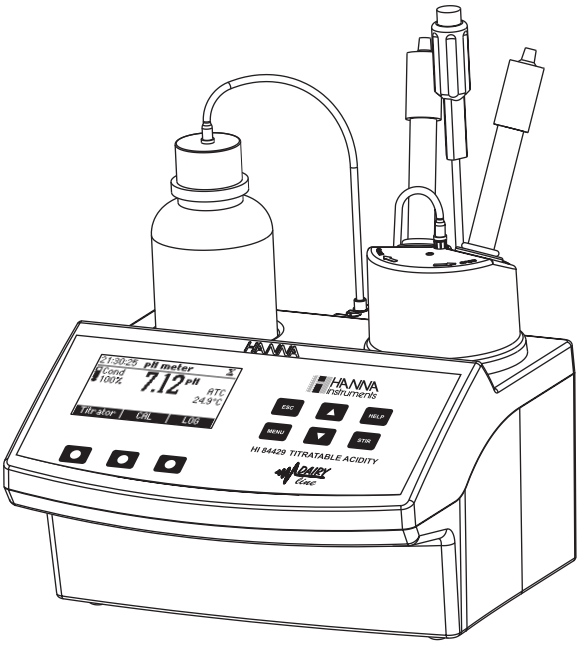
Instruction Manual

HI 84429
TITRATABLE ACIDITY MINITITRATOR & pH METER for Dairy Products



HANNA instruments
www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna product. This manual will provide you with the necessary information for the correct use of the instrument. Please read it carefully before using the meter. If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com.

This instrument is in compliance with CE directives.

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PRELIMINARY EXAMINATION

Please examine this product carefully. Make sure that the instrument is not damaged. If any damage occured during shipment, please notify your Dealer.

Each **HI 84429** minititrator is supplied complete with:

- **FC 260B** pH electrode
- **HI 5315** Reference electrode
- **HI 7072** Filling solution (30 mL)
- **HI 7662-T** Temperature probe
- **HI 84429-50** Titrant (100 mL)
- **HI 84429-55** Standard (500 mL)
- **HI 700640** Cleaning solution for milk deposits (2x20mL)
- **pH 4.01** buffer solution (230 mL)
- **pH 6.00** buffer solution (230 mL)
- **pH 8.30** buffer solution (230 mL)
- Two 50 mL beakers
- Two 20 mL beakers
- Tube set with cap
- Stir bars (2 small & 2 large)
- Power cord
- One 1 mL syringe
- One capillary dropper pipette
- Instruction manual

Note: Save all packing material until you are sure that the instrument works correctly. Any defective item must be returned in its original packing.

GENERAL DESCRIPTION

The **HI 84429** is a valuable, easy to use, microprocessor-based automatic titrator and pH meter that benefits from Hanna's years of experience as manufacturer of analytical instruments.

It has a simple and accurate peristaltic pump to ensure the best accuracy and repeatability. By performing pump calibration with the provided Hanna standards, the instrument accuracy is assured.

The instrument comes with a preprogrammed analysis method designed for Total Titratable Acidity measurements on milk.

The **HI 84429** performs automatic analysis, all the necessary calculations and assures to the user a simple and effective interface.

The instrument has a powerful and effective built-in algorithm to analyze the shape of the pH electrode response and to determine the reaction completion.

By simply pressing the **Start** key, the instrument will automatically titrate the acidity up to the end point. The result is immediately displayed in convenient units, then the instrument is ready for another titration.

Other features:

- Log on demand up to 100 samples (50 for pH measurement; 50 for titration results)
- GLP feature, to view last calibration data for pH electrode and pump
- PC interface

MEASUREMENT SIGNIFICANCE

Both pH and titratable acidity are used to measure milk acidity. A decrease in pH or increase in titratable acidity indicates lactic fermentation has occurred, most likely due to bacterial activity. pH and titratable acidity measurements, together with other tests available to the analyst, provide a mechanism to ensure quality and freshness of the milk products.

The pH of milk (or other dairy products) is a measurement of the actual acidity of the milk at the time of measurement. The measurement uses a pH electrode and pH meter that reads out directly in units of pH after calibrating the electrode and meter together using pH buffers. The pH of fresh milk is slightly acidic typically falling between 6.5 to 6.7 pH at 25°C.

Titratable acidity measures the total titratable acidity and differs from pH as it also includes the buffering capacity of the milk constituents. Titratable acidity in dairy products, is determined by titrating a sample with sodium hydroxide to a fixed endpoint pH (pH 7.0 or a phenolphtalein endpoint of pH 8.3). The actual neutralization of milk occurs at an endpoint of pH 7.00, however standard methods utilize the phenolphtalein endpoint value. The results will differ depending upon which endpoint is utilized. The endpoint can be determined visually using color change produced by phenolphtalein indicator or less subjectively, using a pH electrode as the indicator in a potentiometric acid-base titration.

Titratable acidity can be expressed in various units values basically expressed as a result of the strength of the sodium hydroxide (NaOH) needed for titration:

Soxhlet Henkel degrees (°SH) - mostly used in Central Europe
This value is obtained by titrating 100 mL of milk with 0.25N NaOH, using phenolphtalein as indicator.

Thorner degrees (°Th) - mostly used in Sweden and the CIS
This value is obtained by titrating 100 mL of milk, thinned with 2 parks of distilled water, with 0.1N NaOH, using phenolphtalein as indicator.

Dornic degrees (°D) - mostly used in Netherlands and France
This value is obtained by titrating 100 mL of milk, thinned with 2 parks of distilled water, with N/9 NaOH, using phenolphtalein as indicator.

Percent lactic acid (%l.a.) - frequently used in the UK, USA, Canada, Australia and New Zeeland
This value is obtained in the same way as °D, diving the result by 100.

Taking into account the concentration of sodium hydroxide the result expressed into one unit value can be easily converted into any other unit value according with the chart:

	°SH	°Th	°D	%l.a.
NaOH conc. (N)	0.25	0.1	0.111	0.0111
	1	2.5	2.25	0.0225
	0.4	1	0.9	0.009
	4/9	10/9	1	0.01

The **HI 84429** minititrator permits the measurement of both pH and titratable acidity of dairy products. The titration method is a potentiometric end point determination at fixed pH value of 8.30. The **HI 84429** minititrator eliminates the subjective end point detection given by the human eye, thus eliminating the errors that can appear in the results.
Acidity of dairy products can be measured in any of the unit values described previously by selecting the desired unit value. Furthermore, by performing a pump calibration with the supplied standard titrations with widely varying values may be made without changing the tubes or purging the titrant in order to clean the tubes.

SPECIFICATIONS

Titrator	Range	Titratable acidity (low range)
		°SH: 0.0 to 15.0 °SH
		°Th: 0 to 40 °Th
		°D: 0 to 35 °D
		%l.a.: 0.00 to 0.35 %l.a.
		Titratable acidity HR (high range)
		°SH: 10.0 to 75.0 °SH
		°Th: 20 to 200 °Th
		°D: 20 to 175 °D
		%l.a.: 0.0 to 2.0 %l.a.
	Resolution	Titratable acidity (low range):
		0.1 °SH
		1 °Th
		1 °D
		0.01 %l.a.
		Titratable acidity (high range):
		0.5 °SH
		1 °Th
		1 °D
		0.1 %l.a.
	Accuracy	5% of reading
	Titration method	Acid-base titration
	Principle	End point titration, 8.30 pH
	Pump debit	0.5 ml/min
	Stirring speed	1500 rpm
	Log data	Up to 50 samples
pH meter	pH meter	-2.0 to 16.0 pH / -2.00 to 16.00 pH
	pH Resolution:	0.1 pH / 0.01 pH
	pH Accuracy:	± 0.01 pH
	pH Calibration:	1, 2 or 3 point calibration; 3 available buffers (4.01, 6.00, 8.30)
	Temperature compensation:	manual or automatic from -20 to 120 °C (-4 to 248 °F)
	Log data	Up to 50 samples
Temperature	Range	-20.0 to 120.0 °C (-4.0 to 248.0 °F)

	Resolution	0.1 °C
	Accuracy	±0.4 °C without probe error
Electrode	FC 260B pH electrode (included) HI 5315 reference electrode (included)	
Temperature Probe	HI 7662-T (included)	
Environment	0 to 50 °C (32 to 122 °F); max 95% RH non-condensing	
Power supply	220 V/50Hz; 115 V/60Hz; 10 VA	
Dimensions	208 × 214 × 163 mm (8.2×8.4×6.4") (with beaker)	
Weight	2200 g (77 oz.)	

REQUIRED REAGENTS

Code	Description	Quantity/Test
HI 84429-50	Titrant	0.5 mL
HI 84429-55	Standard	50 mL

PRINCIPLE OF OPERATION

The determination of titratable acidity in dairy products is made according to a neutralization reaction, that is the reaction between the acids found in dairy products and a base. This type of reaction forms the basis of titration methods of analyzing acids.

Titratable acidity is measured on a sample by titrating the sample with sodium hydroxide to an endpoint of **8.30 pH**. The results are expressed in **°SH, °Th, °D or %l.a.** according with the setup selection.

