤	¥
¦	§	¨	©	ª	«	¬	®	¯	°	±	²	³
´	µ	¶	·	¸	¹	º	»	¼	½	¾	¿	

Accept	Escape	Delete Letter	Cursor Left	Cursor Right
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12.4.5.4 STIRRER CONFIGURATION

Option: Overhead or Magnetic

View / Modify Sequence

Id: SEQ0002 Modified: 16:54 Jul 24, 2018
Select the option to be modified.

Sequence Name:	copy of Default Sequence
Revision Number:	1.0
Comments:	
Stirrer Type:	Overhead
Missing Beaker Behavior:	Overhead
Sample Leveling:	Magnetic
Reagent Addition 1:	
Reagent Addition 2:	
Method:	HI0001EN 0.1N Sodium Hydroxide
Method Options:	
Dispenser Position:	140 mm
Head Up Wait Time:	1 sec

Select	Escape			
--------	--------	--	--	--

12.4.5.5. MISSING BEAKER BEHAVIOR

Option: Pause, Skip or Stop

Select the behavior to occur when beaker detection is enabled and no beaker is detected.

View / Modify Sequence

Id: SEQ0002 Modified: 16:54 Jul 24, 2018
Select the option to be modified.

Sequence Name:	copy of Default Sequence
Revision Number:	1.0
Comments:	
Stirrer Type:	Overhead
Missing Beaker Behavior:	Stop
Sample Leveling:	Pause
Reagent Addition 1:	Skip
Reagent Addition 2:	Stop
Method:	HI0001EN 0.1N Sodium Hydroxide
Method Options:	
Dispenser Position:	140 mm
Head Up Wait Time:	1 sec

Select	Escape			
--------	--------	--	--	--

Pause: The autosampler will pause the sequence at the current beaker and wait for the user before continuing the analysis.**Skip:** The autosampler will automatically move to the next available sample.**Stop:** All operations will stop and the analysis will be stopped.

12.4.5.6. SAMPLE LEVELING

Option: Disabled or Enabled

Volumetric samples that do not require high accuracy can be leveled to the correct volume rather than manually being dispensed with a pipette. Sample leveling involved the user adding excess sample to each beaker, and the autosampler removed the excess sample using an aspiration tube. This allows samples to be quickly poured into each beaker by the user while the autosampler accurately removes excess.

Note: Sample leveling requires one peristaltic pump configured for aspiration using *HI920-203 Tubing Set* for aspiration.

Sample Leveling				
Select the option to be modified.				
Leveling Pump Disabled				
Select	Escape			

12.4.5.6.1. LEVELING PUMP

Select the peristaltic pump that is connected to the aspiration tube.

Sample Leveling				
Select the option to be modified.				
Leveling Pump Disabled				
<ul style="list-style-type: none"> Disabled Aux Pump 1 Aux Pump 2 Aux Pump 3 				
Select	Escape			

Sample Leveling				
Select the option to be modified.				
Leveling Pump Aux Pump 1				
Leveling Time 10 sec				
Head Height 120 mm				
Select	Escape			

12.4.5.6.2. LEVELING TIME

Option: 1 second to 300 seconds

Set the duration that the peristaltic pump will run.

Leveling Time				
Enter the period of time for running auxiliary pump.				
10 sec				
Low limit: 1 second				
High limit: 300 seconds				
Accept	Escape	Delete Digit		

12.4.5.6.3. DISPENSER HEAD HEIGHT

Option: 10 to 150 mm

Set the height for the dispenser head. This height should be set to produce the sample volume that is defined within method options. The correct height must be determined experimentally by the user and will depend on the sample size, beaker shape and size, and the aspiration tube position.

The easiest way to determine the volume of a particular height setting is to manually aspirate water from a pre-weighed beaker and weighing the remaining water in the beaker.

Preset Head Height				
Press <UP> or <DOWN> keys to position the head to appropriate position, or Use numeric keys to manually enter the head position.				
<div style="border: 1px solid black; display: inline-block; width: 100px; height: 15px; background-color: black;"></div> 0 mm				
The range is from 10 to 150 mm. press <Accept> to save the head position.				
Accept	Escape		▲	▼

12.4.5.7. REAGENT ADDITION

Option: Disabled or Enabled

Reagents and/or deionized water can be automatically added to each sample using the reagent addition feature.

Note: Reagent addition required a peristaltic pump (for each reagent) configured for dispensing using [HI920-208 Tubing Set for Dispensing](#). The [HI922](#) can perform up to two reagent additions.

12.4.5.7.1. REAGENT PUMP

Select the peristaltic pump that is connected to the reagent container.


Reagent Addition 1				
Select the option to be modified.				
<div style="border: 1px solid black; padding: 2px;"> Reagent Pump: Disabled <div style="border: 1px solid black; padding: 2px; margin-top: 5px;"> Disabled Aux Pump 1 Aux Pump 2 Aux Pump 3 </div> </div>				
Select	Escape			

Reagent Addition 1																
Select the option to be modified.																
<div style="border: 1px solid black; padding: 2px;"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border-bottom: 1px solid black;">Reagent Pump:</td> <td style="border-bottom: 1px solid black;">Aux Pump 1</td> </tr> <tr> <td>Dispenser Position:</td> <td>130 mm</td> </tr> <tr> <td>Dispensing Time:</td> <td>1 sec</td> </tr> <tr> <td>Stirring Time:</td> <td>0 sec</td> </tr> <tr> <td>Dispenser Waiting Position:</td> <td>Down</td> </tr> <tr> <td>Wait Time:</td> <td>0 sec</td> </tr> </table> </div>					Reagent Pump:	Aux Pump 1	Dispenser Position:	130 mm	Dispensing Time:	1 sec	Stirring Time:	0 sec	Dispenser Waiting Position:	Down	Wait Time:	0 sec
Reagent Pump:	Aux Pump 1															
Dispenser Position:	130 mm															
Dispensing Time:	1 sec															
Stirring Time:	0 sec															
Dispenser Waiting Position:	Down															
Wait Time:	0 sec															
Select	Escape															

12.4.5.7.2. DISPENSER POSITION

Option: 10 to 150 mm

Enter the position of the dispenser during reagent addition and stir time.

Preset Head Height 				
Press <UP> or <DOWN> keys to position the head to appropriate position, or Use numeric keys to manually enter the head position.				
█ 130 mm				
The range is from 10 to 150 mm. press <Accept> to save the head position.				
Accept	Escape	Delete Digit		Go to Position

12.4.5.7.3. DISPENSING TIME

Option: 1 to 300 seconds


Enter the dispensing time required to add the desired amount of reagent.

Note: This time should be determined experimentally. The approximately flow rate is 200 mL/min.

Dispensing Time 				
Enter the period of time for running auxiliary pump.				
█ 5 sec				
Low limit: 1 second High limit: 300 seconds				
Accept	Escape	Delete Digit		

12.4.5.7.4. STIRRING TIME

Option: 0 to 1800 seconds

Stirring Time 				
Please enter the stirring time in seconds.				
█ 2 sec				
Low limit: 0 second High limit: 1800 seconds				
Accept	Escape	Delete Digit		

12.4.5.7.5. DISPENSER WAITING POSITION

Option: Up or Down

Set the position of the dispenser during the wait time. This is useful if it is undesirable for the electrode(s) to be immersed in the solution for extended periods of time.

Reagent Addition 1

Select the option to be modified.

Reagent Pump:	Aux Pump 1
Dispenser Position:	130 mm
Dispensing Time:	1 sec
Stirring Time:	0 sec
Dispenser Waiting Position:	Down
Wait Time:	

Up
Down

Select	Escape			
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12.4.5.7.6. WAIT TIME

Option: 0 to 1800 seconds

Set the reaction time. This is the amount of time after the stirring is completed that the autosampler will wait before performing any other actions.

Wait Time

Please enter the wait time in seconds.

2 sec

Low limit: 0 second
High limit: 1800 seconds

ACCEPT	Escape	Delete Digit		
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12.4.5.7.7. ADDITION PHASE (LINKED METHODS ONLY)

Option: First Titration or Second Titration

Set the addition phase for the reagent addition. Reagent addition can be done before the first titration or before the second titration.

Reagent Addition 1

Select the option to be modified.

Reagent Pump:	Aux Pump 1
Dispenser Position:	130 mm
Dispensing Time:	
Stirring Time:	
Dispenser Waiting Pos:	
Wait Time:	
Addition Phase:	First Titration

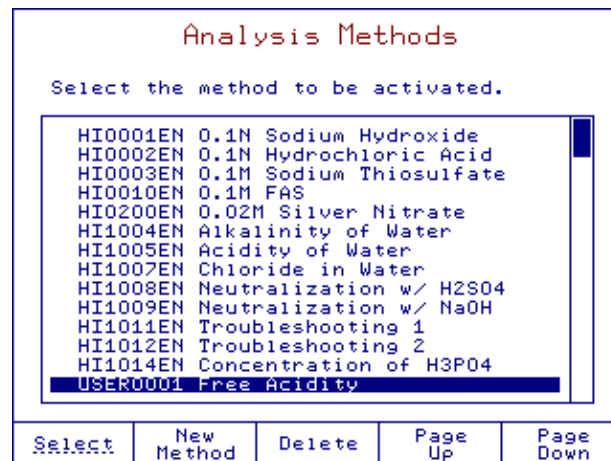
First Titration
Second Titration

Select	Escape			
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12.4.5.8. METHOD

The following types of methods can be run on the autosampler:

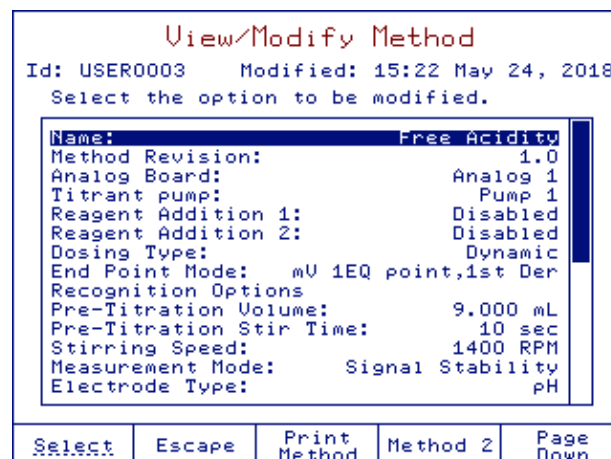
Non-Linked Methods	Sample Titration (Single End point)
	Titrant Standardization
	Back Titration
	Sample Titration (Multi EQ points)
	Direct Reading
Linked Methods	Sample Titration (Single End point) → Sample Titration (Single End point)
	Sample Titration (Single End point) → Sample Titration (Multi EQ points)
	Sample Titration (Single End point) → Direct Reading
	Back Titration → Direct Reading
	Sample Titration (Multi EQ points) → Sample Titration (Single End point)
	Sample Titration (Multi EQ points) → Sample Titration (Multi EQ points)
	Sample Titration (Multi EQ points) → Direct Reading
	Direct Reading → Sample Titration (Single End point)
	Direct Reading → Back Titration
	Direct Reading → Sample Titration (Multi EQ points)
	Direct Reading → Direct Reading



12.4.5.9. METHOD OPTIONS

The analysis method options can be accessed directly from the autosampler interface. Analysis method options can be reviewed and/or modified if necessary.

For more information see [Titration Methods, Method Options](#) section.



12.4.5.10. DISPENSER POSITION

Option: 10 to 150 mm

Enter the position of the head during titration (140 mm by default).

Preset Head Height				
Press <UP> or <DOWN> keys to position the head to appropriate position, or Use numeric keys to manually enter the head position.				
<div style="border: 1px solid black; display: inline-block; padding: 2px;">140 mm</div>				
The range is from 10 to 150 mm. press <Accept> to save the head position.				
ACCEPT	Escape	Delete Digit		Go to Position

12.4.5.11. HEAD UP WAIT TIME

Option: 1 to 30 seconds

Set the duration that the autosampler will wait with the dispenser in the up position for any drops of solution to fall off of the electrodes/stirrer before moving to another sample or rinse beaker.

Head Up Wait Time				
Please enter the wait time in seconds.				
<div style="border: 1px solid black; display: inline-block; padding: 2px;">2 sec</div>				
Low limit: 1 second High limit: 30 seconds				
ACCEPT	Escape	Delete Digit		

12.4.5.12. SAMPLE ASPIRATION

Option: Disabled, Aspirate Only or Aspirate/Spray Rinse

Reacted samples may be aspirated into a waste container after each titration.

Note: Sample aspiration requires one peristaltic pump configured for aspiration using [HI920-203 Tubing Set for Aspiration](#).

Aspirate Sample				
Select the option to be modified.				
<div style="border: 1px solid black; padding: 2px;"> Aspiration Option: Disabled <div style="border: 1px solid black; padding: 2px; margin-top: 5px;"> Disabled Aspirate Only Aspirate/Spray Rinse </div> </div>				
Select	Escape			

Select the aspiration mode:

Aspiration Only: The existing waste from the sample beaker will be removed according to the parameters defined in this menu.

Aspirate/Spray: Reserved for future

12.4.5.12.1. ASPIRATION PUMP

Select the peristaltic pump that is connected to the aspiration tube.

Aspirate Sample					
Select the option to be modified.					
Aspiration Option:	Aspirate Only				
Aspiration Pump:	Disabled				
Aspiration Time:					
Head Height:					
	<table border="1"> <tr><td>Disabled</td></tr> <tr><td>Aux Pump 1</td></tr> <tr><td>Aux Pump 2</td></tr> <tr><td>Aux Pump 3</td></tr> </table>	Disabled	Aux Pump 1	Aux Pump 2	Aux Pump 3
Disabled					
Aux Pump 1					
Aux Pump 2					
Aux Pump 3					
Select	Escape				

12.4.5.12.2. ASPIRATION TIME

Option: 1 to 300 seconds


Set the duration that the peristaltic pump will run.

Aspiration Time	
Enter the period of time for running auxiliary pump.	
<div style="border: 1px solid black; display: inline-block; padding: 2px;">15</div> sec	
Low limit:	1 second
High limit:	300 seconds
Accept	Escape
Delete Digit	

12.4.5.12.3. DISPENSER HEAD HEIGHT


Option: 10 to 150 mm

Set the height for the dispenser head. The aspiration tube should be set to a height that will reach the bottom of the sample beaker when the dispenser head is positioned at this height.

Preset Head Height 				
Press <UP> or <DOWN> keys to position the head to appropriate position, or Use numeric keys to manually enter the head position.				
140 mm				
The range is from 10 to 150 mm. press <Accept> to save the head position.				
Accept	Escape	Delete Digit		Go to Position

12.4.5.13. RINSE

The autosampler can perform a dip rinse function after each analysis. Up to 3 dip rinses can be performed in a dedicated rinse beakers.

Rinse 1 				
Select the option to be modified.				
Rinse Option: Disabled				
Select	Escape			

Dip rinse: Dip rinse can be used to clean the electrodes and stirrer of contaminants after each analysis using dedicated rinsing beakers.

Spray Rinse: Reserved for future

12.4.5.13.1. RINSE BEAKER

Select the position on the tray for the dedicated rinse beaker.

Rinse 1				
Select the option to be modified.				
Rinse Option:	Dip Rinse			
Rinse Beaker:	Beaker 1			
Rinse Time:				
Dispenser Position:	Beaker 1			
Head Up Wait Time:	Beaker 2			
Stirrer:	Beaker 3			
	Beaker 4			
Select	Escape			

12.4.5.13.2. RINSE TIME

Option: 1 to 300 seconds

Rinse Time				
Enter the period of time you would like to remain in the rinse beaker.				
10 sec				
Low limit: 1 second				
High limit: 300 seconds				
Accept	Escape	Delete Digit		

12.4.5.13.3. DISPENSER POSITION

Option: 10 to 150 mm


Set the height for the dispenser head during rinsing.

Preset Head Height				
Press <UP> or <DOWN> keys to position the head to appropriate position, or Use numeric keys to manually enter the head position.				
140 mm				
The range is from 10 to 150 mm. press <Accept> to save the head position.				
Accept	Escape	Delete Digit		Go to Position

12.4.5.13.4. HEAD UP WAIT TIME

Option: 1 to 300 seconds

Set the duration that the autosampler will wait with the dispenser in the up position for any drops of solution to fall off of the electrodes/stirrer before moving to another sample or rinse beaker.

Head Up Wait Time 

Please enter the stirring time in seconds.

1 sec


Low limit: 1 second
High limit: 300 seconds

Accept	Escape	Delete Digit	
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12.4.5.13.5. STIRRER

Option: Enabled or Disabled

Select if the stirrer will run during the rinse operation.

Rinse 1 

Select the option to be modified.

Rinse Option:	Dip Rinse
Rinse Beaker:	Beaker 1
Rinse Time:	10 sec
Dispenser Position:	140 mm
Head Up Wait Time:	1 sec
Stirrer:	Enabled


Disabled
 Enabled

Select	Escape	
--------	--------	--

12.4.5.14. BEAKER HEIGHT

Option: 30 to 120 mm

Set the height of the beaker being used on the autosampler.

Beaker Height 

Enter the beaker height in mm.

100 mm

Low limit: 30 mm
High limit: 120 mm

Accept	Escape	Delete Digit	
--------	--------	--------------	--

12.4.5.15. POSITION WHEN FINISHED

Option: Home, Sample or Storage

View / Modify Sequence	
Id: SEQ0002 Modified: 11:48 Jul 24, 2018	
Select the option to be modified.	
Reagent Addition 2:	Disabled
Method:	USER0003, Free Acidity
Linked To:	USER0004, Direct pH reading
Method Options:	
Dispenser Position:	140 mm
Head Up Wait Time:	1 sec
Aspirate Sample:	Asp. y
Rinse 1:	Home d
Rinse 2:	Sample d
Rinse 3:	Storage d
Beaker Height:	m
Position when finished:	Storage
Select	Escape

Home: The dispenser head will be in the up position over beaker one.

Sample: The dispenser head will remain down in the last sample that was analyzed/titrated.

Storage: The dispenser head will be down in a preset beaker containing storage solution.

12.4.5.16. STORAGE BEAKER (POSITION WHEN FINISHED, STORAGE ONLY)

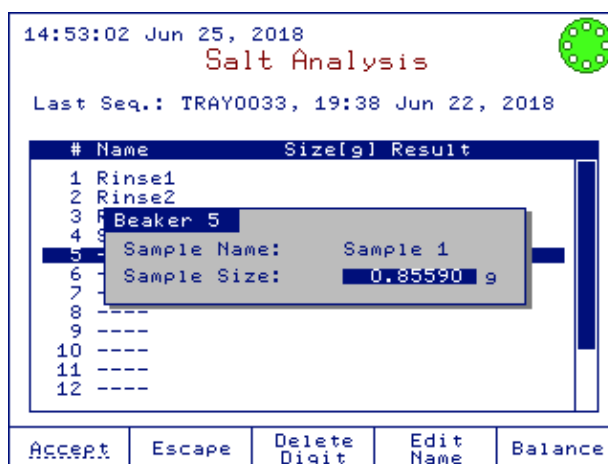
Select the storage beaker. After the sequence has been completed, the autosampler will move to this position automatically and lower the dispenser head.

View / Modify Sequence	
Id: SEQ0002 Modified: 11:50 Jul 24, 2018	
Select the option to be modified.	
Method:	USER0003, Free Acidity
Linked To:	USER0004, Direct pH reading
Method Options:	
Dispenser Position:	140 mm
Head Up Wait Time:	1 sec
Aspirate Sample:	Asp. y
Rinse 1:	Beaker 1 d
Rinse 2:	Beaker 2 d
Rinse 3:	Beaker 3 d
Beaker Height:	Beaker 4 m
Position when finished:	Beaker 1
Storage beaker:	Beaker 1
Select	Escape

12.5. SAMPLE TABLE

All sample information is entered into the sample table according to the tray position. The sample table screen is the default screen when entering the autosampler interface while the autosampler is idle. The sample table is automatically formatted with the appropriate number of beaker, with rinse/storage beaker positions reserved.

To add a sample to the sample table, highlight an empty beaker position using the \triangleup and \triangledown keys, then press $\boxed{\text{Add Sample}}$ to open the sample dialog box. The user can then edit the sample name and size.




- Press $\boxed{\text{Accept}}$ to enter the current sample name and size into the sample table.
- Press $\boxed{\text{Escape}}$ to cancel the sample size entry.
- Press $\boxed{\text{Delete Digit}}$ to modify the sample size entry
- Press $\boxed{\text{Edit Name}}$ to modify the sample name entry
- Press $\boxed{\text{Balance}}$ to access the balance interface for direct entry of sample weight (if available).

Note: Several features have been added to make sample entry faster, depending on your peripheral connections and analysis method. The following are available while an empty table position is highlighted.

- Shortcut to name entry: Typing a sample name using an external keyboard will automatically edit the name if the first character is non-numeric.
- Shortcut to size entry: Typing a sample size using the keypad or external keyboard will automatically edit the sample size. The sample name will be auto-incremented.
- Auto-incrementing name: The default sample name is an auto-increment of the previous sample name.
- Barcode reader: Scanning a barcode with a USB barcode reader automatically enters the barcode into the sample name field.
- Fixed sample size: The sample dialog box is omitted if the sample size entry is set to "Fixed". Typing anything from the keypad or external keyboard will go directly to the Edit Name screen.
- Autofill (Fixed sample size): All empty sample table positions can be automatically filled by pressing $\boxed{\text{Auto Fill}}$. The sample name will be auto-incremented.

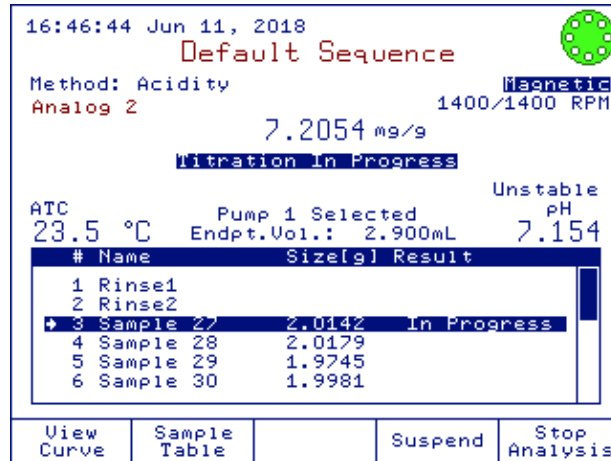
12.6. RUNNING THE AUTOSAMPLER


The autosampler sequence can be started by pressing the  key.