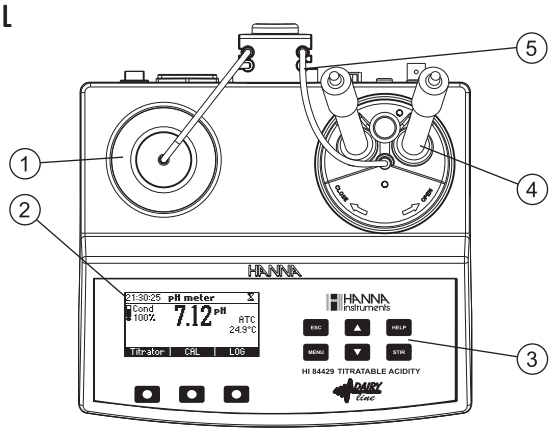
For precise results it is very important to know the exact sample volume, titrant volume and concentration. Also it is better to select the titration **low range** or **high range** according to the expected acidity of the sample.

The peristaltic pump has good repeatability but the dosing volume depends on many factors including the diameter of the tube or the tube stretching. To compensate, the pump needs to be calibrated. The calibration of the pump is also needed in order to have high precision of the titrations.

The calibration procedure is the analysis of a known solution which has a known volume. By doing this, the instrument makes a differential analysis between the standard and the dairy product sample. The pump volumetric debit and the real concentration of the titrant is compensated.

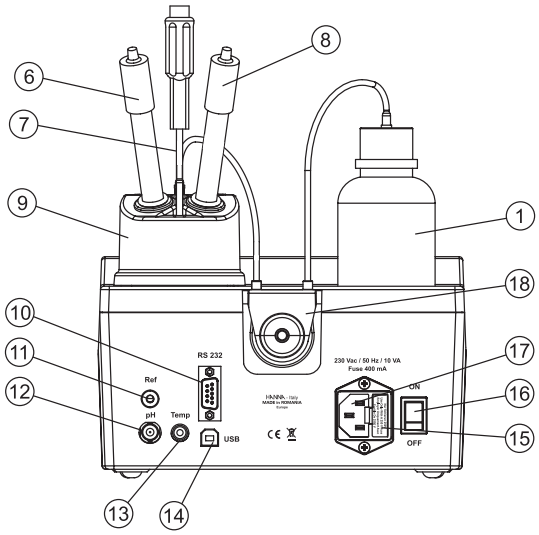
FUNCTIONAL AND PHYSICAL DESCRIPTION

FRONT PANEL



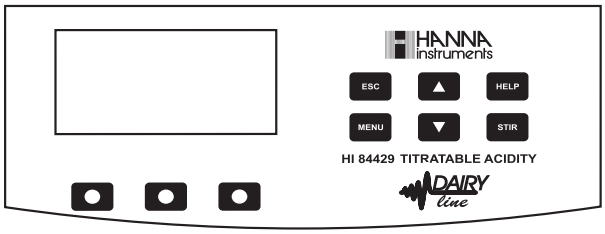
1. Titrant bottle
2. Graphic LCD
3. Keypad
4. Electrode holder
5. Peristaltic pump tubes

REAR PANEL



6. pH Electrode
7. Temperature probe
8. Reference electrode
9. Beaker
10. RS232 connector
11. Reference electrode socket
12. BNC electrode connector
13. Temperature probe socket
14. USB connector
15. Fuse
16. Power switch
17. Power cable connector
18. Peristaltic pump

KEYPAD FUNCTION AND INDICATORS



ESC - used to leave the current screen and to return either to the previous screen or to the main screen, depending on the context, while pressed in **SETUP** the new value of the set parameter is not changed.

▼/▲ - used to modify a parameter's value, to scroll the information displayed while viewing a help or to move between the options from the instrument's setup

HELP - used to access/leave the instrument's contextual help

MENU - used to enter **Setup**, **Recall** or **GLP** selection menu, while instrument is in **pH** or **titration** main screen

STIR - used to start/stop the stirrer.

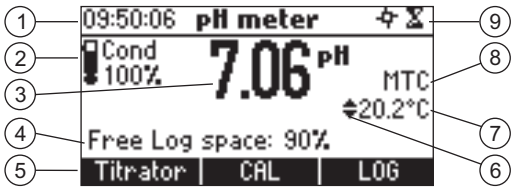
Note: The stirer starts automatically during pump calibration and titration and cannot be stopped by pressing **STIR** key.

GUIDE TO INCDICATORS

During the instrument's operation a set of information are displayed on the LCD.

Displayed icons:

⧗	Unstable reading.		Pump activity.
	Stirrer on.	▲▼	Parameter can be changed.



1) Current time and instrument mode information (pH meter or Titrator)
2) pH electrode condition information
3) main reading information
4) instrument status information

5) functional key area
6) indicates that the displayed value can be changed using ARROW keys
7) temperature reading display
8) pH temperature compensation mode
9) stirrer and reading status area

PERISTALTIC PUMP

Peristaltic pumps are self priming. Liquid never contacts the pump components. The titrant tubing is pressed along the rotating rollers of the pump. The rollers compress the tubing drawing titrant along and out the titrator tip.

TITRATOR STARTUP

- Place the instrument on a flat table. Do not place the instrument in direct sun light.
- Connect the instrument to mains socket with ground connection and the correct voltage and frequency. See the label on the instrument rear for this.
- Turn the instrument ON using the power switch from the rear panel of the instrument.
- Set up the instrument. See the "Setup Configuration Menu" section for details.
- Prepare the electrodes and attach pH sensor and reference electrode to the instrument.
- Calibrate the pH electrode. At least a single point calibration in 8.30 pH buffer is necessary for titration.
- Place the peristaltic pump tube on the pump. See the "Pump Tube Replacement" section for the procedure.
- Remove the reagent bottle cap and place the bottle cap of the tubes. Place the reagent bottle in the appropriate place on the titrator top.
- Connect the tubes with the peristaltic pump (inlet tube is connected with the reagent bottle, outlet tube is connected with the dosing tip).
- Purge line.
- Calibrate the pump.
- Select Acidity titration range.
- Prepare the sample.
- Run a titration and log sample results.

SETUP CONFIGURATION MENU

The titrator's setup configuration menu may be accessed from the pH or titration screens by pressing the **Menu** key, then **Setup**.

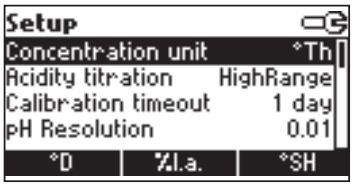
A list of setup parameters will be displayed with currently configured setting.

While in the setup menu it is possible to modify the instrument's operation parameters. The **ARROW** keys permit the user to scroll the setup parameters.

Press **HELP** to view the contextual help.

Press **ESC** to return to the main screen.

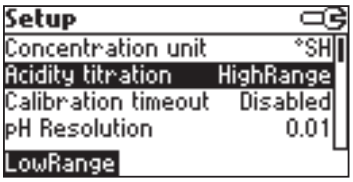
Concentration unit



Option: °SH, °Th, °D, % l.a.

Press the corresponding function key to change the option.

Acidity titration



Option: **Low Range, High Range**.

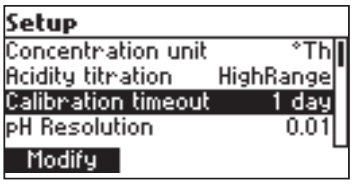
From your knowledge of expected concentrations, use the table below to determine which settings are appropriate. Press the corresponding function key to select the new option.

<u>Note:</u> The milk sample size will change with these settings:

UNIT	Low Range (50 mL milk sample)	High Range (10 mL milk sample)
°SH	0.0 to 15.0	10.0 to 75.0
°TH	0 to 40	20 to 200
°D	0 to 35	20 to 175
%l.a.	0.00 to 0.35	0.0 to 2.0

Select **Low Range** for dairy products in the 0 to 15 °SH range. Select **High Range** for dairy product in the 10 to 75 °SH range. The titrant solution for the **High Range** will remain the same.

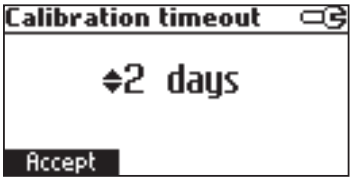
Calibration timeout



Option: **Disabled** or **1 to 7 days**.

This option is used to set the number of days before the pH calibration expired warning message is flagged.

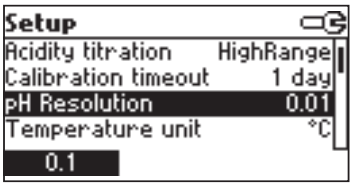
Press **Modify** to access the calibration timeout value modify parameter.



Use the **ARROW** keys in order to increase/decrease the value.

Press **Accept** to confirm or **ESC** to return to the setup menu without saving the new value.

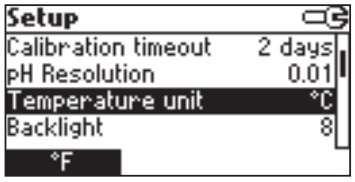
pH resolution



Option: **0.1** or **0.01**.

Press the displayed function key in order to change the option.

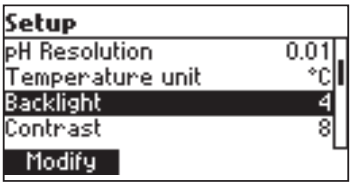
Temperature unit



Option: **°C** or **°F**.

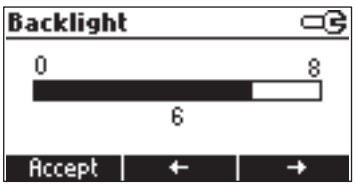
Press the function key in order to change the option.

Backlight



Option: **0** to **8**.

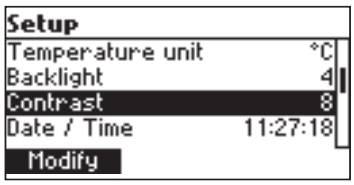
Press **Modify** to access the backlight value.



Use the **ARROW** keys or ← / → in order to increase/decrease the displayed constrast.

Press **Accept** to confirm or **ESC** to return to the setup menu.

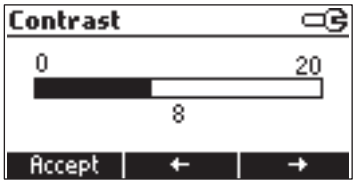
Contrast



Option: **0** to **20**.

This option is used to set the display's contrast.

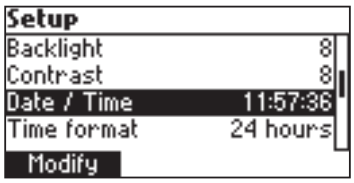
Press **Modify** to change the display's contrast.



Use the **ARROW** keys or ← / → in order to increase/decrease the value.

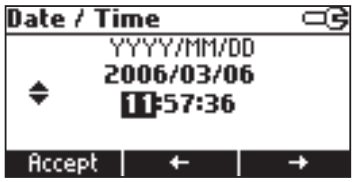
Press **Accept** to confirm the value or **ESC** to return to the setup menu.

Date / Time



This option is used to set the instrument's date and time.

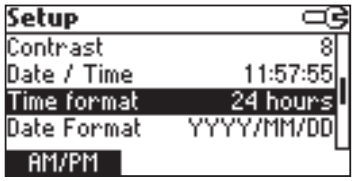
Press **Modify** to change the date/time.



Press ← / → to highlight the value to be modified (year, month, day, hour, minute or second). Use the **ARROW** keys to change the value.

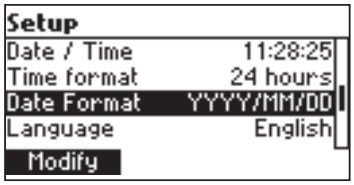
Press **Accept** to confirm the new value or **ESC** to return to the setup.

Time format

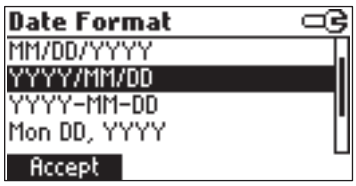


Option: **AM/PM** or **24 hours**.
Press the functional key to select the new value.

Date format

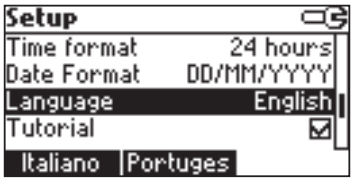


Press **Modify** to change the Date Format.



Use the **ARROW** keys to select the desired format. Press **Accept** to confirm the value or **ESC** to return to the setup menu.

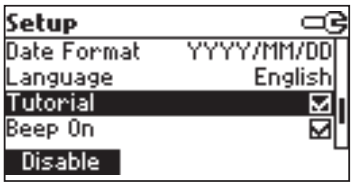
Language



Press the corresponding function key to change the option.
If the new selected language cannot be loaded, the previously selected language will be reloaded.

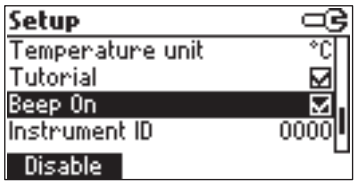
If no language can be loaded the instrument will work in the **"safe mode"**. In **"safe mode"** all the messages are displayed in English and tutorial and help information are not available.

Tutorial



This option is used to enable/disable tutorial mode. If enabled this option will provide the user short guides on the screen.
Press the function key to select this option.

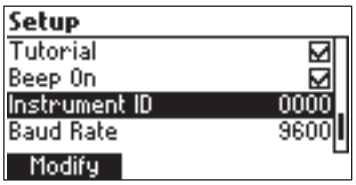
Beep On



Press the function key to select the new option. When enabled, a short beep is heard every time a key is pressed or when the calibration can be confirmed.

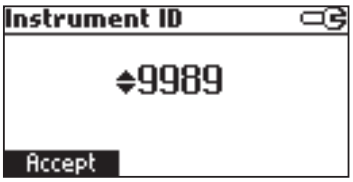
A long beep alert sounds when the pressed key is not active or a wrong condition is detected while in calibration.

Instrument ID



Option: 0 to **9999**.

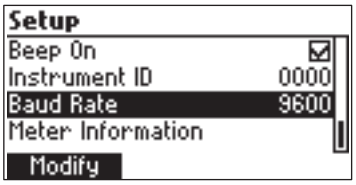
This option is used to set the instrument's ID. The instrument ID is used while exchanging data with a PC.



Press **Modify** to access the instrument ID screen.

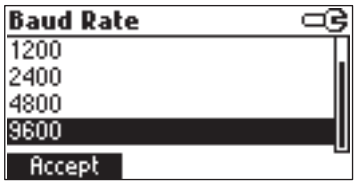
Press **ARROW** in order to select the desired value between 0 and 9999. Press **Accept** to confirm the value or **ESC** to return to the setup menu without saving the new value.

Baud rate



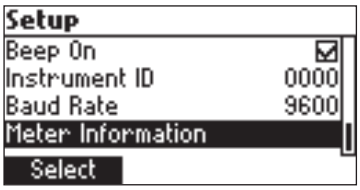
Options: **600**, **1200**, **2400**, **4800**, **9600** bps.

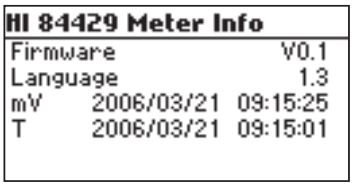
This parameter is used for setting the speed of the serial link between the instrument and a PC.



Press **Modify** to access the baud rate screen. Use **ARROW** to scroll through baud rate values and press **Accept** to confirm the selection or **ESC** to return to the setup menu without saving the new value.

Meter information





Press **Select** to view the firmware version, language version, mV factory calibration date and time and temperature factory calibration date and time.

Press **ESC** to return to the **Setup** mode.

ELECTRODE PREPARATION

PREPARATION PROCEDURE

Remove the electrode protective cap.

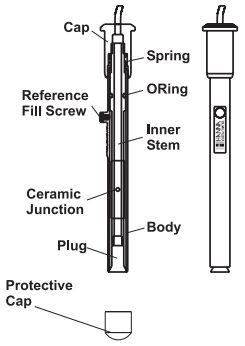
DO NOT BE ALARMED IF ANY SALT DEPOSITS ARE PRESENT. This is normal with electrodes and they will disappear when rinsed with water.

During transport tiny bubbles of air may have formed inside the glass bulb. The electrode cannot function properly under these conditions. These bubbles can be removed by "shaking down" the electrode as you would do with a glass thermometer.

If the bulb is dry, soak the electrode in **HI 70300** Storage Solution for at least one hour.

Preparation of reference electrode:

- Unwrap Parafilm™ seal found over ceramic junction on inner stern of the reference electrod and discard. This is only used for shipping.
- Rinse inner stern with deionized water making certain to wet o-ring found on the inner stern.
- Reassemble reference electrode by gently pushing the inner assembly into the outer body, sliding spring down cable, and screwing cap into place.
- Remove fill hole cover and o-ring or fill hole spout.
- Using the dropper pipette provided, add a few drops of **HI 7072** filling solution to the reference electrode, wetting the o-ring and rinsing out the fill solution chamber.



Reference Elerctrode

- Holding the body of the electrode depress the black cap with your thumb. This permits the fill solution to drain out of the body. Verify if the electrode returns to its original position. (You may need to gently assist for this to occur).
- Tighten the electrode cap onto the body and fill electrode body with **HI 7072** filling solution until fill solution volume is just below fill hole.

Note: During measurement always operate reference electrode with the fill hole open.

MEASUREMENT

Place pH electrode and reference electrode into electrode holder and connect the Cable Connectors to the instrument.

Rinse the pH and reference electrodes tip with distilled water. Immerse the pH and reference electrodes (bottom 4 cm /1½") in the sample and stir gently for a few seconds.

For a faster response and to avoid cross-contamination of the samples, rinse the electrode tip with a few drops of the solution to be tested, before taking measurements.

ELECTRODE CALIBRATION PROCEDURE

It is recommended to calibrate the instrument frequently, especially if high accuracy is required. The pH range should be recalibrated:

a) Whenever the pH electrode is replaced

b) At least once a week

c) After testing aggresive chemicals and after electrode is cleaned

d) When extreme accuracy is required

e) If the pH calibration expired warning is displayed during measurement. Every time you calibrate the instrument use fresh buffers and perform an electrode Cleaning Procedure (see page 45).