The autosampler will process each sample according to the settings in sequence options.

While the autosampler is running, the top part of the screen shows titration information for the current titration, and the bottom part of the screen shows a portion of the sample table.

The sample in progress is marked with  symbol in the sample table.

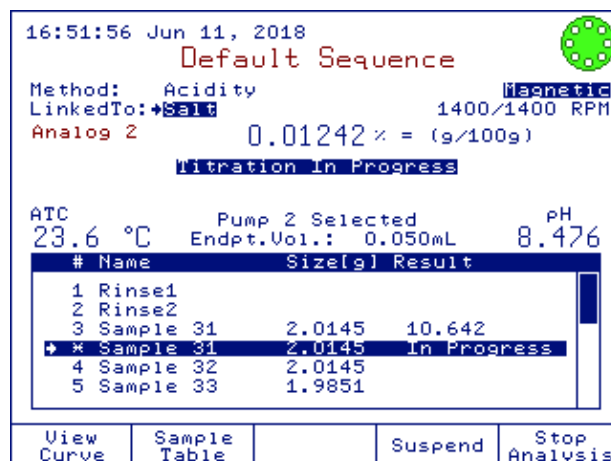




16:46:44 Jun 11, 2018
Default Sequence
 Method: Acidity 
 Analog 2 1400/1400 RPM
 7.2054 mg/g
Titration In Progress
 ATC 23.5 °C Pump 1 Selected Unstable pH
 Endpt.Vol.: 2.900mL 7.154


#	Name	Size(g)	Result
1	Rinse1		
2	Rinse2		
	Sample 27	2.0142	In Progress
4	Sample 28	2.0179	
5	Sample 29	1.9745	
6	Sample 30	1.9981	

View Curve Sample Table Suspend Stop Analysis







If the selected titration method is linked, the linked method will be displayed below the sample when it is in progress.



16:51:56 Jun 11, 2018
Default Sequence
 Method: Acidity 
 LinkedTo:  1400/1400 RPM
 Analog 2 0.01242 % = (g/100g)
Titration In Progress
 ATC 23.6 °C Pump 2 Selected pH
 Endpt.Vol.: 0.050mL 8.476

#	Name	Size(g)	Result
1	Rinse1		
2	Rinse2		
3	Sample 31	2.0145	10.642
	* Sample 31	2.0145	In Progress
4	Sample 32	2.0145	
5	Sample 33	1.9851	

View Curve Sample Table Suspend Stop Analysis



- Use the  and  keys to scroll the sample table.
- Press  to view the graph of the current titration.
- Press  to view/modify the sample table entries. Sample can be added to the sample table while the autosampler is running.
- Press  to pause the current titration.
- Press  to end the current titration immediately and proceed to the next sample.

12.7. REVIEWED RESULTS AND REPORTS

Results for the current or most recent tray of samples are shown directly in the sample table.

The results of all autosampler titrations can be accessed using the  key.

12.7.1. VIEWING RESULTS FROM THE SAMPLE TABLE

The results of each titration is shown directly in the sample table once the sample has been completed. For more information on these reports press  highlight the desired sample and press .

APPENDIX 1. TECHNICAL SPECIFICATIONS

A1 HI932 TECHNICAL SPECIFICATIONS..... A1-3

A2 HI922 TECHNICAL SPECIFICATIONS..... A1-5

A1. HI932. TECHNICAL SPECIFICATIONS

Analysis Type	Standard Titration (Standardization, Fixed pH/ mV, Equivalence Point pH/ mV)	
	Back Titration	
	Direct Reading	
End Point Mode	Fixed mV	
	Fixed pH	
	mV Equivalence Point (up to 5 points, 1 st or 2 nd derivate)	
	pH Equivalence Point (up to 5 points, 1 st or 2 nd derivate)	
Burette	Size	5 mL / 10 mL / 25 mL / 50 mL
	Resolution	0.001 mL
	Flow Rate	0.3 mL to 2 x Burette volume per minute
	Accuracy	± 0.005 mL (5 mL Burette)
		± 0.010 mL (10 mL Burette)
± 0.025 mL (25 mL Burette)		
± 0.050 mL (50 mL Burette)		
Stirrer	Range	200 to 2500 RPM
	Resolution	100 RPM
mV	Range	-2000.0 to 2000.0 mV
	Resolution	0.1 mV
	Accuracy	± 0.1 mV
	Calibration	Single point offset
pH	Range	-2.000 to 20.000 pH
	Resolution	0.1 / 0.01 / 0.001 pH
	Accuracy	± 0.001 pH
	Calibration	Up to 5 points with standard or custom buffers
ISE	Range	1×10^{-6} to 9.999×10^{10}
	Resolution	1 / 0.1 / 0.01
	Accuracy	± 0.001 pH
	Calibration	Up to 5 points
Temperature	Range	-5.0 to 105 °C
		23.0 to 221.0 °F
		268.2 to 378.2 K
	Resolution	0.1 °C / 0.1 °F / 0.1 K
Accuracy	± 0.1 °C / ± 0.2 °F / ± 0.1 K	
Data Storage	Methods	up to 100 titration methods (standard and user) up to 30 autosampler sequences
	Reports	up to 100 titration and pH/mV/ISE reports up to 40 autosampler tray reports (e.g. 720 reports for 18 beaker tray)

Connections	Measurement (per analog board)	1 x BNC Socket (pH, ORP, ISE half-cell and ISE combination electrodes) 1 x 4 mm Banana Socket (reference electrode) 1 x RCA Socket (temperature sensor) 1 x 6-pin Connector (stirrer)
	Peripheral	1 x 6-pin Mini DIN (external PC keyboard) 1 x DB-25 Socket (printer) 1 x USB Standard B (PC connection) 1 x DB-9 Socket (analytical balance) 1 x USB Standard A (USB flash drive)
Additional Specifications	Electrode Holder	4 x multi-purpose slots (titrant/reagent tubes) 3 x 12-mm electrode slots 1 x temperature sensor slot 1 x overhead stirrer slot
	Display	5.7" graphical color display with backlight
	Languages	English, Portuguese, Spanish
	Power Supply	100-240 Vac, 50/60 Hz
	Power Draw	0.5 Amps
	Enclosure Material	ABS, PC and Stainless Steel
	Keypad	Polyester
	Dimensions	315 x 205 x 375 mm (12.4 x 8.1 x 14.8 ")
	Weight	approx. 4.3 kg (9.5 lbs.) with 1 pump, stirrer and sensors
	Operating Environment	10 to 40 °C (50 to 104 °F); up to 95 % RH
	Storage Environment	-20 to 70 °C (-4 to 158 °F); up to 95 % RH

A2. HI922. TECHNICAL SPECIFICATIONS

Electrode Holder	5 x multi-purpose slots (titrant/reagent tubes) 3 x 12-mm electrodes slots 1 x overhead stirrer slot 1 x temperature sensor slot 1 x aspiration tube slot
Stirrer	magnetic stirrer (built-in) overhead stirrer (optional)
Temperature Sensor	HI7662-AW (included)
Peristaltic Pumps	Up to three (Slots 1, 2 & 3)
Diaphragm Pumps	One (Slot 4)
Peripheral Units	USB Barcode Reader
Trays	16 beakers x 150 mL with Built-in RFID 18 beakers x 100 mL with Built-in RFID
Beakers	ASTM short-form glass beakers, 100 & 150 mL HI920-060 (150 mL), Plastic beakers HI920-053 (100 mL), Plastic beakers
Control Panel	Buttons for manual operation of tray Manual operation of peristaltic or diaphragm pumps 2-line backlight display with status information
Enclosure Material	ABS plastic and steel
Electrode Holder Material	ABS plastic
Tray Material	ABS plastic and acrylic
Keypad Material	ABS plastic and polycarbonate
Weight	approx. 13 kg (29 lbs)
Operating Environment	10 to 40°C, up to 95% relative humidity
Storage Environment	-20 to 70°C, up to 95% relative humidity

APPENDIX 2. ACCESSORIES

A2.1. SOLUTIONS **A2-3**

A2.1.1. pH BUFFERS **A2-3**

A2.1.2. pH BUFFERS IN FDA APPROVED BOTTLE **A2-3**

A2.1.3. pH TECHNICAL BUFFERS **A2-3**

A2.1.4. pH MILLESIMAL BUFFERS **A2-3**

A2.1.5. ELECTRODE CLEANING SOLUTIONS **A2-4**

A2.1.6. ELECTRODE CLEANING SOLUTIONS IN FDA APPROVED BOTTLE **A2-4**

A2.1.7. ELECTRODE STORAGE SOLUTIONS **A2-4**

A2.1.8. ELECTRODE STORAGE SOLUTIONS IN FDA APPROVED BOTTLE **A2-4**

A2.1.9. ELECTRODE REFILL ELECTROLYTE SOLUTIONS **A2-4**

A2.1.10. ELECTRODE REFILL ELECTROLYTE SOLUTIONS IN FDA APPROVED BOTTLE **A2-5**

A2.1.11. ORP PRETREATMENT SOLUTIONS **A2-5**

A2.1.12. TITRATION REAGENTS **A2-5**

A2.1.13. ION SELECTIVE ELECTRODE CALIBRATION STANDARDS **A2-5**

A2.2 SENSORS **A2-6**

A2.1.1. pH ELECTRODES **A2-6**

A2.1.2. ORP ELECTRODES **A2-7**

A2.1.3. HALF-CELL ELECTRODES **A2-7**

A2.1.4. ION SELECTIVE ELECTRODES **A2-8**

A2.1.5. TEMPERATURE SENSOR **A2-8**

A2.3. TITRATOR COMPONENTS **A2-9**

A2.4. AUTOSAMPLER COMPONENTS **A2-11**

A2.1. SOLUTIONS

A2.1.1. pH CALIBRATION BUFFERS

HI7001M	pH 1.68 Buffer Solution, 230 mL
HI7001L	pH 1.68 Buffer Solution, 500 mL
HI7004M	pH 4.01 Buffer Solution, 230 mL
HI7004L	pH 4.01 Buffer Solution, 500 mL
HI7006M	pH 6.86 Buffer Solution, 230 mL
HI7006L	pH 6.86 Buffer Solution, 500 mL
HI7007M	pH 7.01 Buffer Solution, 230 mL
HI7007L	pH 7.01 Buffer Solution, 500 mL
HI7009M	pH 9.18 Buffer Solution, 230 mL
HI7009L	pH 9.18 Buffer Solution, 500 mL
HI7010M	pH 10.01 Buffer Solution, 230 mL
HI7010L	pH 10.01 Buffer Solution, 500 mL

A2.1.2. pH CALIBRATION BUFFERS IN FDA APPROVED BOTTLE

HI8004L	pH 4.01 Buffer Solution, 500 mL
HI8006L	pH 6.86 Buffer Solution, 500 mL
HI8007L	pH 7.01 Buffer Solution, 500 mL
HI8009L	pH 9.18 Buffer Solution, 500 mL
HI8010L	pH 10.01 Buffer Solution, 500 mL

A2.1.3. pH TECHNICAL CALIBRATION BUFFERS

HI5016	pH 1.68 Buffer Solution, 500 mL
HI5003	pH 3.00 Buffer Solution, 500 mL
HI5004	pH 4.01 Buffer Solution, 500 mL
HI5068	pH 6.86 Buffer Solution, 500 mL
HI5007	pH 7.01 Buffer Solution, 500 mL
HI5091	pH 9.18 Buffer Solution, 500 mL
HI5010	pH 10.01 Buffer Solution, 500 mL
HI5124	pH 12.45 Buffer Solution, 500 mL

A2.1.4. pH MILLESIMAL CALIBRATION BUFFERS

HI6016	pH 1.679 Buffer Solution, 500 mL
HI6016-01	pH 1.679 Buffer Solution, 1 L
HI6003	pH 3.000 Buffer Solution, 500 mL
HI6003-01	pH 3.000 Buffer Solution, 1 L
HI6004	pH 4.010 Buffer Solution, 500 mL
HI6004-01	pH 4.010 Buffer Solution, 1 L
HI6068	pH 6.862 Buffer Solution, 500 mL
HI6068-01	pH 6.862 Buffer Solution, 1 L

HI6007	pH 7.010 Buffer Solution, 500 mL
HI6007-01	pH 7.010 Buffer Solution, 1 L
HI6091	pH 9.177 Buffer Solution, 500 mL
HI6091-01	pH 9.177 Buffer Solution, 1 L
HI6010	pH 10.010 Buffer Solution, 500 mL
HI6010-01	pH 10.010 Buffer Solution, 1 L
HI6124	pH 12.450 Buffer Solution, 500 mL
HI6124-01	pH 12.450 Buffer Solution, 1 L

A2.1.5. ELECTRODE CLEANING SOLUTIONS

HI7061M	General Purpose Solution, 230 mL
HI7061L	General Purpose Solution, 500 mL
HI7073M	Protein Cleaning Solution, 230 mL
HI7073L	Protein Cleaning Solution, 500 mL
HI7074M	Inorganic Cleaning Solution, 230 mL
HI7074L	Inorganic Cleaning Solution, 500 mL
HI7077M	Oil & Fat Cleaning Solution, 230 mL
HI7077L	Oil & Fat Cleaning Solution, 500 mL

A2.1.6. ELECTRODE CLEANING SOLUTIONS IN FDA APPROVED BOTTLE

HI8061M	General Purpose Solution, 230 mL
HI8061L	General Purpose Solution, 500 mL
HI8073M	Protein Cleaning Solution, 230 mL
HI8073L	Protein Cleaning Solution, 500 mL
HI8077M	Oil & Fat Cleaning Solution, 230 mL
HI8077L	Oil & Fat Cleaning Solution, 500 mL

A2.1.7. ELECTRODE STORAGE SOLUTIONS

HI70300M	Storage Solution, 230 mL
HI70300L	Storage Solution, 500 mL

A2.1.8. ELECTRODE STORAGE SOLUTIONS IN FDA APPROVED BOTTLE

HI80300M	Storage Solution, 230 mL
HI80300L	Storage Solution, 500 mL

A2.1.9. ELECTRODE REFILL ELECTROLYTE SOLUTIONS

HI7071	3.5M KCl + AgCl Electrolyte, 30 mL, for single junction electrodes
HI7072	1M KNO ₃ Electrolyte, 30 mL
HI7075	KNO ₃ and KCl Electrolyte, 30 mL
HI7076	1M NaCl Electrolyte, 30 mL
HI7078	(NH ₄) ₂ SO ₄ Electrolyte, 30 mL
HI7082	3.5M KCl Electrolyte, 30 mL, for double junction electrodes

A2.1.10. ELECTRODE REFILL ELECTROLYTE SOLUTIONS IN FDA APPROVED BOTTLE

HI8071	3.5M KCl + AgCl Electrolyte, 30 mL, for single junction electrodes
HI8072	1M KNO ₃ Electrolyte, 30 mL
HI8082	3.5M KCl Electrolyte, 30 mL, for double junction electrodes

A2.1.11. ORP PRETREATMENT SOLUTIONS

HI7091M	Reducing Pretreatment Solution, 230 mL
HI7091L	Reducing Pretreatment Solution, 500 mL
HI7092M	Oxidizing Pretreatment Solution, 230 mL
HI7092L	Oxidizing Pretreatment Solution, 500 mL

A2.1.12. TITRATION REAGENTS

HI70429	0.05 M AgNO ₃ Titration Reagent, 1 L
HI70433	0.01 N Stabilized Iodine Titration Reagent, 1 L
HI70439	0.1 M Na ₂ S ₂ O ₃ Titration Reagent, 1 L
HI70440	0.02 N Stabilized Iodine Titration Reagent, 1 L
HI70441	0.04 N Stabilized Iodine Titration Reagent, 1 L
HI70448	0.02 M AgNO ₃ Titration Reagent, 1 L
HI70449	0.02 M EDTA Titration Reagent, 1 L
HI70455	0.01 N NaOH Titration Reagent, 1 L
HI70456	0.1 N NaOH Titration Reagent, 1 L
HI70457	1 N NaOH Titration Reagent, 1 L
HI70458	0.01 M H ₂ SO ₄ Titration Reagent, 1 L
HI70459	0.05 M H ₂ SO ₄ Titration Reagent, 1 L
HI70462	0.01 N HCl Titration Reagent, 1 L
HI70463	0.1 N HCl Titration Reagent, 1 L
HI70464	1 N HCl Titration Reagent, 1 L

A2.1.13. ION SELECTIVE ELECTRODE CALIBRATION STANDARDS

HI4001-01	0.1 M Ammonia Standard
HI4001-02	100 ppm Ammonia Standard (as N)
HI4001-03	1000 ppm Ammonia Standard (as N)
HI4002-01	0.1 M Bromide Standard
HI4003-01	0.1 M Cadmium Standard
HI4004-01	0.1 M Calcium Standard
HI4005-01	0.1 M Carbon Dioxide Standard
HI4005-03	1000 ppm Carbon Dioxide Standard (as CaCO ₃)
HI4007-01	0.1 M Chloride Standard
HI4007-02	100 ppm Chloride Standard
HI4007-03	1000 ppm Chloride Standard
HI4008-01	0.1 M Cupric Standard

HI4010-01	0.1 M Fluoride Standard
HI4010-02	100 ppm Fluoride Standard
HI4010-03	1000 ppm Fluoride Standard
HI4011-01	0.1 M Iodide Standard
HI4012-01	0.1 M Lead Standard
HI4012-21	0.1 M Sulfate Standard
HI4013-01	0.1 M Nitrate Standard
HI4013-02	100 ppm Nitrate Standard
HI4013-03	1000 ppm Nitrate Standard
HI4014-01	0.1 M Potassium Standard
HI4015-01	0.1 M Silver Standard

A2.2. SENSORS

A2.2.1. pH ELECTRODES

HI1043B

Glass-body, double junction, refillable, combination pH electrode.

Use: strong acid and base, paint and solvents

HI1053B

Glass-body, triple ceramic, conic shape, refillable, combination pH electrode.

Use: emulsions, fats and creams, soil and semi-solids samples

HI1083B

Glass-body, micro, Viscolene, nonrefillable, combination pH electrode.

Use: biotechnology and micro titration

HI1131B

Glass-body, double junction, refillable, combination pH electrode.

Use: general purpose

HI1330B

Glass-body, semimicro, single junction, refillable, combination pH electrode.

Use: laboratory, vials, and test tubes

HI1331B

Glass-body, semimicro, single junction, refillable, combination pH electrode.

Use: flasks

HI1230B

Plastic-body (PEI), double junction, gel-filled, combination pH electrode.

Use: general purpose

HI2031B

Glass-body, conical tip, refillable, combination pH electrode.

Use: dairy and semi-solid products

HI1332B

Plastic-body (PEI), double junction, refillable, combination pH electrode.

Use: chemicals, field applications and quality control testing.

FC100B

Plastic-body (PVDF), double junction, refillable, combination pH electrode.

Use: cheese

FC200B

Plastic-body (PVDF), single junction, conical tip, non-refillable Viscolene electrolyte, combination pH electrode.

Use: milk, yogurt, dairy products, and semi-solid foods

FC210B

Glass-body, double junction, conical tip, non-refillable Viscolene electrolyte, combination pH electrode.

Use: milk, yogurt, and cream

FC220B

Glass-body, single junction, refillable, combination pH electrode.

Use: milk, yogurt, cream, sauce, and fruit juices

FC911B

Plastic-body (PVDF), double junction, refillable, combination pH electrode.

Use: sauce, juices, dairy products and other liquid or slurry forms of food

HI1413B

Glass-body, single junction, flat tip, non-refillable Viscolene electrolyte, combination pH electrode.

Use: surfaces, skin, leather, paper, and emulsions

A2.2.2. ORP ELECTRODES

HI3131B

Glass-body, refillable, combination platinum ORP electrode.

Use: laboratories and general purpose

HI3230B

Plastic-body (PEI), gel-filled, combination platinum ORP electrode.

Use: municipal water and quality control

HI4430B

Plastic-body (PEI), gel-filled, combination gold ORP electrode.

Use: oxidants and ozone

A2.2.3. HALF-CELL ELECTRODES

HI2110B

Glass-body, single half-cell pH electrode.

Use: general purpose

HI5311

Glass-body, Ag/AgCl reference half-cell electrode, double junction, refillable with 4mm banana plug with 1 m (3.3') cable.

Use: general purpose with wide temperature range

HI5315

Plastic-body (PEI), double junction, Ag/AgCl reference half-cell electrode, refillable with 4mm plug with 1 m (3.3') cable.

Use: Ion Selective Electrodes

HI5412

Glass-body, single Calomel reference half-cell electrode, refillable with 4mm plug with 1 m (3.3') cable.

Use: general purpose with constant temperature range

A2.2.4. ION SELECTIVE ELECTRODES

HI4101 Ammonia ISE

HI4002 / HI4102 Bromide ISE

HI4003 / HI4103 Cadmium ISE

HI4004 / HI4104 Chloride ISE

HI4105 Carbon Dioxide ISE

HI4007 / HI4107 Chloride ISE

HI4008 / HI4108 Cupric ISE

HI4009 / HI4109 Cyanide ISE

HI4010 / HI4110 Fluoride ISE

HI4011 / HI4111 Iodide ISE

HI4012 / HI4112 Lead ISE

HI4013 / HI4113 Nitrate ISE

HI4014 / HI4114 Potassium ISE

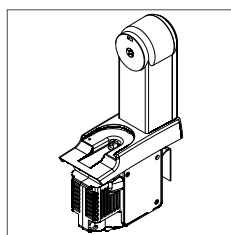
HI4015 / HI4115 Silver / Sulfide ISE

FC300B Sodium

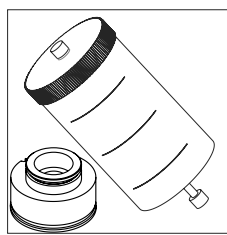
A2.2.5. TEMPERATURE SENSOR**HI7662-TW**

Temperature probe with 1 m (3.3') paneled cable.

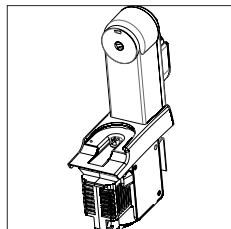
A2.3. TITRATOR COMPONENTS



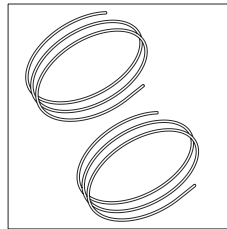
Pump Assembly
HI930100



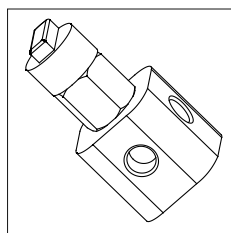
50 mL Syringe
HI900250



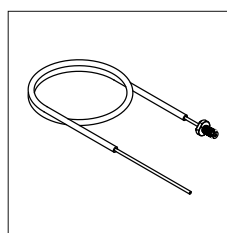
Pump Assembly with Peristaltic Pump
HI930101



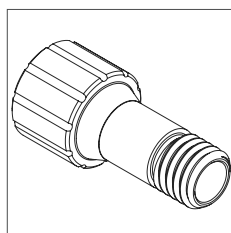
Titration Peristaltic Pump Complete
Tubing Set
HI930202



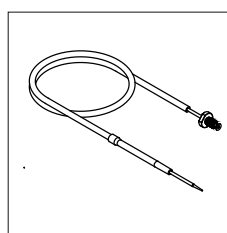
3 Way Valve
HI900260



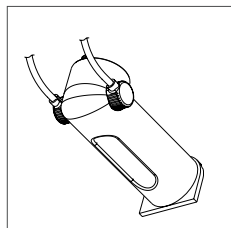
Aspiration Tube with fitting and
protection tube
HI900270



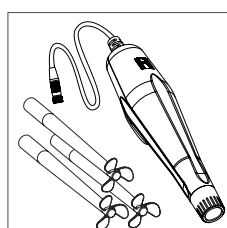
Tool for burette cap removal
HI900942



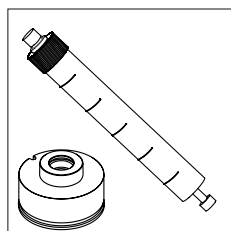
Dispensing Tube with dispensing tip,
fitting, protection tube and tube guide
HI930280



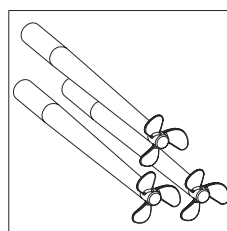
Burette with:
5 mL syringe - HI930105
10 mL syringe - HI930110
25 mL syringe - HI930125
50 mL syringe - HI930150



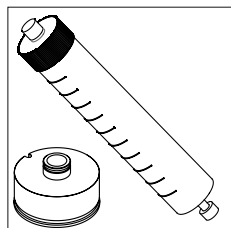
Overhead Stirrer +
3 propellers
HI930301



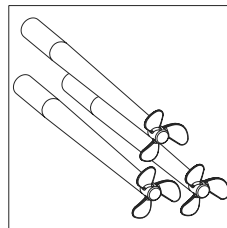
5 mL Syringe
HI900205



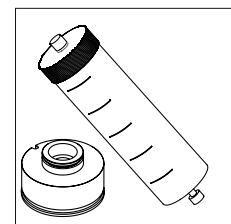
Replacement Propellers
(3 pcs.)
HI930302



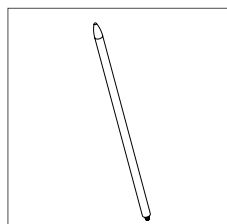
10 mL Syringe
HI900210



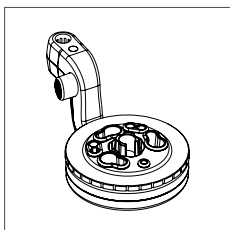
High Chemical Resistance Propellers
(3 pcs.)
HI930303



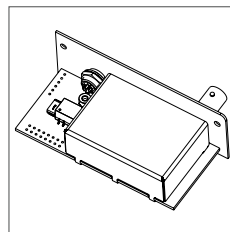
25 mL Syringe
HI900225



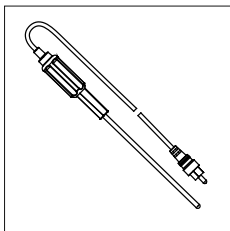
Stirrer Support
HI930320



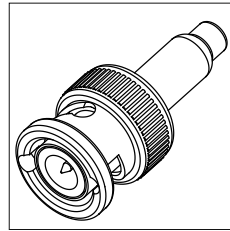
Overhead Electrode Holder
HI930310



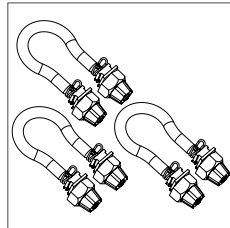
Potentiometric Analog Board
HI930401



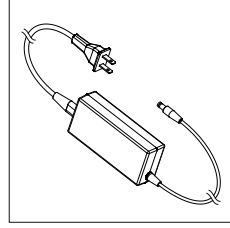
Temperature Probe
HI7662-TW



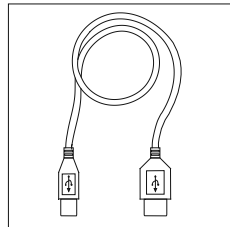
Shorting Cap
HI900945



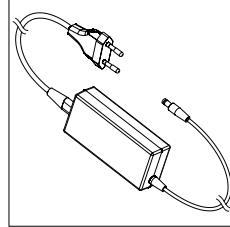
Roller Tube for Titrator peristaltic pump
(3 pcs.)
HI930204



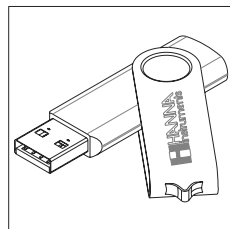
Power Adapter (USA Plug)
HI900946



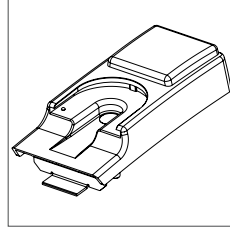
USB Cable
HI920013



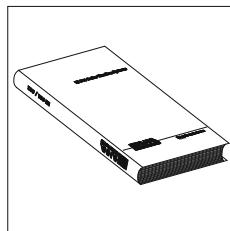
Power Adapter (European Plug)
HI900947



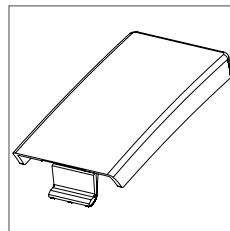
USB Storage Device
HI930900U



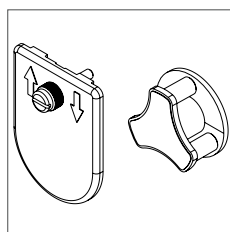
Blank Burette Support
HI930190



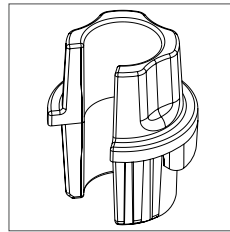
Instruction Manual Binder
HI930801



Blank Support
HI930191

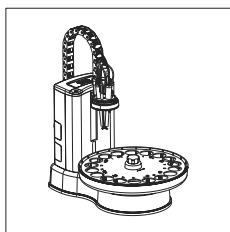


Replacement Cap and Rotor
for Peristaltic Pump
HI930201

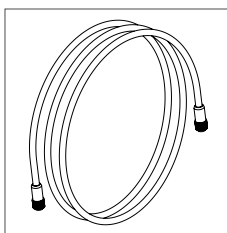


Electrode adapter for
overhead stirrer holder
HI930311

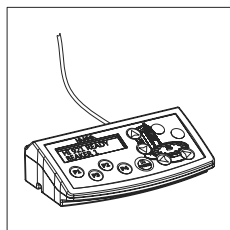
A2.4. AUTOSAMPLER COMPONENTS



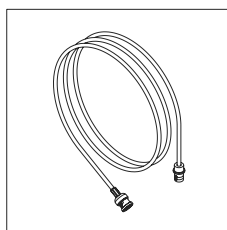
Autosampler
HI922 - XYZ



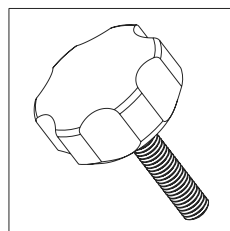
Communication Cable
HI920-933
(HI932 to HI921/HI922)



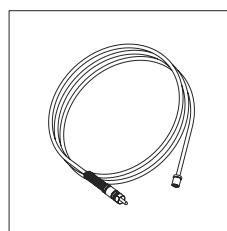
Control Panel
HI920-922



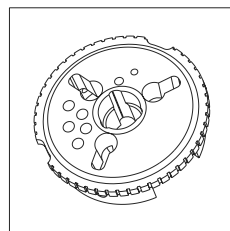
BNC Extension Cable (1 m)
HI920-931



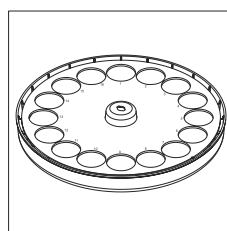
Tray Locking Screw
HI920-960



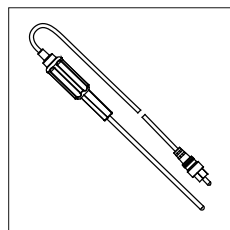
Reference Extension Cable (1 m)
HI920-932



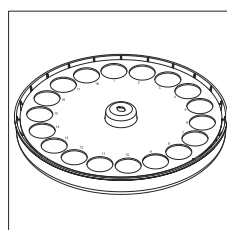
Electrode Holder
HI920-310



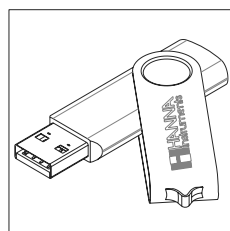
16 Beaker Tray, 60 mm dia.
Single Row with RFID
HI920-11660W



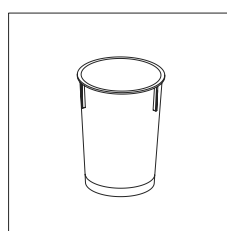
Temperature Sensor
HI7662-AW



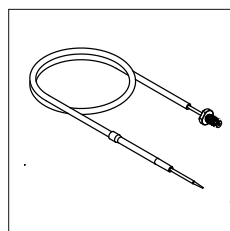
18 Beaker Tray, 53 mm dia.
Single Row with RFID
HI920-11853W



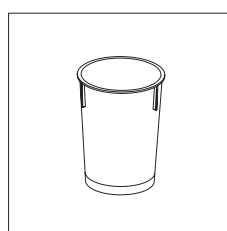
USB Memory Stick
HI920-901



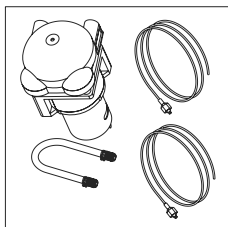
Plastic Beaker for
HI920-11660 (20 pcs.)
HI920-060



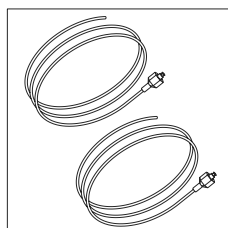
Titrant Dispensing Tube (1.5 m)
HI920-281



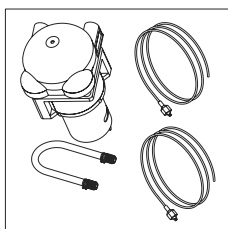
Plastic Beaker for
HI920-11853 (20 pcs.)
HI920-053



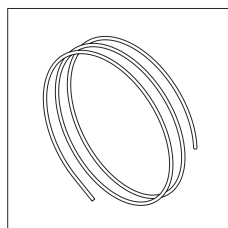
Peristaltic Pump with dispensing tubing
HI920-103



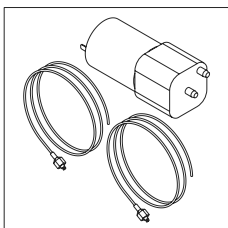
Membrane Pump Complete Tubing Set
HI920-212



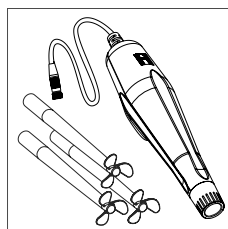
Peristaltic pump with aspiration tubing
HI920-104



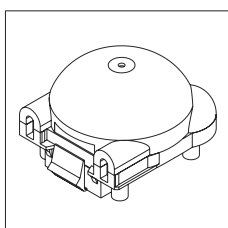
TYGON Tube (5 m)
HI920-290



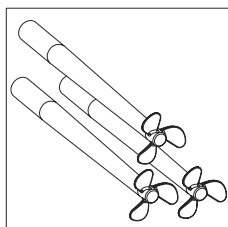
Membrane Pump with tubing
HI920-113



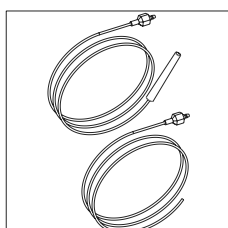
Overhead Stirrer +
3 propellers
HI930301



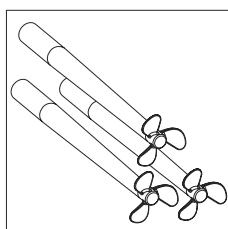
Replacement Cap and Rotor for
Peristaltic Pump
HI920-201



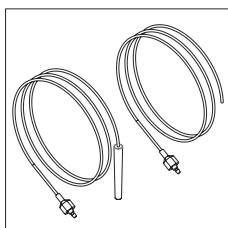
Replacement Propellers
(3 pcs.)
HI930302



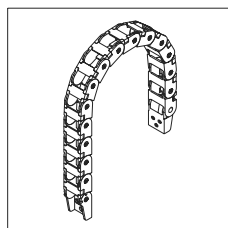
Tubing Set with plastic dispensing tube
guide for peristaltic pump
HI920-208



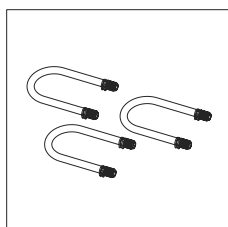
High Chemical Resistance Propellers
(3 pcs.)
HI930303



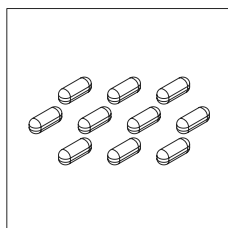
Tubing Set with stainless steel
aspiration tube for peristaltic pump
HI920-203



Cable Chain
HI920-320



Roller Tube for Autosampler peristaltic
pump (3 pcs.)
HI920-204



25 mm x 7 mm Stir Bars (10 pcs.)
HI731319

Certification

All Hanna Instruments conform to the **CE European Directives**.



RoHS
compliant

Disposal of Electrical & Electronic Equipment. The product should not be treated as household waste. Instead hand it over to the appropriate collection point for the recycling of electrical and electronic equipment which will conserve natural resources.

Ensuring proper product and battery disposal prevents potential negative consequences for the environment and human health. For more information, contact your city, your local household waste disposal service, the place of purchase or go to www.hannainst.com.



Recommendations for Users

Before using this product, make sure it is entirely suitable for your specific application and for the environment in which it is used. Any variation introduced by the user to the supplied equipment may degrade the meters' performance. For yours and the meter's safety do not use or store the meter in hazardous environments.

Warranty

The HI932 is warranted for two years against defects in workmanship and materials when used for its intended purpose and maintained according to instructions. Damage due to accidents, misuse, tampering or lack of prescribed maintenance is not covered.

If service is required, contact your local Hanna Instruments Office. If under warranty, report the model number, date of purchase, serial number and the nature of the problem. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization (RGA) number from the Technical Service department and then send it with shipping costs prepaid. When shipping any instrument, make sure it is properly packed for complete protection.

HI932

AUTOMATIC POTENTIOMETRIC TITRATOR



GENERAL TITRATION APPLICATIONS BROCHURE



0.1N SODIUM HYDROXIDE TITRANT CONCENTRATION

DESCRIPTION

Method for the standardization (titer determination) of 0.1N Sodium Hydroxide (NaOH) titrant solution against Potassium Hydrogen Phthalate (KHP). The results are expressed in **N (eq/L)**.

REFERENCE

AOAC Official Methods of Analysis, Official Method 936.16

ELECTRODE

- HI1131B Combination pH Electrode
- HI7662-T Temperature Probe

REAGENTS

- HI70456 0.1N Sodium Hydroxide (1 L)
- HI70401 Potassium Hydrogen Phthalate (20 g)
- HI70436 Deionized Water (1 gal)

ACCESSORIES

- HI70300L Storage Solution (500 mL)
- HI7071 Electrode Fill Solution (30 mL x 4)
- HI7004L pH 4.01 Buffer Solution (500 mL)
- HI7007L pH 7.01 Buffer Solution (500 mL)
- HI7010L pH 10.01 Buffer Solution (500 mL)
- HI740036P 100 mL Plastic Beaker (10 pcs)
- Analytical Balance with 0.0001 g resolution

DEVICE PREPARATION

- Connect the pH electrode and temperature probe to the titrator.
- Install a 25 mL burette filled with 0.1N sodium hydroxide (HI70456) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- Press **Select Method** from the main screen. Use the arrow keys to highlight *HI0001EN 0.1N Sodium Hydroxide* and press **Select**.

ELECTRODE PREPARATION

- Press **Mode** from the main screen, if necessary select the analog board and press **pH**.
- Calibrate the electrode using pH 4.01, 7.01 and 10.01 buffers. Refer to the instruction manual for calibration procedure.

SAMPLE PREPARATION

- Crush approximately 3 grams of potassium hydrogen phthalate (HI70401) and dry it for 2 hours at 120°C. Cool to room temperature in a desiccator.
- Place a clean 100 mL plastic beaker on the analytical balance.
- Zero the balance.
- Carefully weigh approximately 0.20 grams of dried potassium hydrogen phthalate into the beaker. Ensure that all of the potassium hydrogen phthalate is on the bottom of the beaker.

- Record the exact weight of the sample once the balance has stabilized with an accuracy of 0.0001 grams.
- Remove the beaker from the balance and add deionized water to the 50 mL mark on the beaker.

ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the pH electrode, temperature probe and stirrer. Ensure that the reference junction of the pH electrode is 5 to 6 mm below the surface. If necessary add extra deionized water.
 - Note:** The dispensing tip should be slightly submerged in the sample.
- Press **start stop**. You will be prompted to enter the weight of the analyte (weight of potassium hydrogen phthalate). Use the numeric keypad to enter the exact weight and press **enter** to start the analysis.
 - Note:** Ensure that the potassium hydrogen phthalate dissolves completely during the pre-titration stir time. Erroneous results may occur if the sample does not dissolve completely prior to titration. If necessary the pre-titration stir time can be increased.
- At the end of the titration, after detection of the equivalence point, "Titration Completed" will appear with the result. The result is expressed in **N (eq/L) of sodium hydroxide**.
- Remove the pH electrode, temperature probe and stirrer from the sample and rinse them thoroughly with deionized water.
- Record the result.
 - Note:** For improved accuracy, repeat this procedure a minimum of three times and calculate the average value.

For methods utilizing 0.1N sodium hydroxide titrant solution, follow the steps below to enter the titer/standardized value.

- Select the method utilizing 0.1N sodium hydroxide.
- Press **Method Options** from the main screen.
- Using the arrow keys, highlight *Titrant Conc.* and press **Select**.
- Use the numeric keypad to enter the standardized (titer) value of the titrant then press **Accept**.
- Press **Escape** to exit the View/Modify Method screen. Use the arrow keys to highlight *Save Method* and press **Select**.

0.1N SODIUM HYDROXIDE TITRANT CONCENTRATION

METHOD PARAMETERS

Name: 0.1N Sodium Hydroxide
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.030 mL
 Max Vol: 0.500 mL
 delta E: 4.500 mV
 End Point Mode: pH 1EQ point, 1st Der
 Recognition Options:
 Threshold: 500 mV/mL
 Range: NO
 Filtered Derivatives: NO
 Pre-Titration Volume: 5.000 mL
 Pre-Titration Stir Time: 60 sec
 Measurement Mode: Signal Stability
 delta E: 0.3 mV
 delta t: 2 sec
 Min wait: 3 sec
 Max wait: 30 sec
 Electrode Type: pH
 Blank Option: No Blank
 Calculations: Stdz. Titrant by Weight
 Dilution Option: Disabled
 Titrant Name: 0.1N NaOH
 Analyte Size: 0.20000 g
 Analyte Entry: Manual
 Maximum Titrant Volume: 15.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Stdz. Titrant by Weight
 Titrant units: N (eq/L)
 Titrant volume dosed: V (L)
 Standard weight: 0.200 g
 mw of standard: 204.23 g/mol
 Titrant/Standard: 1.000 eq/mol

$$\frac{\text{eq}}{\text{L}} \text{ NaOH} = \frac{0.200 * 1.000}{204.23 * V(\text{L})}$$

RESULTS

Titration Report

Method Name: 0.1N Sodium Hydroxide
 Time & Date: 17:03 Jun 07, 2018
 Report ID: Ti_00053

Titration Results

Method Name: 0.1N Sodium Hydroxide
 Time & Date: 17:03 Jun 07, 2018
 Analyte Size: 0.20920 g
 End Point Volume: 10.215 mL
 pH Equivalence Point: 8.394
 Result: 0.10027 N(eq/L)
 Initial & Final pH: 4.173 to 9.570
 Titration Duration: 6:25 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

0.1N HYDROCHLORIC ACID TITRANT CONCENTRATION

DESCRIPTION

Method for the standardization (titer determination) of 0.1N Hydrochloric Acid (HCl) titrant solution against Sodium Hydroxide (NaOH). The results are expressed in **N (eq/L)**.