PROCEDURE

A one, two or three-point calibration can be performed, using 3 buffers (4.01, 6.00 and 8.30 pH).
Note: The HI 84429 will not accept other pH buffers for calibration.

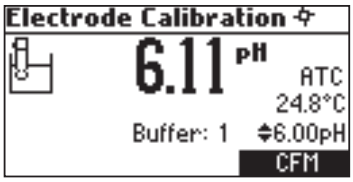
- Pour small quantities of selected buffer solutions into clean beakers. For accurate calibration use two beakers for each buffer solution, the first one for rinsing the electrode and the second one for calibration.
- Put a magnetic stir bar in each beaker with the calibration buffer solution.
- Remove the protective cap and rinse the electrodes with some of the buffer solution to be used for the first calibration point.
- Put the first beaker with calibration buffer in the beaker holder.
- Place the electrode holder on the top of the beaker and secure it by turning clockwise.
- Immerse the pH and reference electrodes and the temperature probe approximately 2 cm (0.8") into the buffer paying attention not to touch the stir bar.

To select **Electrode calibration** screen follow the next steps:

- From **pH meter** screen press **CAL** function key then **Electrode**.
- From **Titrator** screen press **CAL** function key then **Electrode**.

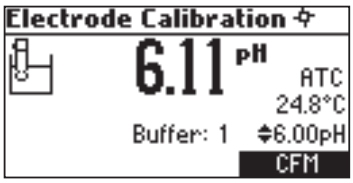
THREE POINT CALIBRATION

- From the pH meter/titrator calibration menu screen select the **Electrode calibration** option.

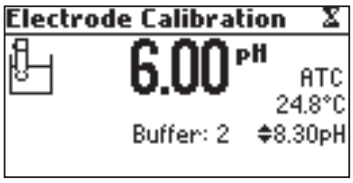


The electrode calibration screen will be displayed.

- The 6.00 buffer will be selected by default. If necessary press the **ARROW** keys in order to select a different buffer value.
- The ⧗ (unstable measurement) symbol will be shown on the display until the reading becomes stable.
- When the reading is stable and close to the selected buffer, the ⧗ (unstable measurement) symbol will disappear and the **CFM** key will become active.



- Press **CFM** to confirm the calibration.
- The calibrated value will be shown on the display and the second expected buffer value will be displayed.

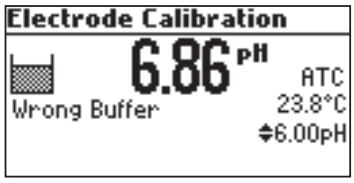


- After the first calibration point has been confirmed, press **STIR** to stop stirring.
- Remove the electrode holder with electrodes from the top of the beaker.
- Place the second buffer into beaker and place in beaker holder. Rinse the electrodes in a beaker containing the second buffer rinsing solution.
- Place the electrode holder (with electrodes) on the top of the beaker, lock cap by turning and press **STIR**.
- If necessary press the **ARROW** keys in order to select a different buffer value.
- The ⧗ (unstable measurement) symbol will be shown on the display until the reading becomes stable.

- When the reading is stable and close to the selected buffer, the ⧗ (unstable measurement) symbol will disappear and the **CFM** key will become active.
- Press **CFM** to confirm the calibration.
- The calibrated value will be shown on the display and the third expected buffer value will be automatically selected.
- After the second calibration point has been confirmed, press **STIR** to stop stirring.
- Remove the electrode holder with electrodes from the top of the beaker.
- Place the third buffer solution in a beaker and place in beaker holder. Rinse the probes in a beaker with third buffer rinsing solution.
- Place the electrode holder (with electrodes) in the beaker with third buffer and secure top by locking. Press **STIR**.
- If necessary press the **ARROW** keys in order to select correct buffer value.
- The ⧗ (unstable measurement) symbol will be shown on the display until the reading becomes stable.
- When the reading is stable and close to the selected buffer, the ⧗ (unstable measurement) symbol will disappear and the **CFM** key will become active.
- Press **CFM** to confirm the calibration. The instrument stores the calibration value and returns to pH meter/titrator calibration menu, where the date and time for the last pH will be updated.

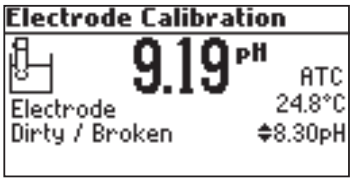
Notes:

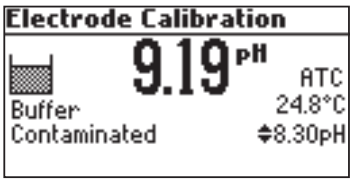
- A buffer confirmed during the calibration process is removed from the list of calibration buffers available for further calibration points.
- If the value measured by the instrument is not close to the selected buffer a **"Wrong buffer"** error message will be shown on the display.



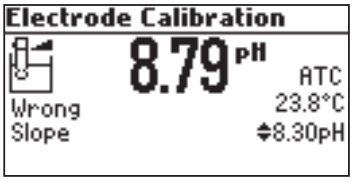
Check if the correct buffer has been used or regenerate the pH electrodes by following the Cleaning Procedure (see page 45). If necessary change the buffer or the electrode or pop the reference junction.

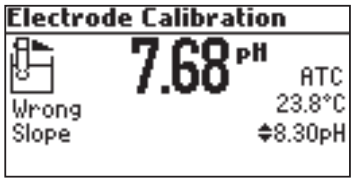
- If the measured offset isn't within the preset limits (±45mV) the meter will display the message **"Buffer Contaminated"** alternatively with **"Electrode Dirty/Broken"**.



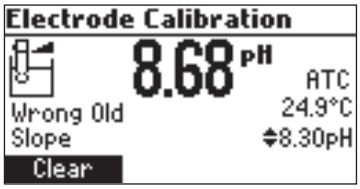


- If the computed slope isn't within the preset limits the meter will display the message "**Wrong Slope**". If the slope is too high the symbol ◢ will be displayed. If the slope is too low the symbol ◣ will be displayed.

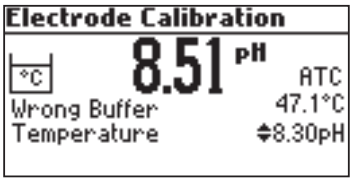




- If the "**Wrong Old Buffer**" error message is displayed, an inconsistency exists between the current and the previous (old) calibration. Clear the calibration parameters by pressing **Clear** and proceed with calibration from the current calibration point. The instrument will keep all the confirmed values during the current calibration point.

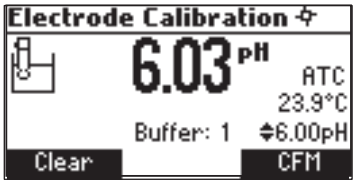


- If the temperature reading is out of the defined temperature range of the buffer (0÷45 °C) the "**Wrong Buffer Temperature**" error message will be displayed, and the symbol °C will blink on the dsplay. Calibration cannot be confirmed in this situation.



Notes: • To clear a previous calibration and to return to the default value, press **Clear** at any time after entering calibration mode. The "**Calibration cleared**" message will be shown for a few seconds on the display. If **Clear** is invoked during the first calibration point the instrument returns to the measurement mode.

• The **Clear** key is displayed only if a previous calibration exists.



pH BUFFER TEMPERATURE DEPENDENCE

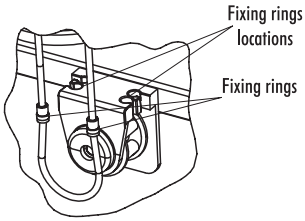
The temperature has an effect on pH. The calibration buffer solutions are affected by temperature changes to a lesser degree than normal solutions. During calibration the instrument will automatically calibrate to the pH value corresponding to the measured or set temperature.

TEMP		pH BUFFERS		
°C	°F	4.01	6.00	8.30
0	32	4.01	6.12	8.48
5	41	4.00	6.09	8.44
10	50	4.00	6.06	8.41
15	59	4.00	6.04	8.37
20	68	4.00	6.02	8.33
25	77	4.01	6.00	8.30
30	86	4.02	5.99	8.27
35	95	4.03	5.98	8.24
40	104	4.04	5.97	8.21

During calibration the instrument will display the pH buffer value at 25 °C.

PUMP TUBE INSTALLATION

To mount the new peristaltic pump tube follow next steps:



Caution: Purge line with water to remove NaOH from tube.

- Position one peristaltic pump fixing ring on its location.
- Stretch the tube over the peristaltic pump cylinders.
- Fix the second pump fixing ring on its location.
- Attach the tube to the reagent bottle and to the dosing tip.

Note: Purge the peristaltic pump until drops of reagent appears on the dosing tip by pressing the **PURGE** key from the titrator main screen.

To remove the tube of the peristaltic pump follow next steps:

- Detach the old tube system from the reagent bottle and from the dosing tip.
- Grasp one fixing ring of the peristaltic pump tube.
- Pull the tube until the fixing rings are taken out from their location.
- Remove the other side of the tube.

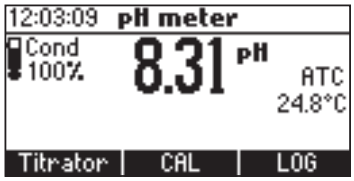
PURGE

Purge should be performed whenever the tube of the peristaltic pump is replaced or before starting a pump calibration or a titration.