REFERENCE

AOAC Official Methods of Analysis, Official Method 936.15

ELECTRODE

- HI1131B Combination pH Electrode
- HI7662-T Temperature Probe

REAGENTS

- HI70463 0.1N Hydrochloric Acid (1 L)
- HI70456 0.1N Sodium Hydroxide (1 L)
- HI70436 Deionized Water (1 gal)

ACCESSORIES

- HI70300L Storage Solution (500 mL)
- HI7071 Electrode Fill Solution (30 mL x 4)
- HI7004L pH 4.01 Buffer Solution (500 mL)
- HI7007L pH 7.01 Buffer Solution (500 mL)
- HI7010L pH 10.01 Buffer Solution (500 mL)
- HI740036P 100 mL Plastic Beakers (10 pcs)
- 10 mL Class A Volumetric Pipette

DEVICE PREPARATION

- Connect the pH electrode and temperature probe to the titrator.
- Install a 25 mL burette filled with 0.1N hydrochloric acid (HI70463) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- Press from the main screen. Use the arrow keys to highlight *HI0002EN 0.1N Hydrochloric Acid* and press .

ELECTRODE PREPARATION

- Press from the main screen and press .
- Calibrate the electrode using pH 4.01, 7.01 and 10.01 buffers. Refer to the instruction manual for calibration procedure.

SAMPLE PREPARATION

- Use a Class A volumetric pipette to transfer exactly 10.00 mL of 0.1N sodium hydroxide (HI70456) to a clean 100 mL beaker.
- Add deionized water to the 50 mL mark on the beaker.

ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the pH electrode, temperature probe and stirrer. Ensure that the reference junction of the pH electrode is 5 to 6 mm below the surface. If necessary add extra deionized water.

Note: The dispensing tip should be slightly submerged in the sample.

- Press , the titrator start the analysis.
 - At the end of the titration, after detection of the equivalence point, "Titration Completed" will appear with the result. The result is expressed in **N (eq/L) of hydrochloric acid**.
 - Remove the pH electrode, temperature probe and stirrer from the sample and rinse them thoroughly with deionized water.
 - Record the result.
- Note:** For improved accuracy, repeat this procedure a minimum of three times and calculate the average value.

For methods utilizing 0.1N hydrochloric acid titrant solution, follow the steps below to enter the titer/standardized value.

- Select the method utilizing 0.1N hydrochloric acid.
- Press from the main screen.
- Using the arrow keys, highlight *Titrant Conc.* and press .
- Use the numeric keypad to enter the standardized (titer) value of the titrant then press .
- Press to exit the View/Modify Method screen. Use the arrow keys to highlight *Save Method* and press .

0.1N HYDROCHLORIC ACID TITRANT CONCENTRATION

METHOD PARAMETERS

Name: 0.1N Hydrochloric Acid
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.030 mL
 Max Vol: 0.500 mL
 delta E: 6.000 mV
 End Point Mode: pH 1EQ point, 1st Der
 Recognition Options:
 Threshold: 500 mV/mL
 Range: NO
 Filtered Derivatives: NO
 Pre-Titration Volume: 5.000 mL
 Pre-Titration Stir Time: 0 sec
 Measurement Mode: Signal Stability
 delta E: 1.0 mV
 delta t: 2 sec
 Min wait: 3 sec
 Max wait: 15 sec
 Electrode Type: pH
 Blank Option: No Blank
 Calculations: Stdz. Titrant by Volume
 Dilution Option: Disabled
 Titrant Name: 0.1N HCl
 Analyte Size: 10.0000 mL
 Analyte Entry: Fixed
 Maximum Titrant Volume: 15.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Stdz. Titrant by Volume
 Titrant units: N (eq/L)
 Titrant volume dosed: V (L)
 Standard volume: 10.000 mL
 Standard conc.: 0.100 eq/L

$$\frac{\text{eq}}{\text{L}} \text{ HCl} = \frac{10.000 * 0.100}{\text{V(L)} * 1000}$$

RESULTS

Titration Report

Method Name: 0.1N Hydrochloric Acid
 Time & Date: 14:55 July 30, 2018
 Report ID: Ti_00002

Titration Results

Method Name: 0.1N Hydrochloric Acid
 Time & Date: 14:55 July 30, 2018
 Analyte Size: 10.000 mL
 End Point Volume: 9.979 mL
 pH Equivalence Point: 5.059
 Result: 0.10020 N(eq/L)
 Initial & Final pH: 12.135 to 4.989
 Titration Duration: 2:45 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

0.1M SODIUM THIOSULFATE TITRANT CONCENTRATION

DESCRIPTION

Method for the standardization (titer determination) of 0.1M Sodium Thiosulfate ($\text{Na}_2\text{S}_2\text{O}_3$) titrant solution against Potassium Iodate (KIO_3). The results are expressed in **M (mol/L)**.

REFERENCE

Standard Methods for the Examination of Water and Wastewater 19th Edition, Method 4500-Cl B

ELECTRODE

- HI3131B Combination ORP Electrode

REAGENTS

- HI70439 0.1M Sodium Thiosulfate (1 L)
- HI70407 Potassium Iodate (20 g)
- HI70425 16% Sulfuric Acid (500 mL)
- HI70468 Potassium Iodide (35 g)
- HI70436 Deionized Water (1 gal)

ACCESSORIES

- HI70300L Storage Solution (500 mL)
- HI7071 Electrode Fill Solution (30 mL x 4)
- HI740036P 100 mL Plastic Beakers (10 pcs)
- Analytical Balance 0.0001 g
- 100 mL Class A Volumetric Flask
- 10 mL Class A Volumetric Pipette

DEVICE PREPARATION

- Connect the ORP electrode to the titrator.
- Install a 25 mL burette filled with 0.1M sodium thiosulfate (HI70439) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- Press from the main screen. Use the arrow keys to highlight *HI0003EN 0.1M Sodium Thiosulfate* and press .

ELECTRODE PREPARATION

- Prepare the ORP electrode according to the procedure in the manual.

SAMPLE PREPARATION

- Crush approximately 2 grams of potassium iodate (HI70407) and dry it for 2 hours at 120°C. Cool to room temperature in a desiccator.
- Carefully weigh approximately 0.35 grams of dried potassium iodate.
- Record the exact weight of the sample once the balance has stabilized with an accuracy of 0.0001 grams.
- Carefully transfer the salt to a 100 mL Class A volumetric flask. Add approximately 80 mL of deionized water, and mix to dissolve. Once the salt is completely dissolved bring the flask to volume with deionized water, mix well.

- Use a Class A volumetric pipette to transfer exactly 10.00 mL of the solution to a clean 100 mL plastic beaker.
- Add deionized water to the 50 mL mark on the beaker.
- Add 5.00 mL of 16% sulfuric acid (HI70425) and 1.5 grams of potassium iodide (HI70468) to the beaker.

ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the ORP electrode and stirrer. Ensure that the reference junction of the ORP electrode is 5 to 6 mm below the surface. If necessary add extra deionized water.
Note: The dispensing tip should be slightly submerged in the sample.
- Press . You will be prompted to enter the weight of the analyte (weight of potassium iodate). Use the numeric keypad to enter the exact weight and press to start the analysis.
- At the end of the titration, after detection of the equivalence point, "Titration Completed" will appear with the result. The result is expressed in **M (mol/L) of sodium thiosulfate**.
- Remove the ORP electrode and stirrer from the sample and rinse them thoroughly with deionized water.
- Record the result.
Note: For improved accuracy, repeat this procedure a minimum of three times and calculate the average value.

For methods utilizing 0.1M sodium thiosulfate titrant solution, follow the steps below to enter the titer/standardized value.

- Select the method utilizing 0.1M sodium thiosulfate.
- Press from the main screen.
- Using the arrow keys, highlight *Titrant Conc.* and press .
- Use the numeric keypad to enter the standardized (titer) value of the titrant then press .
- Press to exit the View/Modify Method screen. Use the arrow keys to highlight *Save Method* and press .

0.1M SODIUM THIOSULFATE TITRANT CONCENTRATION

METHOD PARAMETERS

Name: 0.1M Sodium Thiosulfate
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.030 mL
 Max Vol: 0.600 mL
 delta E: 6.500 mV
 End Point Mode: mV 1EQ point, 1st Der
 Recognition Options:
 Threshold: 50 mV/mL
 Range: NO
 Filtered Derivatives: NO
 Pre-Titration Volume: 5.000 mL
 Pre-Titration Stir Time: 0 sec
 Measurement Mode: Signal Stability
 delta E: 0.3 mV
 delta t: 2 sec
 Min wait: 2 sec
 Max wait: 20 sec
 Electrode Type: ORP
 Blank Option: No Blank
 Calculations: Stdz. Titrant by Weight
 Dilution Option: Enabled
 Final Dilution Volume: 100.000 mL
 Aliquot Volume: 10.000 mL
 Titrant Name: 0.1M Na2S2O3
 Analyte Size: 0.35000 g
 Analyte Entry: Manual
 Maximum Titrant Volume: 15.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Stdz. Titrant by Weight
 Titrant units: M (mol/L)
 Titrant volume dosed: V (L)
 Standard weight: 0.350 g
 Dilution Factor: 0.100
 Final Dilution volume: 100.000 mL
 Aliquot Volume: 10.000 mL
 mw of standard: 214.00 g/mol
 Titrant/Standard: 6.000 mol/mol

$$\frac{\text{mol}}{\text{L}} \text{Na}_2\text{S}_2\text{O}_3 = \frac{0.350 * 0.10 * 6.0}{214.00 * V(\text{L})}$$

RESULTS

Titration Report

Method Name: 0.1M Sodium Thiosulfate
 Time & Date: 17:10 Jun 22, 2018
 Report ID: Ti_00073

Titration Results

Method Name: 0.1M Sodium Thiosulfate
 Time & Date: 17:10 Jun 22, 2018
 Analyte Size: 0.35020 g
 End Point Volume: 9.635 mL
 mV Equivalence Point: 233.0
 Result: 0.10191 M (mol/L)
 Initial & Final mV: 361.8 to 173.4
 Titration Duration: 2:51 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

0.1M FERROUS AMMONIUM SULFATE TITRANT CONCENTRATION

DESCRIPTION

Method for the standardization (titer determination) of 0.1M Ferrous Ammonium Sulfate (FAS) titrant solution against Potassium Dichromate ($K_2Cr_2O_7$). The results are expressed in **M (mol/L)**.

REFERENCE

Standard Methods for the Examination of Water and Wastewater 21st Edition, Method 5220B

ELECTRODE

- HI3131B Combination ORP Electrode

REAGENTS

- HI70444 25% Sulfuric Acid
- HI70436 Deionized Water (1 gal)
- Ferrous Ammonium Sulfate (ACS Grade)
- Potassium Dichromate (ACS Grade)



ACCESSORIES

- HI70300L Storage Solution (500 mL)
- HI7071 Electrode Fill Solution (30 mL x 4)
- HI740036P 100 mL Plastic Beakers (10 pcs)
- Analytical Balance with 0.0001 g resolution
- 100 mL Class A Volumetric Flask
- 500 mL Class A Volumetric Flask
- 10 mL Class A Volumetric Pipette

TITRANT PREPARATION

- Carefully weigh 19.607 grams of ferrous ammonium sulfate.
- Carefully transfer the salt to a 500 mL Class A volumetric flask. Add approximately 300 mL of deionized water, and mix to dissolve.
- Add 40.00 mL of 25% sulfuric acid (HI70444) to the flask. Invert the solution to mix.
- Allow the flask to return to room temperature.
- Bring the flask to volume with deionized water, mix well.

DEVICE PREPARATION

- Connect the ORP electrode to the titrator.
- Install a 25 mL burette filled with 0.1M ferrous ammonium sulfate on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- Press  from the main screen. Use the arrow keys to highlight *HI0010EN 0.1M FAS* and press .

ELECTRODE PREPARATION

- Prepare the ORP electrode according to the procedure in the manual.

SAMPLE PREPARATION



- Crush approximately 2 grams of potassium dichromate and dry it for 2 hours at 150°C. Cool to room temperature in a desiccator.

- Carefully weigh approximately 0.49 grams of dried potassium dichromate.
- Record the exact weight of the sample once the balance has stabilized with an accuracy of 0.0001 grams.
- Carefully transfer the salt to a 100 mL Class A volumetric flask. Add approximately 80 mL of deionized water, and mix to dissolve. Once the salt is completely dissolved bring the flask to volume with deionized water, mix well.
- Use a Class A volumetric pipette to transfer exactly 10.00 mL of the solution to a clean 100 mL plastic beaker.
- Add 25.00 mL of 25% sulfuric acid (HI70444) to the beaker.
- Add deionized water to the 50 mL mark on the beaker.






ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the electrode and stirrer. Ensure that the reference junction of the ORP electrode is 5 to 6 mm below the surface. If necessary add extra deionized water.

Note: The dispensing tip should be slightly submerged in the sample.

- Press . You will be prompted to enter the weight of the analyte (weight of potassium dichromate). Use the numeric keypad to enter the exact weight and press  to start the analysis.
 - At the end of the titration, after detection of the equivalence point, "Titration Completed" will appear with the result. The result is expressed in **M (mol/L) of ferrous ammonium sulfate**.
 - Remove the ORP electrode and stirrer from the sample and rinse them thoroughly with deionized water.
 - Record the result.
- Note:** For improved accuracy, repeat this procedure a minimum of three times and calculate the average value.

For methods utilizing 0.1M ferrous ammonium sulfate titrant solution, follow the steps below to enter the titer/standardized value.

- Select the method utilizing 0.1M ferrous ammonium sulfate
- Press  from the main screen.
- Using the arrow keys, highlight *Titrant Conc.* and press .
- Use the numeric keypad to enter the standardized (titer) value of the titrant then press .
- Press  to exit the View/Modify Method screen and select *Save Method* and press .

0.1M FERROUS AMMONIUM SULFATE TITRANT CONCENTRATION

METHOD PARAMETERS

Name: 0.1M FAS
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.030 mL
 Max Vol: 0.500 mL
 delta E: 4.500 mV
 End Point Mode: mV 1EQ point, 1st Der
 Recognition Options:
 Threshold: 35 mV/mL
 Range: NO
 Filtered Derivatives: NO
 Pre-Titration Volume: 5.000 mL
 Pre-Titration Stir Time: 0 sec
 Measurement Mode: Signal Stability
 delta E: 0.5 mV
 delta t: 3 sec
 Min wait: 2 sec
 Max wait: 20 sec
 Electrode Type: ORP
 Blank Option: No Blank
 Calculations: Stdz. Titrant by Weight
 Dilution Option: Enabled
 Final Dilution Volume: 100.000 mL
 Aliquot Volume: 10.000 mL
 Titrant Name: 0.1M FAS
 Analyte Size: 0.49000 g
 Analyte Entry: Manual
 Maximum Titrant Volume: 15.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Stdz. Titrant by Weight
 Titrant units: M (mol/L)
 Titrant volume dosed: V (L)
 Standard weight: 0.490 g
 Dilution Factor: 0.100
 Final Dilution volume: 100.000 mL
 Aliquot Volume: 10.000 mL
 mw of standard: 294.18 g/mol
 Titrant/Standard: 6.000 mol/mol

$$\frac{\text{mol}}{\text{L}} \text{ FAS} = \frac{0.490 * 0.10 * 6.0}{294.18 * V(L)}$$

RESULTS

Titration Report

Method Name: 0.1M FAS
 Time & Date: 15:59 August 1, 2018
 Report ID: Ti_00015

Titration Results

Method Name: 0.1M FAS
 Time & Date: 15:59 August 1, 2018
 Analyte Size: 0.491 g
 End Point Volume: 9.879 mL
 mV Equivalence Point: 667.4
 Result: 0.10137 M (mol/L)
 Initial & Final mV: 791.3 to 598.0
 Titration Duration: 3:05 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

0.02M SILVER NITRATE TITRANT CONCENTRATION

DESCRIPTION

Method for the standardization (titer determination) of 0.02M Silver Nitrate (AgNO_3) titrant solution against Sodium Chloride (NaCl). The results are expressed in **M (mol/L)**.

REFERENCE

AOAC Official Methods of Analysis, Official Method 941.18

ELECTRODE

- HI4115 Silver/Sulfide Combination ISE

REAGENTS

- HI70448 0.02M Silver Nitrate (1 L)
- HI70406 Sodium Chloride (20 g)
- HI70427 1.5M Nitric Acid Solution (500 mL)
- HI70436 Deionized Water (1 gal)

ACCESSORIES

- HI7072 Electrode Fill Solution (4 x 30 mL)
- Analytical Balance with 0.0001 g resolution
- 150 mL Glass Beaker
- 100 mL Class A Volumetric Flask
- 5 mL Class A Volumetric Pipette

DEVICE PREPARATION

- Connect the Silver/Sulfide electrode to the titrator.
- Install a 25 mL burette filled with 0.02M silver nitrate (HI70448) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- Press **Select Method** from the main screen. Use the arrow keys to highlight *HI0200EN 0.02M Silver Nitrate* and press **Select**.

ELECTRODE PREPARATION

- Prepare the Silver/Sulfide electrode according to the procedure in the manual.

SAMPLE PREPARATION

- Crush approximately 2 grams of sodium chloride (HI70406) and dry it for 2 hours at 140°C. Cool to room temperature in a desiccator.
- Weigh 0.20 g of dried sodium chloride with an accuracy of 0.0001 g. Transfer the salt to a 100 mL volumetric flask. Add approximately 80 mL of distilled water and mix. Dissolve completely before bringing to volume.
- Use a Class A volumetric pipette to transfer exactly 5.00 mL of prepared standard solution to a 150 mL glass beaker and add distilled water to the 100 mL mark on the beaker.
- Add 10.00 mL of 1.5M nitric acid (HI70427) to the beaker.

ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the Silver/Sulfide electrode and stirrer. Ensure that the reference junction of the electrode is 5 to 6 mm below the surface. If necessary add extra deionized water.
Note: The dispensing tip should be slightly submerged in the sample.
- Press **start stop**. You will be prompted to enter the weight of the analyte (weight of sodium chloride). Use the numeric keypad to enter the exact weight and press **enter** to start the analysis.
- At the end of the titration, after detection of the equivalence point, "Titration Completed" will appear with the result. The result is expressed in **M (mol/L) of silver nitrate**.
- Remove the electrode and stirrer from the sample and rinse them thoroughly with deionized water.
- Record the result.
Note: For improved accuracy, repeat this procedure a minimum of three times and calculate the average value.

For methods utilizing 0.02M silver nitrate titrant solution, follow the steps below to enter the titer/standardized value.

- Select the method utilizing 0.02M silver nitrate.
- Press **Method Options** from the main screen.
- Using the arrow keys, highlight *Titrant Conc.* and press **Select**.
- Use the numeric keypad to enter the standardized (titer) value of the titrant then press **Accept**.
- Press **Escape** to exit the View/Modify Method screen. Use the arrow keys to highlight *Save Method* and press **Select**.

0.02M SILVER NITRATE TITRANT CONCENTRATION

METHOD PARAMETERS

Name: 0.02M Silver Nitrate
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.030 mL
 Max Vol: 0.500 mL
 delta E: 8.000 mV
 End Point Mode: mV 1EQ point, 1st Der
 Recognition Options:
 Threshold: 100 mV/mL
 Range: NO
 Filtered Derivatives: YES
 Pre-Titration Volume: 6.000 mL
 Pre-Titration Stir Time: 0 sec
 Measurement Mode: Signal Stability
 delta E: 1.0 mV
 delta t: 2 sec
 Min wait: 2 sec
 Max wait: 20 sec
 Electrode Type: Silver/Sulfide
 Blank Option: No Blank
 Calculations: Stdz. Titrant by Weight
 Dilution Option: Enabled
 Final Dilution Volume: 100.000 mL
 Aliquot Volume: 5.000 mL
 Titrant Name: 0.02M AgNO₃
 Analyte Size: 0.20000 g
 Analyte Entry: Manual
 Maximum Titrant Volume: 15.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Stdz. Titrant by Weight
 Titrant units: M (mol/L)
 Titrant volume dosed: V (L)
 Standard weight: 0.200 g
 Dilution Factor: 0.05
 Final Dilution volume: 100.000 mL
 Aliquot Volume: 5.000 mL
 mw of standard: 58.440 g/mol
 Titrant/Standard: 1.000 mol/mol

$$\frac{\text{mol}}{\text{L}} \text{AgNO}_3 = \frac{0.200 * 0.05 * 1.0}{58.440 * V(L)}$$

RESULTS

Titration Report

Method Name: 0.02M Silver Nitrate
 Time & Date: 15:52 August 1, 2018
 Report ID: Ti_00037

Titration Results

Method Name: 0.02M Silver Nitrate
 Time & Date: 15:52 August 1, 2018
 Analyte Size: 0.1923 g
 End Point Volume: 9.065 mL
 mV Equivalence Point: 273.1
 Result: 0.01815 M (mol/L)
 Initial & Final mV: 146.9 to 291.0
 Titration Duration: 2:21 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

ALKALINITY OF WATER

0 to 2500 mg/L CaCO₃, pH 4.5 Endpoint

DESCRIPTION

Method for the determination of total (methyl red) alkalinity in water by titration of a sample to pH 4.5. The results are expressed in **mg/L (ppm) as calcium carbonate**.

For the determination of phenolphthalein alkalinity, set the endpoint to pH 8.3.

REFERENCE

Standard Methods for the Examination of Water and Wastewater 21st edition, Method 2320B

ELECTRODE

- HI1131B Combination pH Electrode
- HI7662-T Temperature Probe

REAGENTS

- HI70463 0.1N Hydrochloric Acid (1 L)
- HI70436 Deionized Water (1 gal)

ACCESSORIES

- HI70300L Storage Solution (500 mL)
- HI7082 Electrode Fill Solution (4 x 30 mL)
- HI7004L pH 4.01 Buffer Solution (500 mL)
- HI7007L pH 7.01 Buffer Solution (500 mL)
- HI7010L pH 10.01 Buffer Solution (500 mL)
- HI740036P 100 mL Plastic Beaker (10 pcs)
- 50 mL Class A Volumetric Pipette

DEVICE PREPARATION

- Connect the pH electrode and temperature probe to the titrator.
- Install a 25 mL burette filled with 0.1N hydrochloric acid (HI70463) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- For the determination of the exact concentration of the 0.1N hydrochloric acid, follow *HI0002EN 0.1N Hydrochloric Acid Titrant Concentration*.
- Press Select Method from the main screen. Use the arrow keys to highlight *Alkalinity of Water* and press Select.

ELECTRODE PREPARATION

- Press Mode from the main screen, if necessary select the analog board and press pH.
- Calibrate the electrode using pH 4.01, 7.01 and 10.01 buffers. Refer to the instruction manual for calibration procedure.

SAMPLE PREPARATION

- Use a Class A volumetric pipette to transfer exactly 50.00 mL of sample to a clean 100 mL plastic beaker.

ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the pH electrode, temperature sensor and stirrer. Ensure that the reference junction of the pH electrode is 5 to 6 mm below the surface. If necessary add extra deionized water.
Note: The dispensing tip should be slightly submerged in the sample.
- Press start stop, the titrator will start the analysis.
- At the end of the titration, when pH 4.50 is reached, "Titration Completed" will appear with the result. The result is expressed in **mg/L as calcium carbonate**.
- Remove the pH electrode, temperature probe and stirrer from the sample and rinse them thoroughly with deionized water.
- Record the result.

ALKALINITY OF WATER

0 to 2500 mg/L CaCO₃, pH 4.5 Endpoint

METHOD PARAMETERS

Name: Alkalinity of Water
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.050 mL
 Max Vol: 0.500 mL
 delta E: 5.000 mV
 End Point Mode: Fixed 4.500 pH
 Pre-Titration Volume: 0.000 mL
 Pre-Titration Stir Time: 0 sec
 Measurement Mode: Signal Stability
 delta E: 1.0 mV
 delta t: 2 sec
 Min wait: 2 sec
 Max wait: 20 sec
 Electrode Type: pH
 Blank Option: No Blank
 Calculations: Sample Calc. by Volume
 Dilution Option: Disabled
 Titrant Name: 0.1N HCl
 Titrant Conc.: 0.1000 N(eq/L)
 Analyte Size: 50.000 mL
 Analyte Entry: Fixed
 Maximum Titrant Volume: 25.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Sample Calc. by Volume
 Titrant units: N (eq/L)
 Titrant volume dosed: V (L)
 Final result units: mg/L
 Titrant Conc.: 0.1000 N(eq/L)
 Sample/Titrant: 0.500 mol/eq
 mw of sample: 100.09 g/mol
 Sample Volume: 50.000 mL

$$\frac{\text{mg}}{\text{L}} \text{CaCO}_3 = \frac{V(\text{L}) * 1000 * 0.10 * 0.5 * 100.09 * 1000}{50.00}$$

RESULTS

Titration Report

Method Name: Alkalinity of Water
 Time & Date: 14:36 August 1, 2018
 Report ID: Ti_00036

Titration Results

Method Name: Alkalinity of Water
 Time & Date: 14:36 August 1, 2018
 Analyte Size: 50.000 mL
 End Point Volume: 9.336 mL
 pH Fixed End Point: 4.500
 Result: 934.44 mg/L
 Initial & Final pH: 10.232 to 4.419
 Titration Duration: 3:23 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

ACIDITY OF WATER

0 to 2500 mg/L, pH 8.3 Endpoint

DESCRIPTION

Method for the determination of total (phenolphthalein) acidity in water by titration of a sample to pH 8.3. The results are expressed in **mg/L (ppm) as calcium carbonate**.

For the determination of methyl orange acidity, set the endpoint to pH 3.7.

REFERENCE

Standard Methods for the Examination of Water and Wastewater 21st edition, Method 2310B

ELECTRODE

- HI1131B Combination pH Electrode
- HI7662-T Temperature Probe

REAGENTS

- HI70456 0.1N Sodium Hydroxide (1 L)
- HI70436 Deionized Water (1 gal)

ACCESSORIES

- HI70300L Storage Solution (500 mL)
- HI7082 Electrode Fill Solution (4 x 30 mL)
- HI7004L pH 4.01 Buffer Solution (500 mL)
- HI7007L pH 7.01 Buffer Solution (500 mL)
- HI7010L pH 10.01 Buffer Solution (500 mL)
- HI740036P 100 mL Plastic Beaker (10 pcs)
- 50 mL Class A Volumetric Pipette

DEVICE PREPARATION

- Connect the pH electrode and temperature probe to the titrator.
- Install a 25 mL burette filled with 0.1N sodium hydroxide (HI70456) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- For the determination of the exact concentration of the 0.1N sodium hydroxide, follow *HI0001EN 0.1N Sodium Hydroxide Titrant Concentration*.
- Press Select Method from the main screen. Use the arrow keys to highlight *Acidity of Water* and press Select.

ELECTRODE PREPARATION

- Press Mode from the main screen, if necessary select the analog board and press pH.
- Calibrate the electrode using pH 4.01, 7.01 and 10.01 buffers. Refer to the instruction manual for calibration procedure.

SAMPLE PREPARATION

- Use a Class A volumetric pipette to transfer exactly 50.00 mL of sample to a clean 100 mL plastic beaker.

ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the pH electrode, temperature sensor and stirrer. Ensure that the reference junction of the pH electrode is 5 to 6 mm below the surface. If necessary add extra deionized water.
 - Note:** The dispensing tip should be slightly submerged in the sample.
- Press start stop, the titrator will start the analysis.
- At the end of the titration, when pH 8.30 is reached, "Titration Completed" will appear with the result. The result is expressed in **mg/L as calcium carbonate**.
- Remove the pH electrode, temperature probe and stirrer from the sample and rinse them thoroughly with deionized water.
- Record the result.

ACIDITY OF WATER

0 to 2500 mg/L, pH 8.3 Endpoint

METHOD PARAMETERS

Name: Acidity of Water
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.050 mL
 Max Vol: 0.500 mL
 delta E: 5.000 mV
 End Point Mode: Fixed 8.300 pH
 Pre-Titration Volume: 0.000 mL
 Pre-Titration Stir Time: 0 sec
 Measurement Mode: Signal Stability
 delta E: 1.0 mV
 delta t: 2 sec
 Min wait: 2 sec
 Max wait: 20 sec
 Electrode Type: pH
 Blank Option: No Blank
 Calculations: Sample Calc. by Volume
 Dilution Option: Disabled
 Titrant Name: 0.1N NaOH
 Titrant Conc.: 0.1000 N(eq/L)
 Analyte Size: 50.000 mL
 Analyte Entry: Fixed
 Maximum Titrant Volume: 25.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Sample Calc. by Volume
 Titrant units: N (eq/L)
 Titrant volume dosed: V (L)
 Final result units: (mg/L)
 Titrant Conc.: 0.1000 N(eq/L)
 Sample/Titrant: 0.500 mol/eq
 mw of sample: 100.09 g/mol
 Sample Volume: 50.000 mL

$$\frac{\text{mg}}{\text{L}} \text{CaCO}_3 = \frac{V(\text{L}) * 1000 * 0.10 * 0.5 * 100.09 * 1000}{50.0}$$

RESULTS

Titration Report

Method Name: Acidity of Water
 Time & Date: 14:54 August 1, 2018
 Report ID: Ti_00023

Titration Results

Method Name: Acidity of Water
 Time & Date: 14:54 August 1, 2018
 Analyte Size: 50.000 mL
 End Point Volume: 5.879 mL
 pH Fixed End Point: 8.300
 Result: 588.43 (mg/L)
 Initial & Final pH: 2.465 to 8.398
 Titration Duration: 3:42 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

CHLORIDE IN WATER

0 to 150 ppm (mg/L)

DESCRIPTION

Method for the determination of chloride in water. The results are expressed as **ppm (mg/L) as Chloride**.

REFERENCE

Standard Methods for the Examination of Water and Wastewater 21st edition, Method 4500-Cl

ELECTRODE

- HI4115 Silver/Sulfide Combination ISE

REAGENTS

- HI70448 0.02M Silver Nitrate (1 L)
- HI70427 1.5M Nitric Acid Solution (500 mL)
- HI70436 Deionized Water (1 gal)

ACCESSORIES

- HI7072 Electrode Fill Solution (4 x 30 mL)
- 150 mL Glass Beaker
- 100 mL Class A Volumetric Pipette
- 10 mL Class A Volumetric Pipette

DEVICE PREPARATION

- Connect the Silver/Sulfide electrode to the titrator.
- Install a 25 mL burette filled with 0.02M silver nitrate (HI70448) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- For the determination of the exact concentration of the 0.02M Silver Nitrate, follow *HIO200EN 0.02M Silver Nitrate* Titrant Concentration
- Press **Select Method** from the main screen. Use the arrow keys to highlight *HI1007EN Chloride in Water* and press **Select**.

ELECTRODE PREPARATION

- Prepare the Silver/Sulfide electrode according to the procedure in the manual.

SAMPLE PREPARATION

- Use a class A volumetric pipette to transfer exactly 100.00 mL of sample to a clean 150 mL beaker.
- Add 10.00 mL of 1.5M nitric acid (HI70427) to the beaker.

ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the electrode and stirrer. Ensure that the reference junction of the electrode is 5 to 6 mm below the surface. If necessary add extra deionized water.

Note: The dispensing tip should be slightly submerged in the sample.

- Press **start stop**, the titrator will start the analysis.
- At the end of the titration, after detection of the equivalence point, "Titration Completed" will appear with the result. The result is expressed in **ppm (mg/L) of chloride**.
- Remove the electrode and stirrer from the sample and rinse them thoroughly with deionized water.
- Record the result.

CHLORIDE IN WATER

0 to 150 ppm (mg/L)

METHOD PARAMETERS

Name: Chloride in Water
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.030 mL
 Max Vol: 0.500 mL
 delta E: 5.000 mV
 End Point Mode: mv 1EQ point, 1st Der
 Recognition Options:
 Threshold: 100 mV/mL
 Range: NO
 Filtered Derivatives: NO
 Pre-Titration Volume: 0.000 mL
 Pre-Titration Stir Time: 0 sec
 Measurement Mode: Signal Stability
 delta E: 1.0 mV
 delta t: 2 sec
 Min wait: 2 sec
 Max wait: 20 sec
 Electrode Type: Silver/Sulfide
 Blank Option: No Blank
 Calculations: Sample Calc. by Volume
 Dilution Option: Disabled
 Titrant Name: 0.02M AgNO3
 Titrant Conc.: 2.0000E-2 M (mol/L)
 Analyte Size: 100.0000 mL
 Analyte Entry: Manual
 Maximum Titrant Volume: 25.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Sample Calc. by Volume
 Titrant units: M (mol/L)
 Titrant volume dosed: V (L)
 Titrant Conc.: 2.0000E-2 M (mol/L)
 Sample/Titrant: 1.000 mol/mol
 mw of sample: 35.453 g/mol
 Sample Volume: 100.000 mL

$$\frac{\text{mg}}{\text{L}} = \frac{\text{V(L)} * 1000 * 0.02 * 1.0 * 35.45 * 1000}{100.0}$$

RESULTS

Titration Report

Method Name: Chloride in Water
 Time & Date: 15:11 August 1, 2018
 Report ID: Ti_00052

Titration Results

Method Name: Chloride in Water
 Time & Date: 15:11 August 1, 2018
 Analyte Size: 100.000 mL
 End Point Volume: 4.781 mL
 mV Equivalence Point: 280.3
 Result: 33.897 ppm (mg/L)
 Initial & Final mV: 194.8 to 298.5
 Titration Duration: 1:24 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

NEUTRALIZATION WITH SULFURIC ACID

0 to 200 meq/L

DESCRIPTION

Method for the determination of strong or weak base concentration by titration of a sample to the equivalence point with sulfuric acid. The results are expressed as **meq/L**.

ELECTRODE

- HI1131B Combination pH Electrode
- HI7662-T Temperature Probe

REAGENTS

- HI70459 0.05M Sulfuric Acid (1 L)
- HI70436 Deionized Water (1 gal)

ACCESSORIES

- HI70300L Storage Solution (500 mL)
- HI7082 Electrode Fill Solution (4 x 30 mL)
- HI7004L pH 4.01 Buffer Solution
- HI7007L pH 7.01 Buffer Solution
- HI7010L pH 10.01 Buffer Solution
- HI740036P 100 mL Plastic Beaker (10 pcs)
- 10 mL Class A Volumetric Pipette

DEVICE PREPARATION

- Connect the pH electrode and temperature probe to the titrator.
- Install a 25 mL burette filled with 0.05M sulfuric acid (HI70459) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- For the determination of the exact concentration of the 0.05M sulfuric acid, follow *HI0103EN 0.05M Sulfuric Acid Titrant Concentration*.
- Press **Select Method** from the main screen. Use the arrow keys to highlight *HI1008EN Neutralization w/H2SO4* and press **Select**.

ELECTRODE PREPARATION

- Press **Mode** from the main screen, if necessary select the analog board and press **pH**.
- Calibrate the electrode using pH 4.01, 7.01 and 10.01 buffers. Refer to the instruction manual for calibration procedure.

SAMPLE PREPARATION

- Use a class A volumetric pipette to transfer exactly 10.00 mL of sample to a clean 100 mL plastic beaker.
- Add deionized water to the 50 mL mark on the beaker.

ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the pH electrode, temperature probe and stirrer. Ensure that the reference junction of the pH electrode is 5 to 6 mm below the surface.
Note: The dispensing tip should be slightly submerged in the sample.
- Press **start stop**, the titrator will start the analysis.
- At the end of the titration, after detection of the equivalence point, "Titration Completed" will appear with the result. The result is expressed in **meq/L**.
- Remove the pH electrode, temperature probe and stirrer from the sample and rinse them thoroughly with deionized water.
- Record the result.

NEUTRALIZATION WITH SULFURIC ACID

0 to 200 meq/L

METHOD PARAMETERS

Name: Neutralization w/ H2SO4
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.050 mL
 Max Vol: 0.500 mL
 delta E: 20.000 mV
 End Point Mode: pH 1EQ point, 1st Der
 Recognition Options:
 Threshold: 50 mV/mL
 Range: NO
 Filtered Derivatives: NO
 Pre-Titration Volume: 0.000 mL
 Pre-Titration Stir Time: 0 sec
 Measurement Mode: Signal Stability
 delta E: 1.0 mV
 delta t: 2 sec
 Min wait: 2 sec
 Max wait: 15 sec
 Electrode Type: pH
 Blank Option: No Blank
 Calculations: Sample Calc. by Volume
 Dilution Option: Disabled
 Titrant Name: 0.05M H2SO4
 Titrant Conc.: 5.0000E-2 M (mol/L)
 Analyte Size: 10.000 mL
 Analyte Entry: Fixed
 Maximum Titrant Volume: 20.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Sample Calc. by Volume
 Titrant units: M (mol/L)
 Titrant volume dosed: V (L)
 Final result units: meq/L
 Titrant Conc.: 5.0000E-2 M (mol/L)
 Sample/Titrant: 2.000 eq/mol
 Sample Volume: 10.000 mL

$$\frac{\text{meq}}{\text{L}} = \frac{V(\text{L}) * 1000 * 0.05 * 2.0 * 1000}{10.0}$$

RESULTS

Titration Report

Method Name: Neutralization w/ H2SO4
 Time & Date: 09:46 August 1, 2018
 Report ID: Ti_00027

Titration Results

Method Name: Neutralization w/ H2SO4
 Time & Date: 09:46 August 1, 2018
 Analyte Size: 10.000 mL
 End Point Volume: 9.562 mL
 pH Equivalence Point: 7.966
 Result: 95.620 meq/L
 Initial & Final pH: 11.655 to 6.248
 Titration Duration: 3:26 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

NEUTRALIZATION WITH SODIUM HYDROXIDE

0 to 200 meq/L

DESCRIPTION

Method for the determination of strong or weak acid concentration by titration of a sample to the equivalence point with sodium hydroxide. The results are expressed as **meq/L**.

ELECTRODE

- HI1131B Combination pH Electrode
- HI7662-T Temperature Probe

REAGENTS

- HI70456 0.1N Sodium Hydroxide (1 L)
- HI70436 Deionized Water (1 gal)

ACCESSORIES

- HI70300L Storage Solution (500 mL)
- HI7082 Electrode Fill Solution (4 x 30 mL)
- HI7004L pH 4.01 Buffer Solution
- HI7007L pH 7.01 Buffer Solution
- HI7010L pH 10.01 Buffer Solution
- HI740036P 100 mL Plastic Beakers (10 pcs)
- 10 mL Class A Volumetric Pipette

DEVICE PREPARATION

- Connect the pH electrode and temperature probe to the titrator.
- Install a 25 mL burette filled with 0.1N sodium hydroxide (HI70456) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- For the determination of the exact concentration of the 0.1N sodium hydroxide, follow *HI0001EN 0.1N Sodium Hydroxide Titrant Concentration*.
- Press **Select Method** from the main screen. Use the arrow keys to highlight *HI1009EN Neutralization w/NaOH* and press **Select**.

ELECTRODE PREPARATION

- Press **Mode** from the main screen, if necessary select the analog board and press **pH**.
- Calibrate the electrode using pH 4.01, 7.01 and 10.01 buffers. Refer to the instruction manual for calibration procedure.

SAMPLE PREPARATION

- Use a class A volumetric pipette to transfer exactly 10.00 mL of sample to a clean 100 mL plastic beaker.
- Add deionized water to the 50 mL mark on the beaker.

ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the pH electrode, temperature probe and stirrer. Ensure that the reference junction of the pH electrode is 5 to 6 mm below the surface.
Note: The dispensing tip should be slightly submerged in the sample.
- Press **start stop**, the titrator will start the analysis.
- At the end of the titration, after detection of the equivalence point, "Titration Completed" will appear with the result. The result is expressed in **meq/L**.
- Remove the pH electrode, temperature sensor and stirrer from the sample and rinse them thoroughly with deionized water.
- Record the result.

NEUTRALIZATION WITH SODIUM HYDROXIDE

0 to 200 meq/L

METHOD PARAMETERS

Name: Neutralization w/ NaOH
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.050 mL
 Max Vol: 0.500 mL
 delta E: 20.000 mV
 End Point Mode: pH 1EQ point, 1st Der
 Recognition Options:
 Threshold: 50 mV/mL
 Range: NO
 Filtered Derivatives: NO
 Pre-Titration Volume: 0.000 mL
 Pre-Titration Stir Time: 0 sec
 Measurement Mode: Signal Stability
 delta E: 1.0 mV
 delta t: 2 sec
 Min wait: 2 sec
 Max wait: 15 sec
 Electrode Type: pH
 Blank Option: No Blank
 Calculations: Sample Calc. by Volume
 Dilution Option: Disabled
 Titrant Name: 0.1N NaOH
 Titrant Conc.: 0.1000 N(eq/L)
 Analyte Size: 10.000 mL
 Analyte Entry: Fixed
 Maximum Titrant Volume: 20.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Sample Calc. by Volume
 Titrant units: N (eq/L)
 Titrant volume dosed: V (L)
 Final result units: meq/L
 Titrant Conc.: 0.1000 N(eq/L)
 Sample Volume: 10.000 mL

$$\frac{\text{meq}}{\text{L}} = \frac{\text{V(L)} * 1000 * 0.1 * 1.0 * 1000}{10.0}$$

RESULTS

Titration Report

Method Name: Neutralization w/ NaOH
 Time & Date: 10:29 August 2, 2018
 Report ID: Ti_00017

Titration Results

Method Name: Neutralization w/ NaOH
 Time & Date: 10:29 August 2, 2018
 Analyte Size: 10.000 mL
 End Point Volume: 15.970 mL
 pH Equivalence Point: 8.431
 Result: 159.70 meq/L
 Initial & Final pH: 2.675 to 10.316
 Titration Duration: 3:20 [mm:ss]
 Titration went to Completion

Analyst Signature: _____

TROUBLESHOOTING 1

DESCRIPTION

Method for verifying the dosing and potentiometric signal accuracy of the titrator. This method should be used to troubleshoot a titrator equipped with a 25 mL burette. The titrator dispenses a 20.00 mL pre-titration volume, waits 20 seconds and dispenses an additional 20.00 mL dose, bringing the total volume to 40.00 mL. This procedure can also be used to check the stability of the mV and temperature channels.

The specifications of the dosing accuracy are $\pm 0.1\%$ of the full burette volume (± 0.025 mL for a 25 mL burette). For the accuracy of other burette volumes, see the instruction manual.

If the results are not correct, check all fittings for leakage, and burette and tubing for air bubbles. Repeat the measurement.



REFERENCE

ISO/TC 48/SC1N 380E and 383E: "Piston and/or Plunger Operated Volumetric Apparatus"


ACCESSORIES

- HI762000C 0°C Temperature Key
- HI762070C 70°C Temperature Key
- HI70436 Deionized Water (1 gal)
- HI7662-T Temperature Probe
- Shorting Cap
- Narrow Neck Beaker
- Analytical Balance with 0.0001g resolution

DEVICE PREPARATION

- Connect the shorting cap to the BNC socket on Analog Board 1
- Install a 25 mL burette filled with room temperature deionized water (HI70436) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- Press  from the main screen. Use the arrow keys to highlight *HI1011EN Troubleshooting 1* and press .

LARGE DOSE DISPENSING PROCEDURE

- Add a small amount of deionized water to a narrow neck beaker. By doing this the air space in the beaker will be vapor-saturated minimizing evaporation.
- Place the narrow neck beaker on an analytical balance.
- Zero the balance.
- Place the dosing tip through the neck of the beaker. Take care not to immerse it in the liquid during dispensing and not to touch the beaker walls.
- Press .
- Write down the exact weight displaced on the balance after each dose.

- The following information is needed to verify the accuracy of the dosing system:
 - The temperature of the dispensed water
 - The atmospheric air pressure
 - The density of the weight used to calibrate the balance
- This procedure can be repeated on pump 2.