In order to start purging press the **Purge** key from the titrator main screen. The purging stops automatically after 5 minutes.

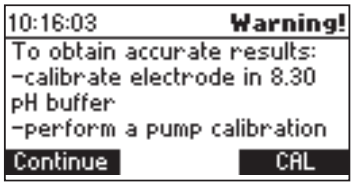
To access the **Purge** key follow the next steps.

- From the instrument main screen (pH meter screen) press "Titrator" function key.



The instrument will display the next screen if any of the following conditions exist:

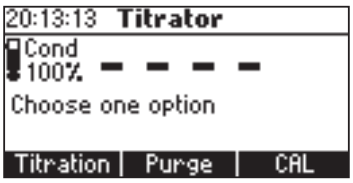
- the meter hasn't been calibrated in 8.30 pH buffer
- the pH calibration has expired
- a pump calibration hasn't been performed or more than 3 days have passed since the last pump calibration



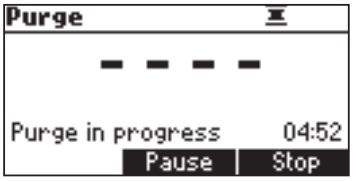
Press **CAL** to access the titration calibration menu where electrode and pump calibration may be accessed.

Press **HELP** to view the contextual help.

- Press **Continue** or **ESC** to skip the message and enter Titrator main screen.



- Press **Purge** to begin a purge cycle.



The purging stops automatically after 5 minutes.

To stop purging at any time and return to the main screen press **ESC** or **Stop**.

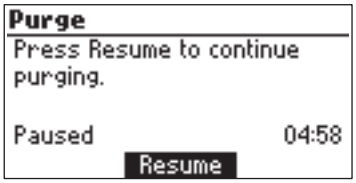
During purge, on the lower right side of the display will be shown the remaining time until the purge process will be completed.

Press **Pause** to interrupt the purge process.

Press **Pause** or **Stop** purging (by pressing the corresponding function key in the purge screen)

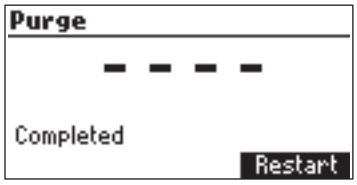
- after the first drops of fresh titrant appear at the dosing tip
- in case of error conditions (empty titrant, bottle, tubes or dosing tip disconected, pump error)
- if you want to resume at a later time

If **Pause** is pressed the next screen is displayed:



Press **Resume** to continue purging.

After the 5 minutes purging interval has elapsed the "**Completed**" message is displayed. Another purge period can be initiated by pressing **Restart**.

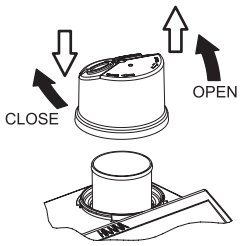


PUMP CALIBRATION PROCEDURE

The calibration of the pump must be performed each time the pump tube, the reagent bottle or the pH electrode is changed. It is recommended to perform the pump calibration before each set of measurements.

Verify: The electrode has been calibrated in 8.30 pH buffer.

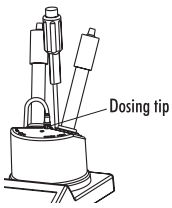
- **Sample preparation:** Fill a beaker up to the 50 mL mark with **HI 84429-55 Standard**. Place the stir bar into the beaker and then place the beaker in the appropiate place on the instrument top.



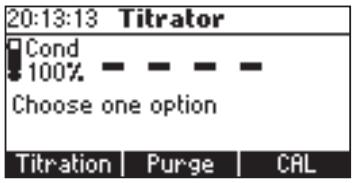
- Place the electrode holder on the top of the beaker and secure it by turning clockwise.

- Immerse the pH, reference and the temperature electrodes approximatively 2 cm (0.8") into the sample to be tested paying attention not to touch the stir bar.

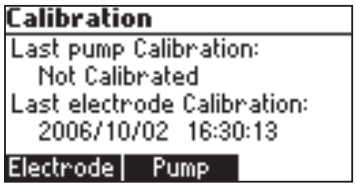
- Insert the dosing tip in the appropriate holder place. Do not immerse tip into solution.



- From the titrator main screen press **CAL**.

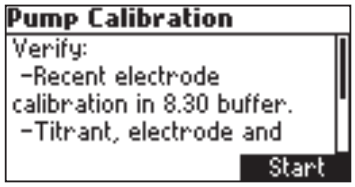


The instrument displays the date and time of the last electrode calibration, and the date and time of the last pump calibration, or calibration expired messages.

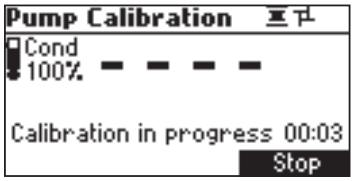


- Press **Pump**.

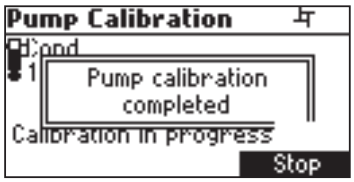
  The next screen will be displayed.



- Press **Start**.
- After the pump calibration is started, on the upper right side of the display two animations will be shown in order to indicate that the pump and the stirrer are working. On the lower right side of the display is shown the amount of time that has passed since the begining of the calibration.



- After the pump calibration is complete a confirmation message is displayed for a few seconds, then the instrument will return to the titrator calibration menu and will display the new time and date for the last pump calibration.



Notes:
- The calibration of the pump is independent of the selected range and concentration unit.
- If an erroneous situation is encountered during the calibration, an error message is displayed and the calibration can be restarted by pressing **Restart**.

- If the calibration doesn't complete within 6 minutes the error message "**Too much standard**" will be displayed and the calibration can be restarted by pressing **Restart** after a new sample with standard is prepared.

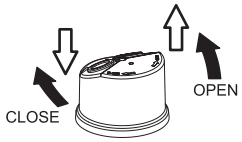
TITRATION PROCEDURE

Verify: The instrument has been calibrated (pH and pump) before performing a titration. An electrode calibration in 8.30 pH buffer is recommended.

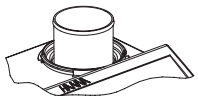
- Refer to Setup Configuration Menu (see page 24) to set up instrument for your measurement.
- Select the corresponding Low Range or High Range according to the table bellow.

UNIT	Low Range (50 mL milk sample)	High Range (10 mL milk sample)
°SH	0.0 to 15.0	10.0 to 75.0
°TH	0 to 40	20 to 200
°D	0 to 35	20 to 175
%l.a.	0.00 to 0.35	0.0 to 2.0

- **Sample preparation:** For Low Range measurement fill a beaker up to the 50 mL mark with sample. For High Range measurement use the 20 mL beaker to measure 10 mL of sample. Put the sample in the 50 mL beaker. Fill the beaker up to 50 mL with deionised water. Place the stir bar into the beaker and then place the beaker in the appropiate place on the instrument top.

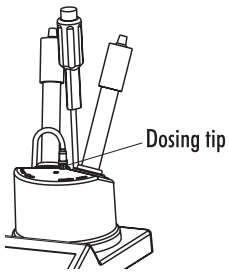


- Place the electrode holder on the top of the beaker and secure it by turning clockwise.

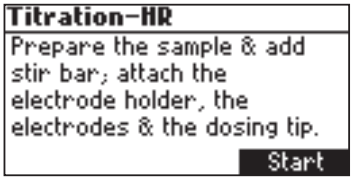


- Immerse the pH, reference and the temperature electrodes approximatively 2 cm (0.8") into the sample to be tested paying attention not to touch the stir bar. Use O-Ring provided to secure electrodes in holder.

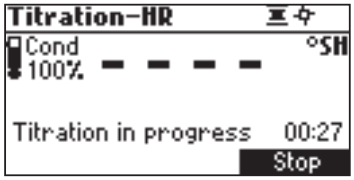
- Insert the dosing tip in the appropriate holder place. Do not immerse tip into solution.



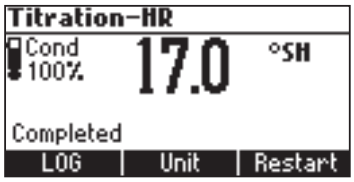
- From the titrator main screen press **Titration**. To enter titrator main screen from pH meter mode press **Titrator** and then **Continue**.



- Press **Start** to begin the titration process.
- After the titration is started on the upper right side of the display two animations will be shown in order to indicate that the pump and the stirrer are running. On the lower right side of the display is shown the period of time since the titration has been started.

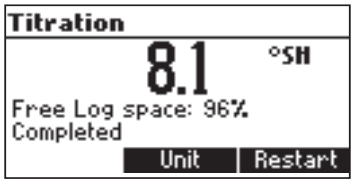


- After the titration is complete, the concentration value is displayed in the selected unit.

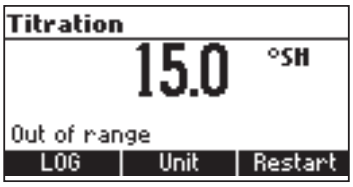


- Press **Unit** to change the display unit.
- Press **LOG** to record the concentration value into the instrument's memory.