Other burette sizes can be checked using the following settings:

Burette Volume	Pre-titration Volume	Max. Titrant Volume
5 mL	4.000 mL	8.000 mL
10 mL	8.000 mL	16.000 mL

METHOD PARAMETERS

Name:	Troubleshooting 1
Method Revision:	3.0
Analysis Type:	Standard Titration
Analog Board:	Analog 1
Stirrer Configuration:	
Stirrer:	Stirrer 1
Stirring Speed:	0 RPM
Pump Configuration:	
Titrant Pump:	Pump 1
Reagent Addition 1:	Disabled
Reagent Addition 2:	Disabled
Dosing Type:	Linear - 20.000 mL
End Point Mode:	Fixed 10.0 mV
Pre-Titration Volume:	20.000 mL
Pre-Titration Stir Time:	0 sec
Measurement Mode:	Timed Increment
Time interval:	20 sec
Electrode Type:	Shorting Cap
Blank Option:	No Blank
Calculations:	No Formula (mL only)
Titrant Name:	DI Water
Maximum Titrant Volume:	40.000 mL
Potential Range:	-2000.0 to 2000.0 mV
Volume/Flow Rate:	25 mL/50.0 mL/min
Signal Averaging:	1 Reading
Significant Figures:	XXXXX

CALCULATIONS

The measured volume of the dispensed liquid is calculated from the measure mass using the following equation:

$$V = m * \frac{1}{\rho} * \left(1 + \frac{\rho_{air}}{\rho_L} - \frac{\rho_{air}}{\rho_{std}} \right)$$

V Volume of measure mass of water (mL)

m Measure mass of water (g)

ρ_L Density of dispensed water (g/mL)

ρ_{air} Density of ambient air (g/mL)

ρ_{std} Density of calibration standard weight (g/mL)

TROUBLESHOOTING 1

ALTERNATIVE CALCULATIONS

If the actual values of the above parameters are not accessible the following equation can be used:

$$V = M * F$$

V Volume of measured mass of water (mL)

F Transformation factor

The transformation factor takes into account the air buoyancy, the water density and temperature dependence. Standard values can be used to obtain the transformation factor.

The values from the table below have been calculated by correcting the air and water density with temperature, assuming the density of dry air $\rho_{\text{air}} = 0.0012 \text{ g/mL}$ and density of calibration steel standard weigh $\rho_{\text{STD}} = 8 \text{ g/mL}$.

Temperature (°C)	Factor
17.0	1.002290
18.0	1.002467
19.0	1.002654
20.0	1.002853
21.0	1.003061
22.0	1.003282
23.0	1.003512
24.0	1.003752
25.0	1.004002
26.0	1.004261
27.0	1.004531
28.0	1.004809
29.0	1.005097
30.0	1.005395

TEMPERATURE CHANNEL FAST CHECK PROCEDURE

- Connect the shorting cap to the BNC socket on Analog Board 1.
- Connect the HI762000C 0°C temperature key to the RCA socket (temperature sensor input) on Analog Board 1.
- On the main screen select **Mode** if necessary select the analog board and press **mV**.
- The titrator should display ATC 0.0 ± 0.4°C with no fluctuations or drift.
- Connect the HI762070C 70°C temperature key to the RCA socket (temperature sensor input) on Analog Board 1.
- The titrator should display ATC 70.0 ± 0.4°C with no fluctuations or drift.
- This procedure can be repeated on analog board 2.

TEMPERATURE & MV CHANNEL LOGGING PROCEDURE

- Connect the shorting cap to the BNC socket on Analog Board 1.
- Connect the HI762000C 0°C temperature key to the RCA socket (temperature sensor input) on Analog Board 1.
- On the main screen select **Mode**, if necessary select the analog board and press **mV**.
- Press **mV Setup** and use the arrow keys to highlight **Logging Interval**. Set the logging interval to 15 seconds and press **Accept**. Press **Escape** to return to the main screen.
- Press the **results** key and use the arrow keys to highlight **Setup pH/mV/ISE Report**, press **Select**.
- Select **Potential and Temperature and Units** (the selected fields are marked with an *). All other fields should be unselected.
- Press **Save Report** to return to the Data Parameters screen.
- Press **Escape** to return to the main screen.
- Once on the main screen press **Start Log** to start the automatic log.
- Let the log run for about 10 minutes. Press **Stop Log** to stop the automatic log.
- Press **results**, use the arrow keys to highlight **Review Last Analysis Report**, and press **Select**.
- The mV column should display 0.0 ± 0.1 mV and the temperature column should display 0.0°C ± 0.4°C.
- This procedure can be repeated using the HI762070C 70°C temperature key and on analog board 2.

TROUBLESHOOTING 2

DESCRIPTION

Method for verifying the dosing of the titrator. This method should be used to troubleshoot a titrator equipped with a 25 mL burette. The titrator dispenses a 10.00 mL pre-titration volume, waits 20 seconds and dispenses an additional 0.5 mL dose twenty times, waiting 20 seconds between each dose, bringing the total volume to 20 mL. This procedure can also be used to check the stirrer functionality.

The specifications of the dosing accuracy are $\pm 0.1\%$ of the full burette volume (± 0.025 mL for a 25 mL burette). For the accuracy of other burette volumes, see the instruction manual.

If the results are not correct, check all fittings for leakage, and burette and tubing for air bubbles. Repeat the measurement.

REFERENCE

ISO/TC 48/SC1N 380E and 383E: "Piston and/or Plunger Operated Volumetric Apparatus"

ACCESSORIES

- HI762000C 0°C Temperature Key
- HI70436 Deionized Water (1 gal)
- HI7662-T Temperature Probe
- Shorting Cap
- Narrow Neck Beaker
- Analytical Balance with a resolution of 0.0001g

DEVICE PREPARATION

- Connect the shorting cap to the BNC socket on Analog Board 1
- Install a 25 mL burette filled with room temperature deionized water (HI70436) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- Press Select Method from the main screen. Use the arrow keys to highlight *HI1012EN Troubleshooting 2* and press Select.

SMALL DOSE DISPENSING PROCEDURE

- Add a small amount of deionized water to a narrow neck beaker. By doing this the air space in the beaker will be vapor-saturated minimizing evaporation.
- Place the narrow neck beaker on an analytical balance.
- Zero the balance.
- Place the dosing tip through the neck of the beaker. Take care not to immerse it in the liquid during dispensing and not to touch the beaker walls.
- Press start stop.
- Write down the exact weight displaced on the balance after each dose.

- The following information is needed to verify the accuracy of the dosing system:
 - The temperature of the dispensed water
 - The atmospheric air pressure
 - The density of the weight used to calibrate the balance
- This procedure can be repeated on pump 2.

Other burette sizes can be checked using the following settings:

Burette Volume	Pre-titration Volume	Max. Titrant Volume
5 mL	4.000 mL	8.000 mL
10 mL	8.000 mL	16.000 mL

METHOD PARAMETERS

Name: Troubleshooting 2
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 0 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Linear - 0.500 mL
 End Point Mode: Fixed 10.0 mV
 Pre-Titration Volume: 10.000 mL
 Pre-Titration Stir Time: 0 sec
 Measurement Mode: Timed Increment
 Time interval: 10 sec
 Electrode Type: Shorting Cap
 Blank Option: No Blank
 Calculations: No Formula (mL only)
 Titrant Name: DI Water
 Maximum Titrant Volume: 20.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

The measured volume of the dispensed liquid is calculated from the measure mass using the following equation:

$$V = m * \frac{1}{\rho} * \left(1 + \frac{\rho_{air}}{\rho_L} - \frac{\rho_{air}}{\rho_{std}} \right)$$

V Volume of measure mass of water (mL)

m Measure mass of water (g)

ρ_L Density of dispensed water (g/mL)

ρ_{air} Density of ambient air (g/mL)

ρ_{std} Density of calibration standard weight (g/mL)

TROUBLESHOOTING 2

ALTERNATIVE CALCULATIONS

If the actual values of the above parameters are not accessible the following equation can be used:

$$V = M * F$$

V Volume of measured mass of water (mL)

F Transformation factor

The transformation factor takes into account the air buoyancy, the water density and temperature dependence. Standard values can be used to obtain the transformation factor.

The values from the table below have been calculated by correcting the air and water density with temperature, assuming the density of dry air $\rho_{\text{air}} = 0.0012 \text{ g/mL}$ and density of calibration steel standard weigh $\rho_{\text{STD}} = 8 \text{ g/mL}$.

Temperature (°C)	Factor
17.0	1.002290
18.0	1.002467
19.0	1.002654
20.0	1.002853
21.0	1.003061
22.0	1.003282
23.0	1.003512
24.0	1.003752
25.0	1.004002
26.0	1.004261
27.0	1.004531
28.0	1.004809
29.0	1.005097
30.0	1.005395

STIRRING SPEED FAST CHECK PROCEDURE

- On the main screen select **Mode**, if necessary select the analog board and press **mV**.
- Press **mV Setup** and use the arrow keys to highlight *Stirrer Configuration*. Use the arrow keys to highlight *Stirrer 1*. Press **Accept**.
- Use the arrow keys to highlight *Stirring Speed*. Use the numeric keypad to enter 200 rpms then press **Accept**.
- Press **Escape** to exit the mV Setup screen.
- From the main screen, press **stir**, use the up arrow key to increase the stir speed slowly to 2500 rpms.
- Check that the propeller continues to increase speed, following the commands.
- This procedure can be repeated on stirrer 2.

CONCENTRATION OF PHOSPHORIC ACID

0.00 to 0.01 M (mol/L)

DESCRIPTION

Method for the determination of phosphoric acid (H_3PO_4), by titration of a sample to the point of inflection with sodium hydroxide.

The first inflection point corresponds to the H_3PO_4 content and the difference between the first and second corresponds to $H_2PO_4^-$.

The results are expressed as **M (mol/L) phosphoric acid**.

If only phosphoric acid and no other acids or bases are present in the sample, then $H_3PO_4 = H_2PO_4^-$. If H_3PO_4 is greater than $H_2PO_4^-$ this means other weak acids or bases are present (e.g. citric acid / citrate or ascorbic acid / ascorbate).

ELECTRODE

- HI1131B Combination pH Electrode
- HI7662-T Temperature Probe



REAGENTS

- HI70456 0.1N Sodium Hydroxide (1 L)
- HI70436 Deionized Water (1 gal)



ACCESSORIES

- HI70300L Storage Solution (500 mL)
- HI7082 Electrode Fill Solution (4 x 30 mL)
- HI7004L pH 4.01 Buffer Solution (500 mL)
- HI7007L pH 7.01 Buffer Solution (500 mL)
- HI7010L pH 10.01 Buffer Solution (500 mL)
- 100 mL Class A Volumetric Pipette
- 150 mL Glass Beaker

DEVICE PREPARATION

- Connect the pH electrode and temperature probe to the titrator.
- Install a 25 mL burette filled with 0.1N sodium hydroxide (HI70456) on pump one and verify that no air bubbles are present in the burette or tubing. If necessary prime the burette until all the air has been removed completely.
- For the determination of the exact concentration of the 0.1N sodium hydroxide, follow *HI0001EN 0.1N Sodium Hydroxide Titrant Concentration*.
- Press  from the main screen. Use the arrow keys to highlight *HI1014EN Concentration of H3PO4* and press .

ELECTRODE PREPARATION

- Press  from the main screen, if necessary select the analog board and press .
- Calibrate the electrode using pH 4.01, 7.01 and 10.01 buffers. Refer to the instruction manual for calibration procedure.


SAMPLE PREPARATION

- Use a Class A volumetric pipette to transfer exactly 100.00 mL of sample to a clean 150 mL glass beaker.

ANALYSIS

- Place the beaker under the stirrer assembly and lower it to immerse the pH electrode, temperature probe and stirrer. Ensure that the reference junction of the pH electrode is 5 to 6 mm below the surface.

Note: The dispensing tip should be slightly submerged in the sample.

- Press , the titrator will start the analysis.
- At the end of the titration, after the detection of the second equivalence point, "Titration Completed" will appear with the phosphoric acid concentration. The result is expressed in **M (mol/L) of phosphoric acid**.
- Remove the pH electrode, temperature probe and stirrer from the sample and rinse them thoroughly with deionized water.
- Record the result.

CONCENTRATION OF PHOSPHORIC ACID 0.00 to 0.01 M (mol/L)

METHOD PARAMETERS

Name: Concentration of H3PO4
 Method Revision: 3.0
 Analysis Type: Standard Titration
 Analog Board: Analog 1
 Stirrer Configuration:
 Stirrer: Stirrer 1
 Stirring Speed: 1400 RPM
 Pump Configuration:
 Titrant Pump: Pump 1
 Reagent Addition 1: Disabled
 Reagent Addition 2: Disabled
 Dosing Type: Dynamic
 Min Vol: 0.030 mL
 Max Vol: 0.500 mL
 delta E: 8.000 mV
 End Point Mode: pH 2EQ points, 1st Der
 Recognition Options:
 Threshold: 50 mV/mL
 Range: NO
 Filtered Derivatives: NO
 Pre-Titration Volume: 0.000 mL
 Pre-Titration Stir Time: 10 sec
 Measurement Mode: Signal Stability
 delta E: 0.8 mV
 delta t: 2 sec
 Min wait: 2 sec
 Max wait: 20 sec
 Electrode Type: pH
 Blank Option: No Blank
 Calculations: Sample Calc. by Volume
 Dilution Option: Disabled
 Titrant Name: 0.1N NaOH
 Titrant Conc.: 0.1000 N(eq/L)
 Analyte Size: 100.000 mL
 Analyte Entry: Fixed
 Maximum Titrant Volume: 20.000 mL
 Potential Range: -2000.0 to 2000.0 mV
 Volume/Flow Rate: 25 mL/50.0 mL/min
 Signal Averaging: 1 Reading
 Significant Figures: XXXXX

CALCULATIONS

Calculations: Sample Calc. by Volume
 Titrant units: N (eq/L)
 Titrant volume dosed: V (L)
 Final result units: M (mol/L)
 Titrant Conc.: 0.1000 N(eq/L)
 Sample/Titrant: 1.000 mol/eq
 Sample Volume: 100.000 mL

$$\frac{\text{mol}}{\text{L}} = \frac{V(\text{L}) * 100 * 0.1 * 1.0}{100.00}$$

RESULTS

Titration Report

Method Name: Concentration of H3PO4
 Time & Date: 11:56 August 2, 2018
 Report ID: Ti_00034

Titration Results

Method Name: Concentration of H3PO4
 Time & Date: 11:56 August 2, 2018
 Analyte Size: 100.000 mL

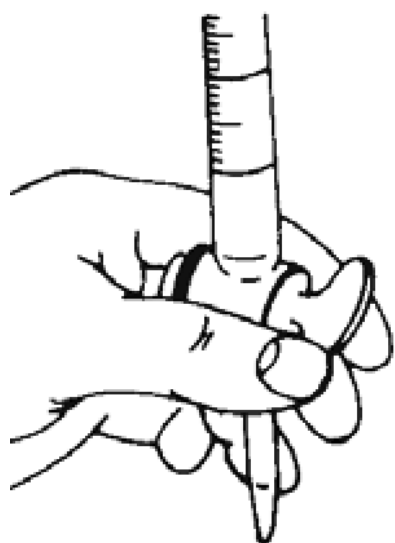
Equivalence point 1:
 pH: 4.677
 Volume: 4.397 mL
 Result: 4.3972E-03 M (mol/L)

Equivalence point 2:
 pH: 8.916
 Volume: 4.429 mL
 Result: 4.4293E-03 M (mol/L)

Titration Duration: 6:01 [mm:ss]
 Titration went to Completion
 Operator name: _____

HI932/HI931

**AUTOMATIC
POTENTIOMETRIC TITRATOR**



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1. GENERAL REVIEW OF TITRATION THEORY

1.1. INTRODUCTION TO TITRATIONS

A titration is a quantitative, volumetric procedure used in analytical chemistry to determine the concentration of an analyte (the species being measured) in solution. The concentration of the analyte is determined by slowly adding a titrant (reagent) to the solution. As the titrant is added, a chemical reaction occurs between the titrant and the analyte.

Titration reactions are relatively fast, simple reactions that can be expressed using a chemical equation. The titration reaction continues as the titrant is added until all of the analyte is consumed and the analyte reacts completely and quantitatively with the titrant.

The point at which all of the analyte has been reacted is called the equivalence point, also known as the theoretical or stoichiometric endpoint. This point is accompanied by an abrupt physical change in the solution, which sharply defines the endpoint of the reaction. The physical change associated with the titration endpoint can be produced by the titrant or an indicator and can be detected either visually or by some other physical measurement.

Titration cannot be used to determine the quantity of all analytes. The chemical reaction between the titrant and analyte must fulfill four requirements:

- The reaction must be fast and occur within approximately one second after the titrant is added
- The reaction must go to completion
- The reaction must have well-known stoichiometry (reaction ratios)
- A convenient endpoint or inflection point

Titration is highly precise and can provide many advantages over alternative methods. Titrations are quickly performed and require relatively simple apparatus and instrumentation.

1.2. USES OF TITRATIONS

Titration can be used in many applications, including:

- Acid content of plant effluents, food (e.g.: cheese and wine), plating and etching baths, petroleum products, drugs
- Base content of fertilizer (containing ammonia), bleach, minerals
- Hardness in water
- Metal content of alloys, minerals, ores, clays, waters, plating baths, paints, paper, plant materials, biological fluids, petroleum products
- Moisture content in foodstuffs, petrochemicals, pharmaceutical products, and plastics
- Redox reagent concentrations such as available chlorine in potable water, peroxide, traces of oxidants and reductants in food, reductants in high temperature or high pressure boiler water, vitamin analysis

1.3. ADVANTAGES AND DISADVANTAGES OF TITRATIONS

Some advantages of titration as an analytical technique are:

- More precise results than many instrumental methods, such as measurement by electrode, the accuracy of the measurement is up to 0.1%
- Simple methods, reasonable capital costs, and easy training
- Suitability to measure major components of a mixture or product
- Automation can reduce time and labor spent on each analysis

Some disadvantages of titration are:

- Time it takes to prepare standards and titrants
- Good technique is required to achieve precise results (training and practice required)
- Not suitable for determining trace or minor components of a mixture or product
- Limited dynamic range, it may require additional sample preparations (dilution) and repeat analyses

2. TYPES OF TITRATIONS

2.1. TITRATIONS ACCORDING TO THE MEASUREMENT METHOD

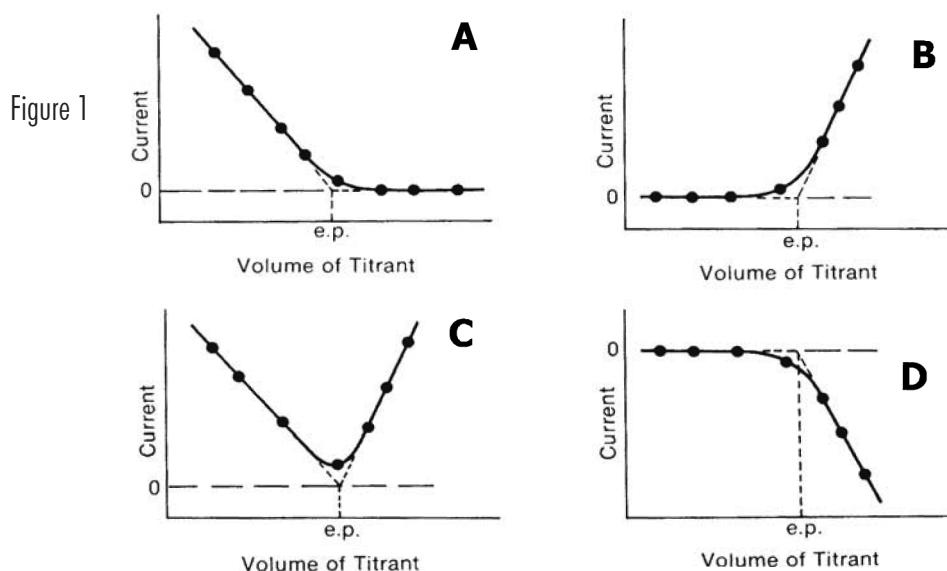
2.1.1. AMPEROMETRIC TITRATIONS

An amperometric titration is performed by placing two electrodes (often a metal ISE and a reference electrode) into the sample solution and holding the potential of the metal electrode at a selected voltage. The current that flows, due to the oxidation or reduction of a reactant or product, is plotted vs. volume of titrant to provide the titration curve and locate the equivalence point. Changes in the current are due to changes in the concentration of a particular species (being oxidized or reduced at the electrode).

Generally the reaction between the analyte and titrant forms a new species. Depending on the titration, the reactants are electroactive and the products are not, or vice-versa. Amperometric titration curves look like two straight lines intersecting at the equivalence point, this is due to the change in the electroactivity of the solution.

Many metal ions can be amperometrically titrated using a precipitation, complexation or redox reaction. Some metal ions and species that can be determined in this manner include silver, barium, halides, potassium, magnesium, palladium, molybdate, sulfate, tungstate, zinc, bismuth, cadmium, fluoride, indium, thallium, iodine, and gold.

Figure 1 shows four amperometric titrations and their endpoints. In graph "A" the analyte is electroactive and gives current but the reacted species does not. In "B" the reactant is not active but the titrant is. In "C" both the analyte and titrant are active and both give current flow. Graph "D" shows the same situation as "B"; however, the current has an opposite sign (the titrant is reduced).



2.1.2. POTENTIOMETRIC TITRATIONS

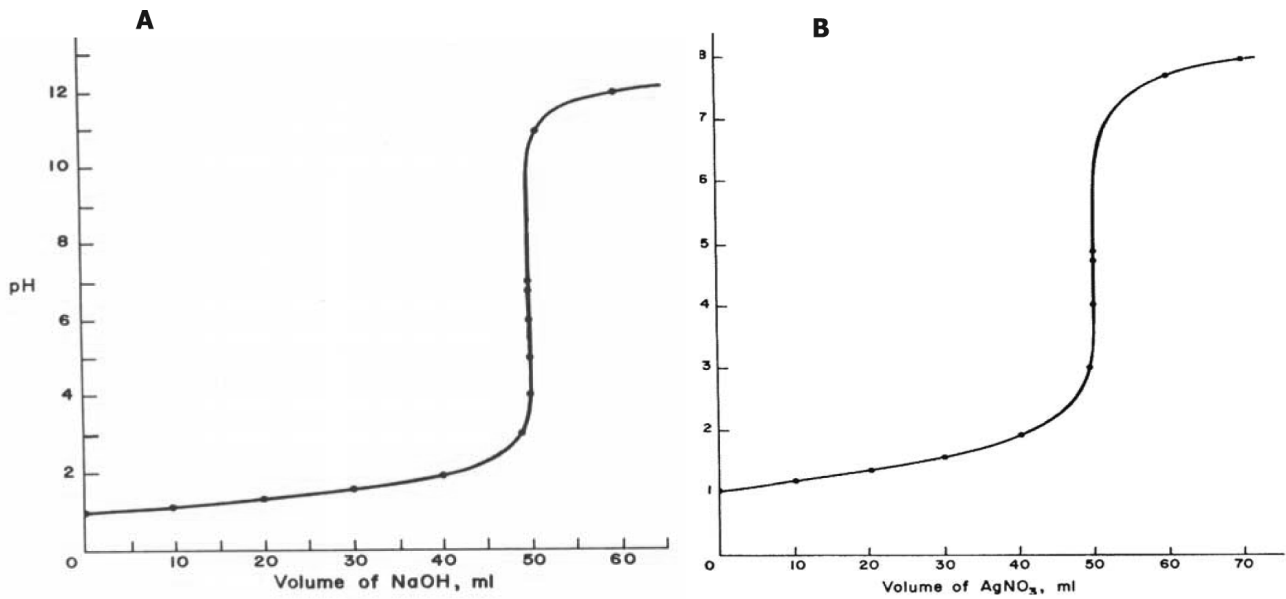
Potentiometric titrations are done by measuring the voltage across the solution using an electrode system. An electrode system consists of an indicator electrode and a reference electrode. As titrant is added the variations in the potential of the indicator electrode, with respect to the reference electrode, are monitored to show the progress of the titration.

Potentiometry is the measurement of a potential under conditions of zero current flow. The measured potential can then be used to determine the analytical quantity of interest, generally a component concentration of the analyte solution. The potential that develops in the electrochemical cell is the result of the free energy change that would occur if the chemical phenomena were to proceed until the equilibrium condition has been satisfied.

There are many types of titrations where potentiometry can be used, e.g., pH electrodes for acid-base titrations, platinum ORP electrodes in redox titrations, ion selective electrodes, such as chloride or fluoride for a specific ion titration, and silver electrodes for argentometric (silver-based) titrations.

An example of potentiometric titrations are shown below. Figure 2 "A" is the pH of a solution vs. the volume of titrant and "B" is the potential from a chloride electrode vs. the volume of AgNO_3 .

Figure 2



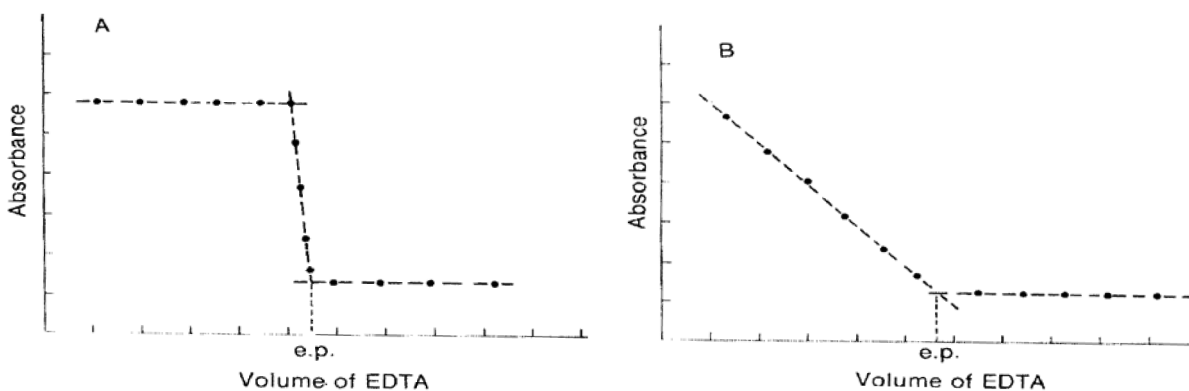
2.1.3. SPECTROPHOTOMETRIC TITRATIONS

The name comes from the method used to detect the endpoint of the titration, not its chemistry. Highly colored indicators that change color during the course of the titration are available for many titrations. More accurate data on the titration curve can be obtained if the light absorption is monitored instrumentally using a light source, a simple monochromator and a photodetector, rather than visually determining the color or light absorption change. Light absorption by either an indicator or by one of the reactants or products can be used to monitor the titration.

In the first titration curve, Figure 3 "A", the absorption of a metal-indicator complex is being monitored. The absorption is constant while the metal is complexed by the EDTA titrant. The metal indicator complex was stripped, causing a sharp break in the titration curve. The point where all the metal is complexed and stripped from the indicator is the equivalence point. This point is marked by "e.p." on the graph.

In the second titration curve, Figure 3 "B", the metal complex is being measured while being titrated with EDTA. The new complex being formed is not colored and does not absorb light. The extrapolated intersection of the two lines determines the equivalence point.

Figure 3



2.2. TITRATIONS ACCORDING TO THE REACTION TYPE

2.2.1. ACID-BASE TITRATIONS

Acid–base titrations are the most common type of titrations. They are based upon a reaction between an acid and a base, a stoichiometric neutralization, or the exchange of protons. Virtually all acid–base titrations are carried out using a strong acid or a strong base as the titrant. The endpoint of a titration carried out with a weak acid or a weak base would be difficult to detect due to a small change in pH at the equivalence point.

Chemical indicators can be used to determine the endpoint. The indicator will change color to signify that the end of the titration has been reached. The color of the indicator is dependent upon the concentration of ions in the solution. An acid–base indicator is composed of a conjugate weak acid–weak base pair, where the two forms exhibit different colors depending on the pH of the solution. For an indicator, the acid ionization constant K_a is usually written as:

$$K_a = \frac{[\text{H}_3\text{O}^+][\text{In}^-]}{[\text{HIn}]}$$

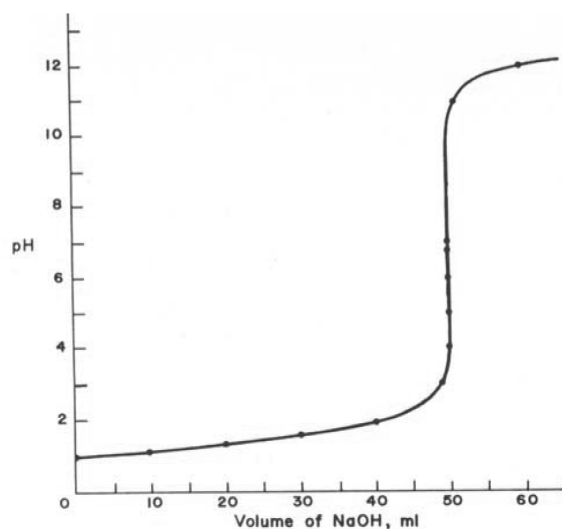
HIn is the acid form of the indicator and In^- is the base form. At the center of the change region, the ratio of $[\text{In}^-]$ to $[\text{HIn}]$ is one, $[\text{H}_3\text{O}^+] = K_a$ and $\text{pH} = \text{p}K_a$. The color change region is usually ± 1 pH unit around this point. Table 1 contains a list of some aqueous acid–base chemical indicators, as well as the pH range, the $\text{p}K_a$ and the expected color (acid and base form). When choosing the proper indicator you should select one that has a $\text{p}K_a$ as close to the endpoint of the titration.

When chemical indicators are not suitable, a potentiometric pH titration can also be used. The pH of the solution is plotted versus the volume of titrant added. Figure 4 shows a traditional strong acid–strong base titration curve. The graph shows the volume of NaOH added to an acidic solution and the resulting pH of the solution. Note the abrupt change in the pH at the equivalence point.

Table 1

pH Range	Indicator	$\text{p}K_a$	Acid Form	Base Form
0.0 - 1.6	Methyl Violet		Yellow	Blue
1.2 - 2.8	Thymol Blue	1.65	Red	Yellow
3.2 - 4.4	Methyl Orange	3.46	Red	Yellow
3.8 - 5.4	Bromocresol Green	4.90	Yellow	Blue
4.8 - 6.0	Methyl Red	5.00	Red	Yellow
5.2 - 6.8	Chlorophenol Blue	6.25	Yellow	Red
6.0 - 7.6	Bromothymol Blue	7.30	Yellow	Blue
6.6 - 8.0	Phenol Red	8.00	Yellow	Red
7.4 - 9.0	Metacresol Purple	8.30	Yellow	Purple
8.0 - 9.6	Thymol Blue	9.20	Yellow	Blue
8.2 - 10.0	Phenolphthalein	9.50	Clear	Pink
9.4 - 10.6	Thymolphthalein		Clear	Blue
10.1 - 12.0	Alizarin Yellow R		Yellow	Red
11.4 - 12.6	Indigo Carmine		Blue	Yellow

Figure 4

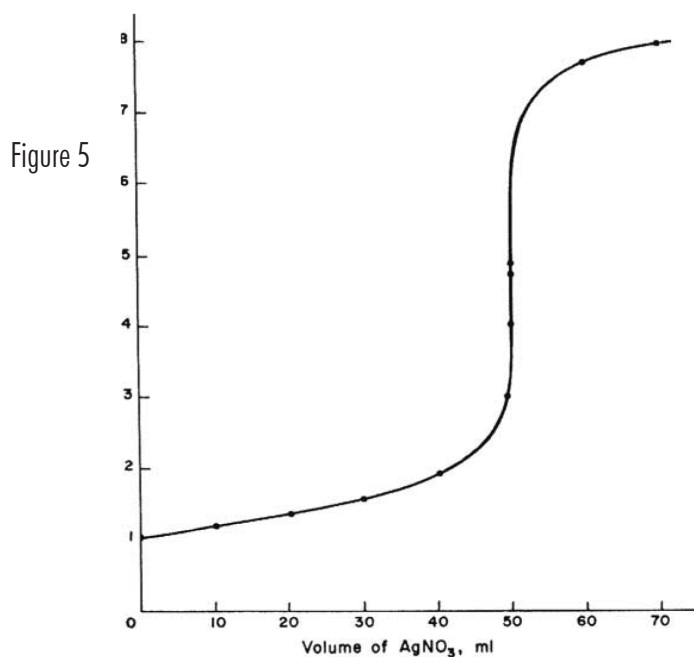


2.2.2 ARGENTOMETRIC TITRATIONS

Argentometric titrations use silver (nitrate) as the titrant and are generally precipitation titrations, as many silver salts are insoluble. These titrations are commonly used to titrate and determine the concentration of bromide, chloride, cyanide, iodide, and sulfide.

Argentometric titrations can be done with Mohr's indicator (when all of the chloride has reacted, a red silver chromate precipitate is formed) or the titration can be easily followed with a silver ISE (or chloride ISE for chloride titrations) and a reference electrode.

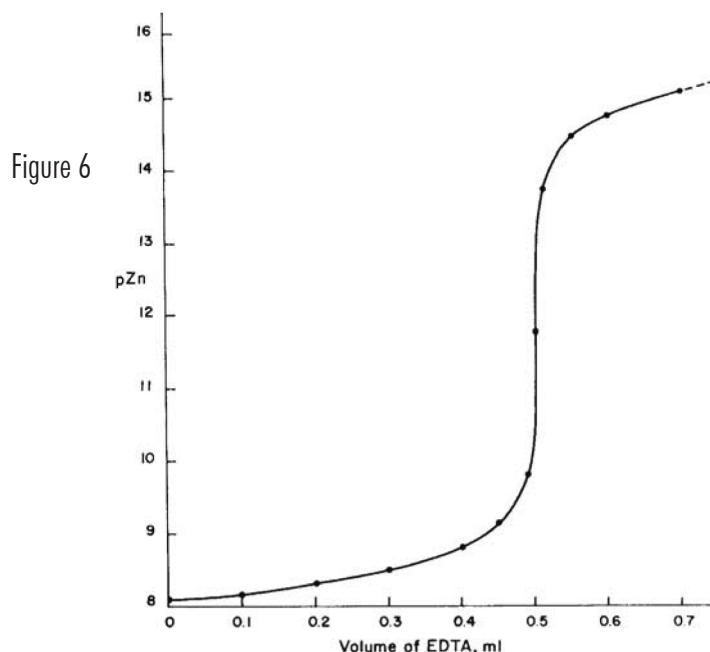
Figure 5 shows the titration of 50 mL of 0.1N NaCl with 0.1N AgNO_3 . The potentiometric signal is from a chloride ISE and is plotted as pCl ($-\log [\text{Cl}^-]$).



2.2.3. COMPLEXOMETRIC TITRATIONS

A complex is a species where a central metal ion is covalently bonded to one or more electron donating groups called ligands. In a complexometric titration, metal ions are titrated using a titrant that binds strongly to it. Often these titrants contain EDTA or CDTA, polydentate ligands that form very stable coordination compounds with metal ions. The complexation reaction must be fast in order to be useful for direct titration. Some metal ions react too slowly with EDTA for a direct titration.

An indicator electrode that responds to the metal ion can be used to monitor the titration progress. The titration curve will appear similar to a usual potentiometric titration. Complexation indicators change color at the endpoint as all metal ions are “consumed”, or complexed, by the titrant. The titration curve will appear similar to a potentiometric titration when using an indicator electrode that responds to the metal ion (see Figure 6).



2.2.4. ION SELECTIVE TITRATIONS

The most popular ion selective titration is an acid-base titration. The hydrogen ion concentration is specifically measured and monitored during the titration process to locate the equivalence point. Using an ion selective electrode (ISE) as the indicator electrode, the potentiometric signal (in mV) is used to directly follow a specific ion's concentration (or activity).

Examples of ISE titrations include titrating fluoride with an aluminum titrant using a fluoride ISE, chloride with silver nitrate using a chloride ISE, sodium with a sodium ISE, etc. The equivalence point can be determined by plotting the mV value vs. the amount of titrant added.

2.2.5. NON-AQUEOUS SOLVENT ACID-BASE TITRATIONS

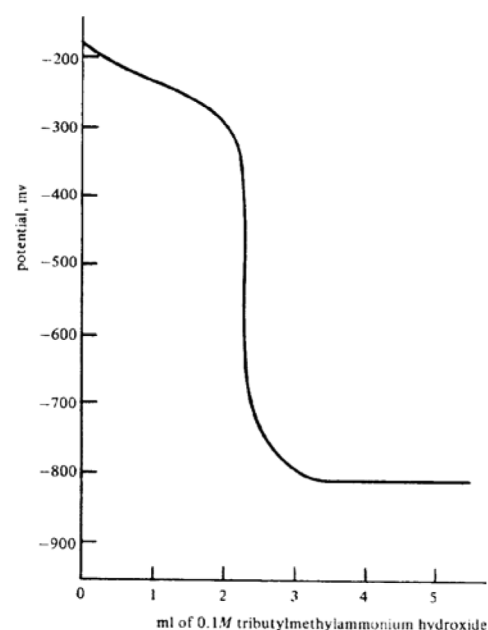
Non-aqueous solvents must be used to titrate very weak acids and bases due to the inherent leveling effect water has on all acids and bases dissolved in it.

A wide variety of weak acids and bases can be titrated using non-aqueous solvents. Mixtures of acids or bases can often be individually analyzed in a single sequential titration.

TITRATION OF ACIDS

Weak acids with pK_a 's up to about 11 can be titrated in non-aqueous solvents. These include carboxylic acids, enols, phenols, imides, sulfonic acids, and inorganic acids. Water or lower alcohols are suitable for titrating medium to strong acids (pK_a less than 5). Titrating a weaker acid with a strong base titrant requires a solvent less acidic than water or ethanol/methanol. Solvents such as acetone, acetonitrile, *t*-butyl alcohol, dimethylformamide, isopropanol and pyridine have been found to work well for acid-base titrations of strong, medium and weak acids/bases. Titrants include alcoholic potassium hydroxide and various sodium or potassium alkoxides in a 10:1 mixture of benzene/methanol. The best titrants are quaternary ammonium hydroxides (such as tetrabutylammonium hydroxide) due to good solubility of tetraalkylammonium salts of the titrated acids and the clean potentiometric titration curve obtained (see Figure 7).

Figure 7



TITRATION OF BASES

Weak bases with pK_b 's up to about 11, which do not ionize with water, can be titrated in non-aqueous solvents. These bases include aliphatic and aromatic amines, basic nitrogen heterocycles, alkali metal and amine salts of acids, and many other organic basic compounds. Titrating a weak base with a strong acid titrant requires a basic solvent that is as weak as possible. Water and alcohols allow the titration of medium strength bases such as aliphatic amines ($pK_b = 4$ to 5), but not the titration of weaker bases such as pyridine ($pK_b = 8.8$). Glacial acetic acid works well for weak bases and has been used extensively. Less basic solvents such as acetone, acetonitrile, and nitromethane extend the range of titratable compounds.

The endpoint for non-aqueous titrations are usually determined potentiometrically using a pH glass electrode, a modified calomel or double junction reference electrode with a low-flow rate reference junction. Good potentiometric titration curves are obtained in most solvents, except those with very low dielectric constants such as benzene, chloroform and others, when high electrical resistance of the solvent causes unstable potentials.

2.2.6. PRECIPITATION TITRATIONS

Precipitation titrations allow for faster analysis compared to the old gravimetric analysis, where a precipitate is formed, filtered, dried and weighed to analyze a compound. Typically silver halides, silver thiocyanate and a few mercury, lead, and zinc salts are titrated using this method. The chemical reactions must form an insoluble salt and precipitate out quickly in order to be analyzed by this method. When the reaction is not quick, a back titration can be used. A measured excess of the precipitating reagent (titrant) is added to force the reaction to occur, and then unreacted titrant is then titrated with a standard solution of another reagent.

2.2.7. REDOX TITRATIONS

There are a number of oxidation-reduction reactions that can be used to determine unknown concentration by titration. If the reaction goes to completion, is fast and has an analytical signal available to follow it, a titration can be performed. The term "fast" means that each addition of titrant is reacted completely and the sensing electrode is able to detect the change in solution in less than one second.

Redox titrations are potentiometric titrations where the mV signal from a combination ORP (redox) electrode (usually with a platinum indicator electrode) is used to follow the reaction of oxidant/reductant. The electrode potential is determined by the Nernst equation and is controlled by the oxidant/reductant ratio.

Visual indicators such as Ferrion are also available. The oxidized and reduced form of the indicator will have different colors and can be used to determine the end point.

Various reductants can be determined by titrants with oxidants such as potassium permanganate, potassium chromate or iodine. Commonly used reductants that are used as titrants include sodium thiosulfate, and ferrous ammonium sulfate.

As with Acid-Base titrations the potential changes dramatically at the equivalence point.

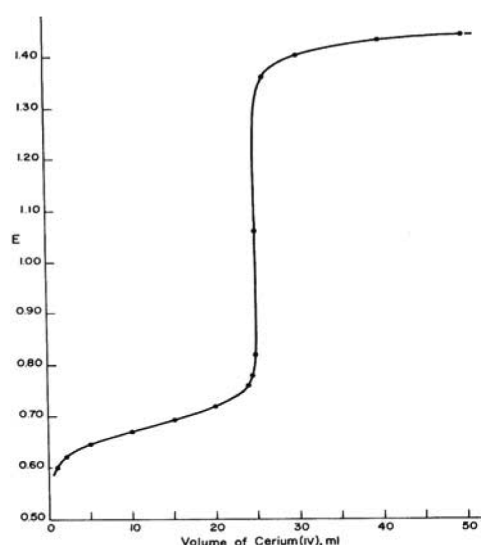


Figure 8

2.2.8. KARL FISCHER TITRATIONS

This method is based on a well-defined chemical reaction between water and the Karl Fischer reagent. The chemistry provides excellent specificity for water determination. The method can be used to determine free and bound water in a sample matrix. The Karl Fischer method is widely considered to produce the most rapid, accurate and reproducible results and has the largest detectable concentration range spanning 1 ppm to 100%.

The determination of water content is one of the most commonly practiced methods in laboratories around the world. Knowledge of water content is critical to understanding chemical and physical properties of materials and ascertaining product quality. Water content determination is conducted on many sample types including pharmaceuticals and cosmetics, foods and natural products, organic and inorganic compounds, chemicals, solvents and gases, petroleum and plastic products as well as paints and adhesives. The KF method is verifiable and can be fully documented. As a result, Karl Fischer titration is the standard method for analysis of water in a multitude of samples as specified by numerous organizations including the Association of Official Analytical Chemists, the United States and European Pharmacopoeia, ASTM, American Petroleum Institute, British Standards and DIN.