  A message will be dislayed for a few seconds indicating the amount of the free log space. Up to 50 log samples can be recorded in the instrument's memory. When the free titrator log space is under 12% the message will be shown permanently.



- If the concentration is out of limits (15 SH for Low Range, 10 or 75 SH for High Range - see pg. 6 for range limits) the exceeded range limit will be displayed blinking and the message "**Out of range**" will be shown. Another titration can be initiated by pressing **Restart**.



Note: If the end-point is not reached or it is not recognized or the input reading is out of 3.00 to 8.30 pH range, an error message will be displayed. The titration can be restarted after a new sample is prepared by pressing **Restart**.

TIPS FOR AN ACCURATE MEASUREMENT

- Calibrate the instrument in 8.30 pH buffer solution at least once a day, before you start to perfom measurements.
- Purge the peristaltic pump to have the fresh titrant when starting a new analysis or calibration.
- Calibrate the peristaltic pump daily before performing an analysis.
- Clean the electrode and the reference in order to remove the possible milk deposits.

VIEW/DELETE MEMORIZED SAMPLES

Press **MENU** key while in Titrator main screen.

Press **Recall** to access the titrator memorized data.

The instrument will display a list of all the titration records stored in the titration log.

Use the **ARROW** keys to scroll the stored records list.

If the saved concentration was out of range the "**!**" symbol is displayed in front of the reading.

	Conc	Unit	Titration
1	5.1	°SH	LowRange
2	5.4	°SH	LowRange
3	10.5	°SH	LowRange
4	42.0	°SH	HighRange

Delete All | Delete | More

Press **Delete** to enter record deleting mode.

Press **Delete All** to enter all records deleting mode.

Press **More** to view more information.

Record number: 5
Date: 2006/03/23
Time: 10:59:46
Concentration: 82°Th
Acidity titration: HighRange

Unit

Press **Unit** to convert the result to other unit.

Use the **ARROW** keys when ⬍ is displayed to scroll between the log records.

Press **ESC** to return to the previous screen.

If **Delete** was pressed the instrument will ask for confirmation.

Delete Record?

1	5.1	°SH	LowRange
2	5.4	°SH	LowRange
3	10.5	°SH	LowRange
4	42.0	°SH	HighRange

CFM

Use the **ARROW** keys to focus on the record to be deleted.

Press **CFM** to delete the record or **ESC** to return to the previous screen.

Deleting a record will reorganise the list of records.

If **Delete All** was pressed the instrument will ask for confirmation.

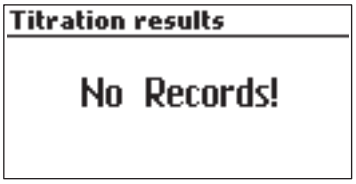
Delete all records?

1	5.1	°SH	LowRange
2	5.4	°SH	LowRange
3	10.5	°SH	LowRange
4	42.0	°SH	HighRange

CFM

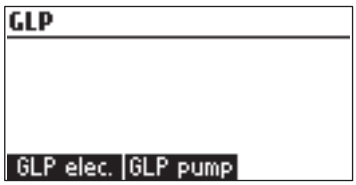
Press **CFM** to delete all the records or **ESC** to return to the previous screen.

If the titrator log is empty the message "**No Records!**" will be displayed.

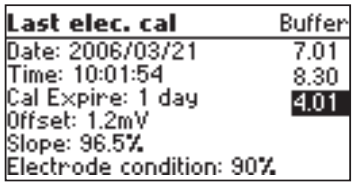


TITRATOR GLP INFORMATION

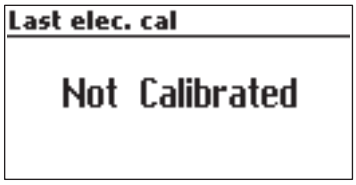
Press **MENU** while in **Titration** mode and then **GLP**.



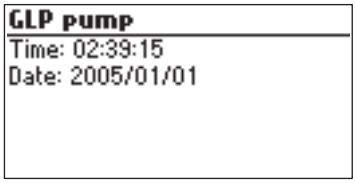
From this screen it is possible to select between viewing the **electrode GLP** or the **pump GLP**.
Press **GLP elec.** to view the **electrode's last calibration parameters and date**.
Press **GLP pump** to view the **pump's last calibration time and date**.
If **GLP elec.** is pressed one of the next screens will be displayed.



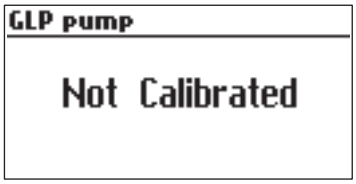
GLP contains a set of information regarding electrode calibration. The following items are included in electrode GLP: the time and date of the last calibration, Offset, Slope, Electrode condition, calibration timeout and the calibration buffers. The buffers displayed in video inverse mode are from the previous calibration.
If a calibration hasn't been performed the message "**Not calibrated**" will be displayed.



If GLP pump is pressed, one of the next screens is displayed.

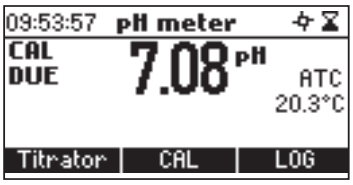


The pump **GLP** displays the Time and Date of the last pump calibration.
If a calibration hasn't been performed the message **"Not calibrated"** will be displayed.



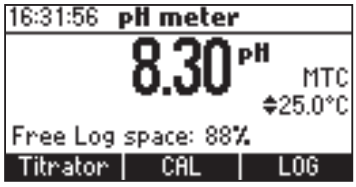
pH MEASUREMENT

The **HI 84429** may be used as a pH meter for direct measurements.
Verify that the instrument has been calibrated before taking pH measurements. Set the instrument to **pH meter**. At power up the instrument enters **pH meter** mode. From titrator mode press ESC until pH units are displayed.
If an electrode calibration hasn't been performed, or the number of days since the last pH calibration is greater than the number of days after wich a calibration time-out warning is displayed the message **"CAL DUE"** will blink on the left side of the display (see **Calibration timeout** option from **Setup** for details).
If **CAL DUE** is displayed perform an electrode calibration.



Press **MENU** to access the instrument's menu.
Press **HELP** to view the contextual help, every time you need suplimentary information. The help is customized for every situation that can appear during instrument usage.
Press **STIR** to start/stop the stirrer.
Press **Titrator** to enter titrator mode.
Press **CAL** to access the calibration menu.

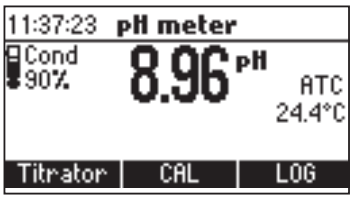
Press **LOG** to memorize the current reading. A message indicating the free log space will be displayed for a few seconds.



Up to 50 log samples can be saved into the instrument's memory. When the pH log space is under 12% a message will be permanently shown on the display, indicating the remaining free log space.

In order to take pH measurements follow the next steps:

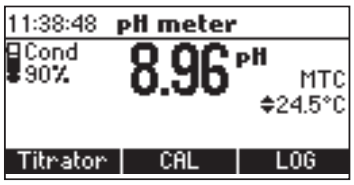
- Submerge the tip of the electrode (4 cm/1 1/2'') and the temperature probe into the sample to be tested and stir gently. Allow time for the electrode to stabilize. When the reading becomes stable the ⧗ (unstable measurement) symbol will disappear.



- If the pH reading is out of range (-2.00 to 16.00 pH) the closest full-scale value (-2.00 pH or 16.00 pH) will be displayed blinking.

If measurements are taken successively in different samples, it is recommended to rinse the electrodes thoroughly with deionised water or tap water and then with some of the next sample to prevent cross-contamination.

The pH reading is affected by temperature. In order to have accurate pH measurements, the temperature effect must be compensated for. To use the Automatic Temperature Compensation (**ATC**) feature, connect and submerge the **HI 7662-T** temperature probe into the sample as close as possible to the electrode and wait for a few seconds. The "**ATC**" message will be shown on the display. Automatic temperature compensation will provide pH corrected values at the temperature of measurements. If Manual Temperature Compensation (**MTC**) is desired, the temperature probe must be disconnected from the instrument. The default temperature of 25 °C (77 °F) or the last temperature reading will be displayed preceded by the symbol ⬍ and the "**MTC**" message.



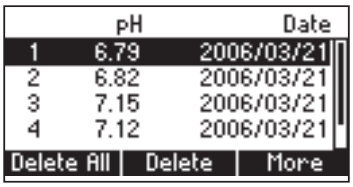
The manually set temperature can now be adjusted with the **ARROW** keys (from -20.0 to 120.0 °C).

VIEW/DELETE pH MEMORIZED SAMPLES

Press **MENU** key while in pH meter screen.

Press **Recall** to access the pH recall.

A list of records is stored in the pH log.



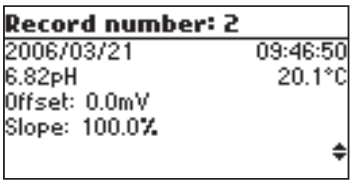
Use the **ARROW** keys to scroll the list of records.

Press **More** to see detailed information about focused record.

Press **Delete** to enter record deleting mode.

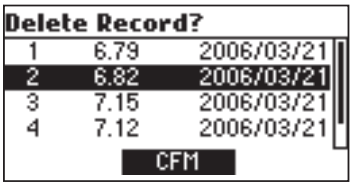
Press **Delete All** to enter all records deleting mode.

If **More** is pressed a complete set of data is displayed.



Use **ARROW** keys when ⬍ is displayed to scroll between the records.

If **Delete** was pressed the instrument will ask for confirmation.

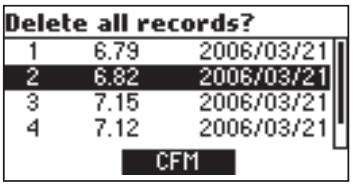


Use the **ARROW** keys to focus on the record to be deleted.

Press **CFM** to delete the record or **ESC** to return to the previous screen without deleting.

Deleting a record will reorganise the list of records.

If **Delete All** was pressed the instrument will ask for confirmation.



Press **CFM** to delete all records or **ESC** to return to the previous screen without deleting.

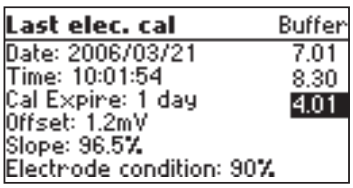
If the pH log is empty the message "**No Records!**" will be displayed.

pH METER GLP INFORMATION

The pH meter GLP information refers to the pH calibration date.

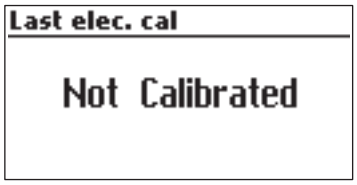
To view this information press **MENU** key while in pH meter mode then **GLP**.

A set of information regarding electrode calibration is displayed.



The following items are included in electrode GLP: the time and date of the last calibration, Offset, Slope, Electrode condition, calibration timeout and the calibration buffers. The buffers displayed in video inverse mode are from the previous calibration.

If a calibration hasn't been performed the message "**Not calibrated**" will be displayed.



TEMPERATURE CALIBRATION PROCEDURE (for technical personnel only)

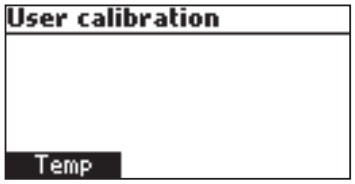
All the instruments are factory calibrated for temperature.

HANNA's temperature probes are interchangeable and no temperature calibration is needed when they are replaced.

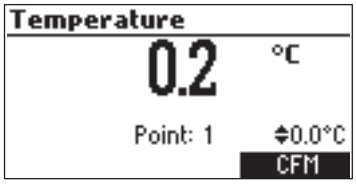
If the temperature measurements are inaccurate, temperature recalibration should be performed.

For an accurate recalibration, contact your dealer or the nearest HANNA Customer Service Center, or follow the instructions bellow.

- Prepare a vessel containing ice and water and another one containing hot water (at a temperature of around 50 °C). Place insulation material around the vessels to minimize temperature changes.
- Use a calibrated thermometer with a resolution of 0.1 °C as a reference.
- To enter user calibration screen press and hold down the **ARROW** keys simultaneously, then power on the instrument. After a few seconds the **User calibration** screen is displayed.



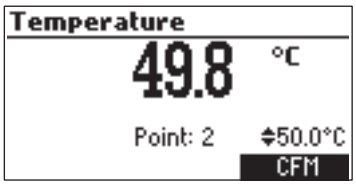
- Press **Temp** function key to enter temperature calibration.
- Immerse the temperature probe in the vessel with ice and water as near as possible to the reference thermometer. Allow a few seconds for the probe to stabilize.
- Use the **ARROW** keys to set the calibration point value to that of the ice and water measured by the reference thermometer.
- The ⧗ (unstable measurement) symbol will be shown on the display until the reading becomes stable.
- When the reading is stable and close to the selected calibration point, the ⧗ (unstable measurement) symbol will disappear and the **CFM** key will become active.



- Press **CFM** to confirm the calibration point.
- The meter will be automatically move to the second calibration point, and will display 50 °C for

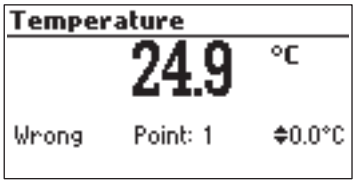
the buffer value.

- Immerse the temperature probe in the second vessel as near as possible to the reference thermometer. Allow a few seconds for the probe to stabilize.
- Use the **ARROW** keys to set the calibration point value to that of the hot water, measured by the reference thermometer.
- The ⧗ (unstable measurement) symbol will be shown on the display until the reading becomes stable.
- When the reading is stable and close to the selected calibration point, the ⧗ (unstable measurement) symbol will disappear and the **CFM** key will become active.

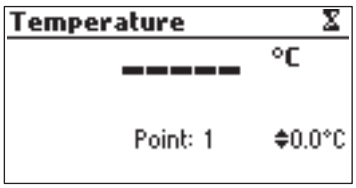


- Press **CFM** to confirm the calibration point. The instrument will return to the pH meter/titrator main screen.

Note: If the reading is not close to the selected calibration point, the "**Wrong**" message will be displayed. Change the temperature probe and restart the calibration.



If the temperature probe is disconnected or the measured temperature is out of the - 20 to120 °C range the instrument will display "----". The calibration point value can be changed using the **ARROW** keys.



PC INTERFACE

Data transmission from the instrument to the PC can be done with the **HI 92000** Windows compatible software (optional). **HI 92000** also offers graphing and on-line help feature.

Data can be exported to the most popular spreadsheet programs for further analysis.

To connect your instrument to a PC, use the optional Hanna **HI 920010** cable connector or a standard USB connector. Make sure that your instrument is switched off and plug one connector to the instrument's **RS 232C** or USB socket and the other to the serial or USB port of your PC.

Notes: Other cables than **HI 920010** may use a diffrent configuration. In this case, communication between instrument and PC may not be possible.

If you are not using Hanna Instruments **HI 92000** software, please see the following instructions.

SENDING COMMANDS FROM PC

It is also possible to remotely control the instrument with any terminal program. Use **HI 920010** cable to connect the instrument to a PC, start the terminal program and set the communication options as follows: 8, N, 1, no flow control.

COMMAND TYPES

To send a command to the instrument follow the next scheme:

<command prefix> <comand><CR>

where <command prefix> is the ASCII character having the code 16.
<command> is the command code.

Note: Either small or capital letters can be used.

Upon reception of a command the instrument will answer with:

<STX><answer><checksum><ETX>

where the checksum is the bytes sum of the answer string, sent as 2 ASCII characters. All the answer messages are with ASCII characters.

COMMANDS

RAS Causes the instrument to send a complete set of readings in according with the current meter mode.
The answer string contains:
-Meter mode (2 chars): -00 pH meter (0.1 resolution)
-01 pH meter (0.01 resolution)
-02 titrator

-Meter status (2 chars) represents a 8 bit hexadecimal encoding.

-0x10: temperature probe connection

-0x01: new GLP data available

-0x02: new setup parameter

-Reading status (1 char): R-in range, O - over range, U - under range.

-pH reading with sign and decimal point (7 chars)

-Temperature, with sign and 2 decimals point, always in °C (7 chars).

-Checksum (2 chars)

Note: If the meter is in titrator mode only, the meter status and the checksum will be sent.

MDR Requests the instrument model name and firmware code (20 chars).

GLP Requests te calibration data record.

The answer string contains:

-GLP status (1 char): represents a 4 bit hexadecimal enconding.

-0x1-pH calibration available

-0x2- pump calibration available

-pump calibration data (if available):

-calibration time, yymmddhhmmss (12 chars)

-pH calibration data (if available):

-the number of calibrated buffers (1 char)

-the ion charge, with sign (2 chars)

-the offset, with sign and decimal point (7 chars)

-the average of slopes, with sign and decimal point (7chars)

-the calibration time: yymmddhhmmss (12 chars)

-buffer information (for each buffer)

-type (1 char): 0-standard, 1-custom

-status (1 char): N (new)-calibrated in last calibration

O (old)-from an old calibration

-warning during calibration (2 chars):

00- no warning,

04- Clean Electrode warning

-buffer value, with sign and decimal point (7 chars)

-calibration time, yyymmddhhmmss (12 chars)

-electrode condition, with sign (3 chars). The "01" code means not calculated.

-Checksum (2 chars)

PAR Requests the setup parameters setting.

The answer string contains:

-Instrument ID (4 chars)

-Calibration alarm time out (2 chars)

-Concentration unit (1 char): 0=°SH, 1=°Th, 2= °D, 3=% l.a.

-Sample type (1 char): 0=High Range, 1=Range

-SETUP information (2 chars): 8 bit hexadecimal encoding

-0x01-beep ON (else OFF)

-0x04-degree Celsius (else degrees Fahrenheit)

-Backlight value (1 char)

-Contrast value (2 chars)

-Time format (1 char): 0=24 hours, 1=AM/PM

-Date format (1 char): 0-DD/MM/YYYY
1-MM/DD/YYYY
2-YYYY/MM/DD
3-YYYY-MM-DD
4-Mon DD, YYYY
5-DD-Mon-YYYY
6-YYYY-Mon-DD

-Language name (3 chars, "sfm" when the instrument is in safe mode)

-Checksum (2 chars)

NSLx Requests the number of logged samples (4 chars).