2.3. TITRATIONS ACCORDING TO THE TITRATION SEQUENCE

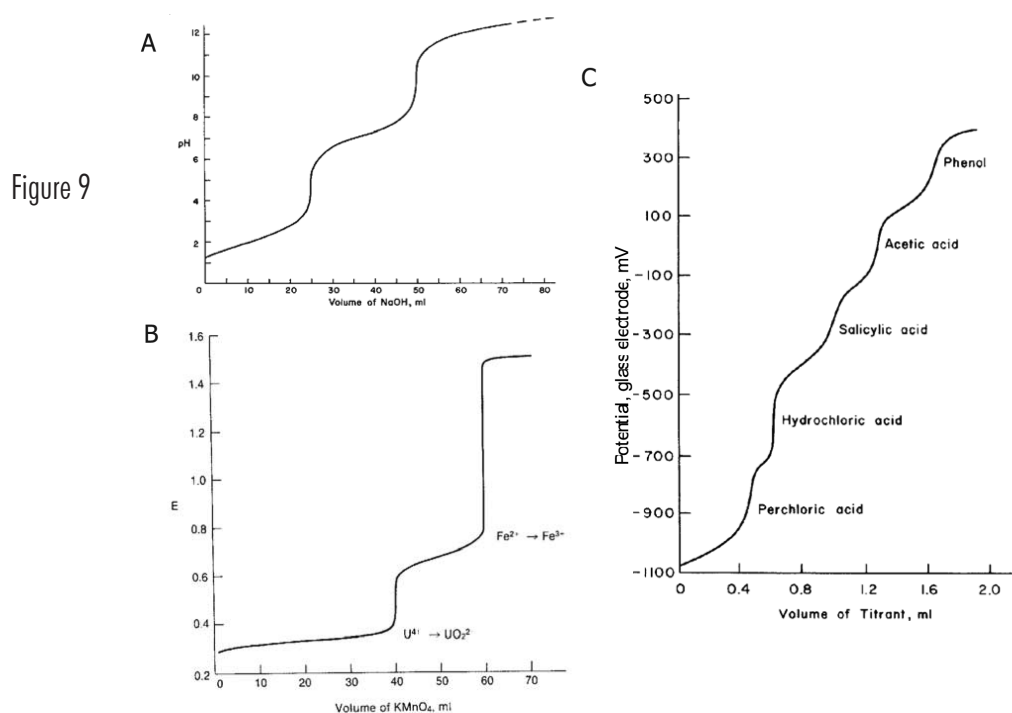
2.3.1. BACK TITRATIONS

Back titrations are generally used when a reaction is too slow to be directly accomplished using a "direct" titration, where the reaction goes to completion within a few seconds. In a back titration, a large excess of a reagent is added to the sample solution, helping a slow reaction to go to completion. The unreacted, excess reagent is then titrated. The difference in the total volume of the first reagent added and amount determined from the second titration is the quantity of reagent required to complete the first reaction.

2.3.2. MULTIPLE ENDPOINT TITRATIONS

Under certain conditions, some titrations can exhibit more than one equivalence point and be titratable to the individual endpoints to determine the concentration of each individual component. Examples of these types of titrations include acid-base (where different strength acid or bases are in a mixture), redox (where each species has a different reduction potential), complexometric (where different species are separately titratable), and acid-base using polyprotic acids (the pK_a of the different protons varies enough to separate them).

Figure 9 shows three different types of multiple endpoint titrations. "A" shows the titration of a polyprotic acid. The different acid strengths of the first and second proton can be determined. "B" illustrates a mixture of two different metal redox species, where the different redox potentials allow the species to be separated. "C" is the titration of a solution containing strong, weak, and very weak acids.



3. INTRODUCTION TO TITRATION APPARATUS AND TYPICAL TITRATION PROCEDURE

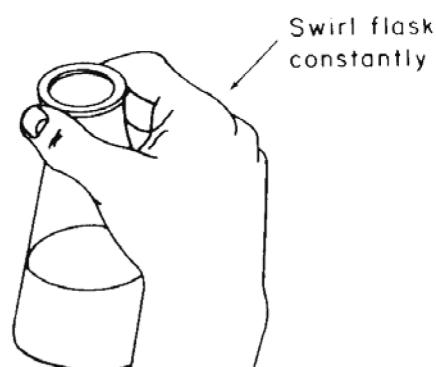
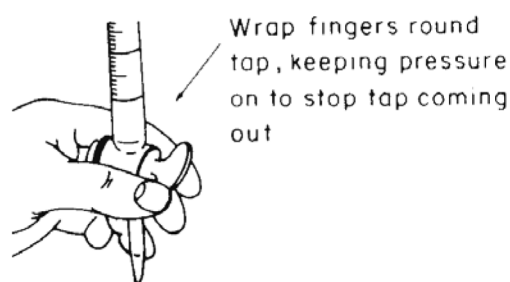
3.1. MANUAL TITRATION

Apparatus required for manual titration include:

- Volumetric Burette, for precisely controlled delivery of titrant to the reaction vessel
- An Erlenmeyer, or similar flask, that facilitates constant mixing or swirling required to ensure solution homogeneity
- Volumetric pipettes for the precise addition of samples and indicator solutions
- Titrant solutions of known concentration
- A visual or instrumental indicator for detecting the completion of the reaction

A typical manual titration consists of the following steps:

1. A volumetric pipette is typically used to add a known volume of sample to the flask
2. An indicator solution or instrument probe is added to the flask
3. A burette is used to measure the addition of titrant to the flask and dispense titrant in a controlled manner
4. Titrant is added via the burette until the method indication signals the reaction endpoint
5. The concentration of analyte is calculated based on the concentration and volume of titrant required to reach the endpoint



3.2. AUTOMATIC TITRATION

Automatic titrators are high-precision analytical instruments that deliver the titrant, monitor the physical change associated with the titration reaction, automatically stop at the endpoint and calculates the concentration of the analyte. Automatic titrators are best for repetitive titrations and high-accuracy analyses.

An automatic titrator must have an accurate liquid dispensing system. In high accuracy systems like the [HI900-series](#) titrators, the liquid dispensing system consists of a stepper-motor driven piston syringe burette capable of accurately and precisely dispensing very small volumes of titrant, a valve system to switch between titrant intake and outlet and a dispensing tip. These three main subsystem components must be as accurate as possible, with very low gear backlash in the burette pump, minimal piston seal flexing, precision ground inner diameter of the glass syringe, a low dead volume valve, minimal evaporation/permeation, and chemically resistant tubing.

Apparatus required for automatic titration include:

- An automatic titrator, equipped with a burette
- A beaker
- An electronic stirring system, either a propeller stirrer or a magnetic stir bar and stir plate
- Volumetric pipettes for the precise addition of samples
- Standard titrant solutions of known concentration
- An electrode system that can be used to determine the endpoint of the titration

A typical automatic titration consists of the following steps:

1. Set up the automatic titrator according to the manufacturer's instructions
2. A volumetric pipette is typically used to add a known volume of sample to the beaker
3. Submerge the propeller stirrer or add the stir bar to the beaker, and turn on
4. Start the titration, the titrator will automatically stop at the endpoint and determine the concentration of the analyte

4. TITRATION RESULTS

4.1. ACCURACY

The factors most critical to achieving accurate results with the [HI932](#) titration systems are the concentration of the sample, size of the sample and having an optimized set of method parameters.

4.2. REPEATABILITY

Repeatability, or the agreement between replicate determinations, is expressed quantitatively as the relative standard deviation (RSD).

4.3. SOURCES OF ERROR

One of the advantages of volumetric analysis is excellent accuracy and precision. The sources of error can be grouped into sampling, titrant and standards, chemical reactions, endpoint determination and calculations.

4.3.1. SAMPLING ERRORS

- Selection of a non-homogeneous or non-representative sample
- Sample changed or was contaminated during collection, storage or transfers
- Poor technique when transferring sample to beaker or flask
- Errors in the balance, calibrate and check balance regularly

4.3.2. ERRORS WITH TITRANT AND STANDARD

4.3.2.1. PREPARATION ERRORS

Incorrect preparation due to:

- Poor technique in weighing the salt or when transferring to volumetric glassware
- Low-purity of salts or water used to make titrant and standard
- Dirty or wet glassware
- Improper storage of titrant or standard which allows water gain, evaporation or deterioration
- Failure to standardize frequently to adjust for change in titrant
- Failure to flush titrator tubing with a volume of titrant before standardizing
- Volume errors from pipettes and volumetric flasks, grade A glassware is required
- Balance errors when weighing out salts, calibrate and check balance regularly

4.3.2.2. DISPENSING ERRORS

Incorrect dispensing due to:

- Dead valve volume and leaking valve
- Inaccuracy in motor drive and gear lash/ backlash
- Poor burette/ piston seal
- Non-uniform diameter of burette glass cylinder
- Chemical incompatibility with tubing or bubble generation
- Density/ temperature changes in titrant

4.3.3. CHEMICAL REACTION ERRORS

- Inappropriate solvent or sample resulting in side reactions
- Poor mixing of the titrant and solvent or sample in the titration vessel
- Reaction between titrant and sample is not rapid
- Reaction does not go to completion
- Reaction has side reactions

4.3.4. ENDPOINT DETERMINATION ERRORS

Most manual titrations use a visual indicator to indicate when the endpoint is reached and the titration should be stopped. Automatic titrators use instrumental methods to determine the end of a titration and the equivalence point. There are two predominant methods used to determine the equivalence point, first derivative and second derivative.

The inflection point of the titration curve (mV vs. Volume) is normally assumed to be the equivalence point. The first derivative is often used to determine the inflection point. The maximum value of the first derivative (dmV vs. dV) corresponds to the theoretical equivalence point. During a titration it is rare to have a data point exactly at the first derivative maximum, the maximum value is determined by interpolating the first derivative data points.

The second derivative (d^2 mV vs. dV^2) can also be used to determine the equivalence point, and can offer advantages over the first derivative method. Second derivatives have increased sensitivity to smaller inflection points and easier numerical evaluation of the actual equivalence point. The value where the second derivative is equal to zero is the equivalence point. The second derivative requires fewer points located near the equivalence point, where data is often not obtained or not as reliable.

Errors in determining the endpoint can result from:

- Incorrect signals from the sensor
- Sensor drift
- Sensor or instrument has slow response, keep sensors in good condition
- Inappropriate setting on the titrator

5. CALCULATIONS

The main variables used in calculating a result from a titration are the sample volume, the concentration of the titrant, and the volume of titrant required to reach the equivalence point. At the equivalence point, an equal number of equivalents of the analyte and titrant has been added.

5.1. SAMPLE CALCULATION

By Mass

$$C_{\text{sample}} = \frac{V_{\text{titrant}} \times C_{\text{titrant}} \times \text{Ratio} \times \text{FW}_{\text{analyte}}}{m_{\text{sample}}} \times 100$$

C_{sample}	Sample Concentration (g/100g)
V_{titrant}	Volume of titrant (L)
C_{titrant}	Titration Concentration (eq/L)
Ratio	Equivalence ratio of analyte/ titrant (mol analyte/ eq titrant)
$\text{FW}_{\text{analyte}}$	Formula Weight of the Analyte (g/mol)
m_{sample}	Mass of sample (g)

By Volume

$$C_{\text{sample}} = \frac{V_{\text{titrant}} \times C_{\text{titrant}} \times \text{Ratio} \times \text{FW}_{\text{analyte}}}{V_{\text{sample}}} \times 100$$

C_{sample}	Sample Concentration (g/100mL)
V_{titrant}	Volume of titrant (L)
C_{titrant}	Titration Concentration (eq/L)
Ratio	Equivalence ratio of analyte/ titrant (mol analyte/ eq titrant)
$\text{FW}_{\text{analyte}}$	Formula Weight of the Analyte (g/mol)
V_{sample}	Volume of Sample (mL)

5.2. STANDARDIZE TITRANT

Titration standardization is the second most important calculation in titrations. A primary standard is titrated in order to determine the concentration of the titrant. This is essentially a typical titration calculated in "reverse", where the concentration of the solution is known and the titrant is the unknown.

By Mass

$$C_{\text{titrant}} = \frac{m_{\text{standard}} \times \text{Ratio}}{\text{FW}_{\text{standard}} \times V_{\text{titrant}}}$$

C_{titrant}	Titration Concentration (N)
m_{standard}	Mass of Standard (g)
Ratio	Equivalence ratio of titrant/standard (eq titrant/ mol standard)
$\text{FW}_{\text{standard}}$	Formula Weight of the Standard (g/mol)
V_{titrant}	Volume of Titration (L)

By Volume

$$C_{\text{titrant}} = \frac{V_{\text{standard}} \times (1 \text{ L} / 1000 \text{ mL}) \times C_{\text{standard}}}{V_{\text{titrant}}}$$

C titrant	Concentration of titrant (N)
V standard	Volume of Standard (mL)
C standard	Concentration of standard (eq/L)
V titrant	Volume of Titrant (L)

5.3. BLANK TITRATION

In a blank titration a pre-titration is performed, often times on the solvent to be used for the sample titration, and the titrant volume required to reach the endpoint is noted. This blank value nullifies error due to titrant required to react with the components of the titration solution matrix. The basic titration equation can be used for a blank titration, with the single modification that the volume of titrant used in the blank titration should be subtracted from the regular titration titrant volume.

$$C_{\text{sample}} = \frac{C_{\text{titrant}} \times (V_{\text{sample}} - V_{\text{blank}}) \times \text{Ratio} \times \text{FW}_{\text{analyte}}}{m_{\text{sample}}} \times 100$$

C Sample	Sample Concentration (g/100g)
C titrant	Titrant Concentration (eq/L)
V sample	Volume of Titrant required for the sample (L)
V blank	Volume of Titrant required for the blank (L)
Ratio	Equivalence ratio of analyte/ titrant (mol analyte/ eq titrant)
FW analyte	Formula Weight of the Analyte (g/mol)
m sample	Mass of sample (g)

5.4. MULTIPLE ENDPOINT TITRATION

Some titrations have two or more endpoints, each corresponding to the equivalence point for a specific reaction. Multiple endpoint titrations are similar to a blank titration in that the volume of titrant required to reach the first endpoint is subtracted from the titrant volume used to reach the next sequential endpoint.

$$C_{\text{sample 1}} = \frac{V_{\text{titrant 1}} \times C_{\text{titrant}} \times \text{Ratio} \times \text{FW}_{\text{analyte 1}}}{m_{\text{sample}}} \times 100$$

$$C_{\text{sample 2}} = \frac{(V_{\text{titrant 2}} - V_{\text{titrant 1}}) \times C_{\text{titrant}} \times \text{Ratio} \times \text{FW}_{\text{analyte 2}}}{m_{\text{sample}}} \times 100$$

$$C_{\text{sample 3}} = \frac{(V_{\text{titrant 3}} - V_{\text{titrant 2}}) \times C_{\text{titrant}} \times \text{Ratio} \times \text{FW}_{\text{analyte 3}}}{m_{\text{sample}}} \times 100$$

C sample1	Sample 1 Concentration (g/100g)
C sample2	Sample 2 Concentration (g/100g)
C sample3	Sample 3 Concentration (g/100g)
V titrant 1	Volume of titrant required to reach the first end point (L)
V titrant 2	Volume of titrant required to reach the second end point (L)
V titrant 3	Volume of titrant required to reach the third end point (L)
C titrant	Concentration of titrant (N)

Ratio	Equivalence ratio of analyte/ titrant (mol analyte/ eq titrant)
FW analyte 1	Formula Weight of the Analyte 1 (g/mol)
FW analyte 2	Formula Weight of the Analyte 2 (g/mol)
FW analyte 3	Formula Weight of the Analyte 3 (g/mol)
m sample	Weight of Sample (mL)

5.5. BACK TITRATION

The equation used in back titration calculations is also similar to the equation for a blank titration. Instead of subtracting the initial amount of titrant needed to react with the blank, the amount of second titrant needed to react with the excess titrant added in the first titration is subtracted from the amount of the first titrant added. The difference between the two amounts is the amount of titrant necessary to reach the first equivalence point.

$$C_{sample} = \frac{(C_{titrant\ 1} \times V_{titrant\ 1} - C_{titrant\ 2} \times V_{titrant\ 2}) \times Ratio \times FW_{analyte}}{V_{sample}} \times 100$$

C sample	Sample Concentration (g/100mL)
C titrant 1	Concentration of titrant 1 (N)
V titrant 1	Volume of titrant 1 (L)
C titrant 2	Concentration of titrant 2 (N)
V titrant 2	Volume of titrant 2 (L)
Ratio	Equivalence ratio of analyte/ titrant (mol analyte/ eq titrant)
FW analyte	Formula Weight of the analyte (g/mol)
V sample	Volume of sample (mL)

6. GLOSSARY

Acid

A chemical species that can donate one or more protons (hydrogen ions).

Acid-Base Titration

Stoichiometric neutralization titrations, based upon the reaction that occurs between an acid and base.

Activity

A physical property corresponding to the concentration of all ions in a solution. Electrodes respond to activity.

Amperometric Titration

Titrations where the current flow between two electrodes (often a metal electrode and a reference electrode) are used to monitor the titration progress.

Analyte

The chemical species being measured in a titration.

Argentometric Titration

Titrations that use silver (nitrate) as the titrant. These titrations are typically precipitation titrations.

Automatic Titrator

An instrument designed to automatically carry out a titration. It will add the appropriate amount of titrant, determine the endpoint and calculate the results.

Back Titration

A type of titration where an excess amount of titrant is added to a sample, forcing a sluggish reaction to go to completion. The excess reagent is then “back” titrated with a second titrant.

Base

A chemical species that can accept one or more protons (hydrogen ions).

Biamperometric Indication

Uses a double platinum pin electrode to measure the current flow through a titration solution.

Bivoltametric Indication

Uses a double platinum pin electrode to measure the voltage required to maintain a constant current flow through a titration solution while constant voltage is applied across the platinum elements of the electrode.

Burette

A graduated cylindrical piece of laboratory glassware that is used to dispense precise amounts of solution.

Complex Ion

A species where a central metal ion is covalently bonded to one or more electron donating groups called ligands.

Complexometric Titrations

Metal ions are titrated using a titrant that binds strongly to it. The titrants often contain Ethylenediaminetetraacetic Acid (EDTA) or Cyclohexylenedinitrilotetraacetic Acid (CDTA).

Endpoint

The point where a titration is stopped because a physical change in the solution has indicated a completed titration. Titration endpoints typically coincide with the equivalence point. A fixed value endpoint (pH or mV) can be used as well. The titration will stop at the desired point regardless if the titration is complete.

Equivalence point

The point where the quantity of titrant is stoichiometrically equal to the quantity of analyte.

Formal

The theoretical number of equivalents per liter of the solution. It is used in solutions where the exact concentration of a species may be affected by the other ions present, therefore the stated concentration may not be exactly correct.

Gravimetric Analysis

A quantitative determination of an analyte based on the mass of the solid.

Indicator Electrode

An electrode that responds to the species of interest. The electrode potential is proportional to the concentration or activity of that ion in the solution being measured.

Indicators

Chemical indicators are typically organic dyes that change form under different physical conditions, causing a color change that can be seen by an analyst. Typically used in manual titrations, chemical indicators have been replaced with electrometric indicators, which are used with automatic titrators.

Inflection Point

The point on a titration curve where the second derivative curve changes signs.

Ion Selective Electrode (ISE)

An electrode that responds to a specific ion. The electrode potential is proportional to the concentration or activity of that ion in the solution being measured.

Karl Fischer Titration

A titration that uses a chemical reaction that is specific for determining water.

Manual Titration

A titration that is carried out by hand. The analyst must add the appropriate amount of titrant, determine the endpoint and calculate the results.

Molar

The concentration of a solute in a solution.

Mole (mol)

A quantity of a chemical species. The molecular weight of a substance in grams is equal to the mass of one mole of the substance. One mole is equal to 6.022×10^{23} atoms or molecules.

Monochromator

A device that allows only a narrow range of wavelengths to pass through it by separating the light into different wavelengths.

Multiple Endpoint Titration

A titration that reacts multiple species in solution sequentially using the same titrant. The concentration of each analyte can be determined from their respective endpoints.

Nernst Equation

The fundamental equation relating cell voltage to the concentration of a solution.

Neutralization

A chemical reaction where an acid and a base react to form a neutral salt and water.

Non-aqueous

A solution that does not contain water.

Non-aqueous Titration

A titration that is performed in non-aqueous solutions, typically used to titrate very weak acids and bases to eliminate the leveling effect water has on all acids and bases dissolved in it.

Normal

The concentration of a solution which accounts for any stoichiometric difference between the various species in a solution.

Oxidation / Reduction Potential (ORP)

The measurement describing whether a species wants to donate or accept electrons from other species in a redox reaction. If a solution's reduction potential is higher than the species it is reacting with, it will typically gain electrons or be reduced. If the potential is lower than the species it is reacting with, it will typically lose electrons or be oxidized.

Oxidant

The species that is accepting electrons in a redox reaction.

Pipette

Scientific apparatus that is used to deliver precise volumes of liquids.

Polyprotic Acid

Acids that are capable of donating more than one proton per acid molecule.

Potentiometric Titration

A titration in which the endpoint is determined by monitoring the voltage of the solution using an electrode.

Precipitation Titration

A titration in which the analyte reacts with the titrant to form an insoluble compound. The endpoint is typically detected with an ISE sensitive to either the analyte or titrant.

Reagent

The chemical added in a titration that causes the given reaction to occur.

Reduction-Oxidation Reaction (redox)

A chemical reaction in which the atoms involved in the reaction have their oxidation numbers changed. Reduction is the gain of electrons, which decreases the oxidation number. Oxidation is the loss of electrons, which increases the oxidation number.

Reductants

The electron donor in a redox reaction.

Reference Electrode

An electrode that supplies a constant electrode potential. It is used in combination with an "indicator" electrode, allowing for the "indicator" electrode potential to be measured.

Relative Standard Deviation (RSD)

A measure of the amount of relative variation in a set of data. It is calculated by dividing the standard deviation by the mean:

$$\text{RSD} = (\text{Standard Deviation of } X) * 100 / (\text{Mean of } X)$$

Repeatability

The variation in sample measurements taken by a single person or instrument under the same conditions.

Spectrophotometric Titration

A titration in which the endpoint is marked by a change in the color and/or color intensity.

Stoichiometry

The quantitative relationship of the reactants and products in a chemical reaction.

Titrant

The chemical added in a titration that causes the given reaction to occur.

Titration

A quantitative, volumetric procedure used in analytical chemistry to determine the concentration of an analyte in solution. The concentration of the analyte is determined by slowly adding a titrant to the solution. As the titrant is added, a chemical reaction between the titrant and the analyte occurs.

Titration Curve

A graph containing the physical data obtained for a titration. The data plotted is often an independent variable (volume of titrant) vs. a dependent variable (pH of the solution). From the titration curve, the equivalence point or endpoint can be determined.

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