The command parameter (1 char):

-P-request for pH meter

-T-request for titrator

LODPxxx Requests the xxxth pH record logged data

LODTxxx Requests the xxxth titrator record logged data

LODPALL Requests all the stored records from the pH meter log

LODTALL Requests all the stored records from the titrator log

The answer string for each record contains:

-Logged mode (2 chars): -00-pH meter (0.1 resolution)
-01-pH meter (0.01 resolution)

-02-titrator

-Overrage for the measured value: R-in range, O-over range, U-under range.

-Measured value (7 chars): for the pH meter log this is the measured pH value; for the titrator log this is the concentration value

-Temperature reading, with two decimals point (7 chars) (only for pH meter log)

-Calibration offset (7 chars) (only for pH meter log)

-Calibration slope (7 chars) (only for pH meter log)

-Concentration unit (1 char) (only for titrator log): 0=°SH, 1=°Th, 2=°D, 3=%l.a.

-Range type (1 char) (only for titrator log): -0=High Range, 1=Range

-Logged time (12 chars): **yymmddhhmmss**

-Temperature probe presence (1 char)

-Checksum (2 chars)

Notes:

-"Err8" is sent if the instrument is not in measurement mode

-"Err6" is sent if the requested range is not available

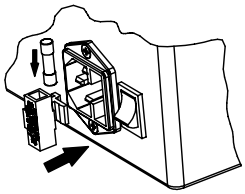
-"Err4" is sent if the requested set parameter is not available

-"Err3" is sent if the Log on demand is empty

-Invalid commands will be ignored.

FUSE REPLACEMENT

To change the fuse follow next steps:



- Disconnect the power cord from the rear panel of the instrument.
- Pull out the fuse holder located near the power cord connector.
- Replace the fuse with a similar one.
- Push the fuse holder with the fuse in the appropriate place.

TROUBLESHOOTING GUIDE

SYMPTOMS	PROBLEM	SOLUTION
Slow response/excessive drift.	Dirty pH or reference electrode.	Soak the electrode tip **HI 7061** or **HI 8061** solution for 30 minutes and follow the cleaning procedure. Pop the reference electrode and refill with electrolyte.
Reading fluctuates up and down (noise).	Clogged/dirty junction. Low electrolyte level (refillable pH electrodes only).	Clean the electrodes and the reference. Refill with fresh fill solution.
While in pH reading mode, -2.00 or 16.00 pH is displayed blinking.	Reading out of range.	Check the quality of the sample. Clean the electrodes and the reference. Refill with fresh fill solution.
The meter does not accept the pH buffer solution for calibration.	Broken pH or reference electrode.	Follow the electrode cleaning procedure. If still no results replace the electrode.
The pump calibration can't be performed	Wrong standard. Broken electrodes.	Check the standard or the electrodes (dirty/broken). Clean/change the electrodes if neccessary. Prepare another standard, purge to have fresh titrant and restart the calibration.
The temperature probe is connected, but the meter displays "MTC".	Broken temperature probe.	Replace temperature probe.
After a titration in Low Range the instrument displays 15°SH or 40°TH or 35°D or 0.35%l.a. (according with the selected unit) blinking.	Broken electrodes. Instrument not calibrated. Wrong sample. Concentration out of range.	Check/clean the electrodes. Recalibrate the instrument (pump and pH). Select High Range. Take care at sample preparation.
After a titration in High Range the instrument displays 10°SH or 20°TH or 20°D (according with the selected unit) blinking.	Broken electrodes. Instrument not calibrated. Wrong sample. Concentration out of range.	Check/clean the electrodes. Recalibrate the instrument (pump and pH). Select Low Range. Take care at sample preparation.

SYMPTOMS	PROBLEM	SOLUTION
After a titration in High Range the instrument displays 75°SH or 200°TH or 75°D or 2.0%I.a. (according with the selected unit) blinking.	Broken electrodes. Instrument not calibrated. Wrong sample. Concentration out of range.	Check/clean the electrodes. Recalibrate the instrument (pump and pH). Take care at sample preparation.
At startup the meter displays the HANNA logo permanently.	One of the keys is blocked.	Check the keyboard or contact the vendor.
"Error xx" message is displayed.	Internal error.	Power off the meter and then power it on again. If the error persists, contact the vendor.

ELECTRODE CONDITIONING AND MAINTENANCE

STORAGE PROCEDURE

To assure a quick response time, the glass bulb be kept moist and not allowed to dry out.

Replace the solution in the protective cap with a few drops of **HI 70300** or **HI 80300** Storage Solution. The HI 5313 Reference may be stored with its black cap and Fill hole covered. Rinse and refill before using. Follow the Preparation Procedure on page 61 before taking measurements.

Note: NEVER STORE THE ELECTRODE IN DISTILLED OR DEIONIZED WATER.

PERIODIC MAINTENANCE

Inspect the electrodes and the cables. The cable used for connection to the instrument must be intact and there must be no points of broken insulation on the cable or cracks on the electrode stem or bulb. Connectors must be perfectly clean and dry. If any scratches or cracks are present, replace the electrode. Rinse off any salt deposits with water.

pH CLEANING PROCEDURE

- *General* — Soak in Hanna **HI 7061** or **HI 8061** General Cleaning Solution for approximately ½ hour.
- *Milk deposits* — Soak in Hanna **HI 700640** Cleaning Solution for milk deposits for approximately ½ hour (pH half cell only).
- *Protein* — Soak in Hanna **HI 7073** or **HI 8073** Protein Cleaning Solution for 15 minutes.

IMPORTANT: After performing any of the cleaning procedures, rinse the electrode thoroughly with distilled water and soak the electrode in **HI 70300** or **HI 80300** Storage Solution for at least 1 hour before taking measurements.

REFERENCE ELECTRODE CLEANING

- Drain the old filling solution, rinse with an adequate **HI 7072** solution, drain, then refill with **HI 7072** solution.
- Do not use an electrode if crystalized salts are visible inside the electrode. Drain electrode, dissasamble and rinse internal body with deionised water. Reassemble and refill with fresh refill solution.
- The internal chamber of this electrode is gell filled. If the electrode has been left dry for long periods of time the gell may be dehydrated and stable measurements may not be obtenable. Dissasamble electrode and soak internal assembly in **HI 7072** filling solution. Verify the ceramic is wetted by the fill solution. Warming the solution slightly (50 °C) before soaking will hasten this process. Permit the electrode to cool completely while immersed in this solution.

ACCESORIES

REAGENTS

HI 84429-50 Titrant solution 100 ml
HI 84429-55 Pump Calibration Standard (500 mL)

pH CALIBRATION SOLUTIONS

HI 84429-65 pH 4.01 Buffer Solution (6 pcs×230 mL)
HI 84429-70 pH 6.00 Buffer Solution (6 pcs×230 mL)
HI 84429-60 pH 8.30 Buffer Solution (6 pcs×230 mL)

ELECTRODES

FC 260B pH electrode
HI 5315 Reference electrode
HI 7662-T Temperature probe

ELECTRODE FILL SOLUTION

HI 7072 Reference electrode filling solution

ELECTRODE STORAGE SOLUTION

HI 70300L Storage Solution, 500 mL bottle

CLEANING SOLUTIONS

HI 70640L Cleaning solution for remaining milk deposits (500 mL)
HI 70641L Cleaning and desinfecting for dairy products (500 mL)
HI 70642L Cleaning solution for remaining cheese deposits (500 mL)

OTHER ACCESSORIES

HI 70483T Tube set with cap for titrant bottle and tip
HI 731316 Stir bar 12x5 mm (5 pcs)
HI 731319 Stir bar 25x7 mm (10 pcs)
HI 740036P 50 mL plastic beaker (10 pcs)
HI 740037P 20 mL plastic beaker (10 pcs)
HI 740143 Syringe 1 mL (6 pcs)
HI 740144 Pipette tip 1 mL (6 pcs)

WARRANTY

HI 84429 is warranted for two years against defects in workmanship and materials when used for its intended purpose and maintained according to the instructions.

This warranty is limited to repair or replacement free of charge.

Damage due to accident, misuse, tampering or lack of prescribed maintenance is not covered.

If service is required, contact your dealer. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. 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 Number from the Customer Service Department and then send it with shipment costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

To validate your warranty, fill out and return the enclosed warranty card within 14 days from the date of purchase.

RECOMMENDATION FOR USERS

Before using this product, make sure that it is entirely suitable for your specific application and for the environment in which it is used.

Operation of this instrument may cause unacceptable interferences to other electronic equipments, this requiring the operator to take all necessary steps to correct interferences.

Any variation introduced by the user to the supplied equipment may degrade the instrument EMC performance.

To avoid damages or burns, do not put the instrument in microwave ovens. For yours and the instrument safety do not use or store the instrument in hazardous environments.

Hanna Instruments reserves the right to modify the design, construction and appearance of its products without advance notice.

SALES AND TECHNICAL SERVICE CONTACTS

Australia:
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Germany:
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For e-mail contacts and a complete list of Sales and Technical offices, please see ***www.hannainst.com***.

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