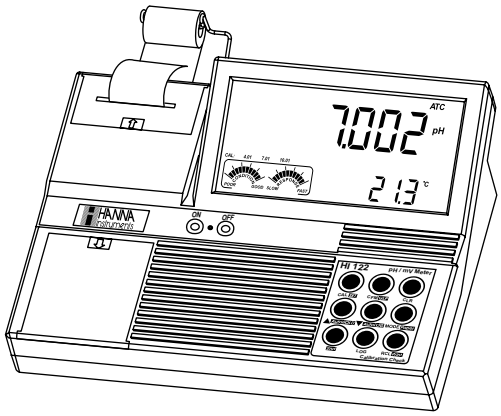
Instruction Manual

HI 120 & HI 122

pH/mV/Temperature Bench Meters with Calibration Check



HANNA instruments
www.hannainst.com

Dear Customer,

Thank you for choosing a Hanna Instruments product.

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

If you need additional technical information, do not hesitate to e-mail us at tech@hannainst.com or turn to the back cover for our worldwide contact list.

These instruments are in compliance with CE directives.

WARRANTY

HI 120 and **HI 122** are guaranteed for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. Electrodes and probes are guaranteed for six months. This warranty is limited to repair or replacement free of charge.

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

If service is required, contact the dealer from whom you purchased the instrument. 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 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.

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PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it carefully to make sure that no damage has occurred during shipping. If there is any damage, notify your Dealer or the nearest Hanna Service Center.

Each instrument is supplied with:

- **HI 1131P** Glass-body Combination pH Electrode
- **HI 7662-T** Temperature probe
- **pH 4.01 & 7.01** Buffer solutions, 20 mL each
- **HI 7071S** Electrolyte solution
- 5 paper rolls (**HI 122** only)
- 12VDC Power Adapter
- Instruction Manual

Note: Save all packing material until you are sure that the instrument functions correctly. All defective items must be returned in the original packing with the supplied accessories.

GENERAL DESCRIPTION

The Hanna **HI 120** and **HI 122** are professional bench meters for pH, ORP (Oxidation Reduction Potential) and Temperature measurements with Calibration Check. **Relative mV** feature is also provided.

Calibration Check performs a set of diagnostic tests during calibration using the history of electrode slope and offset to detect problems that can cause loss of accuracy.

Calibration Check Features are:

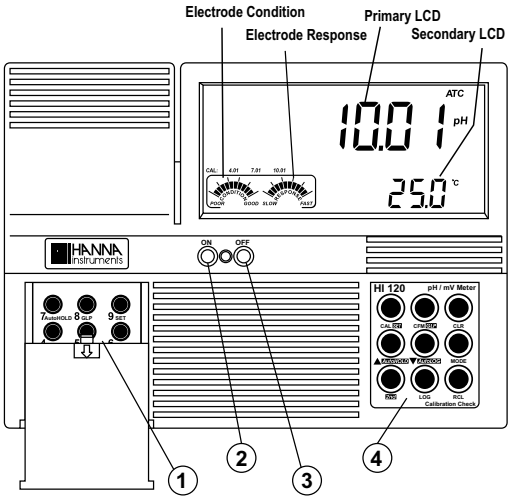
- Enhanced Calibration Messages
- Electrode Condition on LCD Display
- Electrode Response Time on LCD Display
- Calibration Alarm Time-Out
- Out of Calibration Range

Other features include:

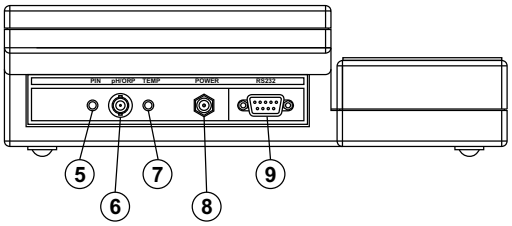
- Up to five-point calibration with seven memorized buffers (1.68, 4.01, 6.86, 7.01, 9.18, 10.01 and 12.45 pH) and two custom buffers.
- pH calibration using pH buffers with 0.001 resolution.
- pH reading with manual or automatic temperature compensation.
- Up to 50 samples for Log on demand mode and up to 1000 samples for AutoLOG mode.
- Two selectable alarm limits.
- User selectable AutoLOG modes.
- Printing feature in four selectable languages (**HI 122** only).
- Large easy-to-read LCD which shows the pH or mV and Temperature simultaneously, together with graphic symbols.
- AutoHOLD feature to freeze first stable reading on the LCD.
- GLP feature to view last calibration data for pH and Relative mV.
- PC interface.

FUNCTIONAL DESCRIPTION
HI 120

Front Panel



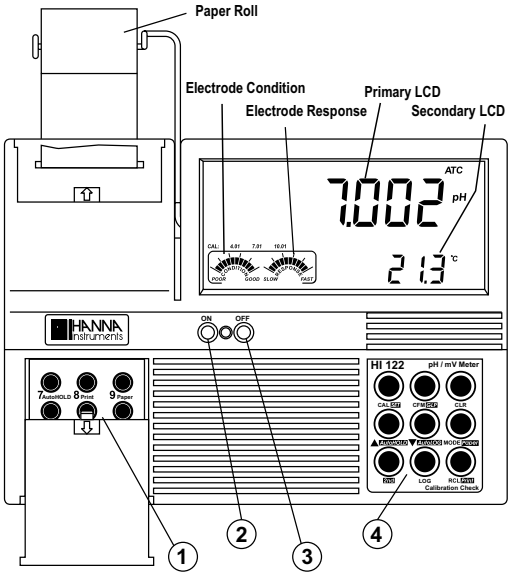
Rear Panel



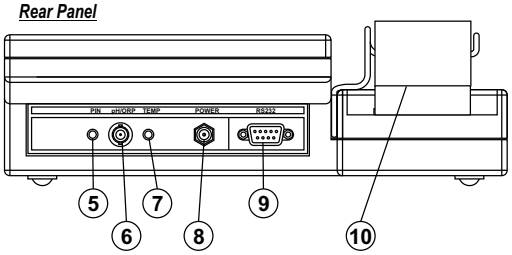
1) Left Keyboard
2) **ON** switch
3) **OFF** switch
4) Right Keyboard
5) Pin input socket
6) BNC electrode connector
7) Temperature probe socket
8) Power adapter socket
9) RS232 serial communication connector

FUNCTIONAL DESCRIPTION
HI 122

Front Panel

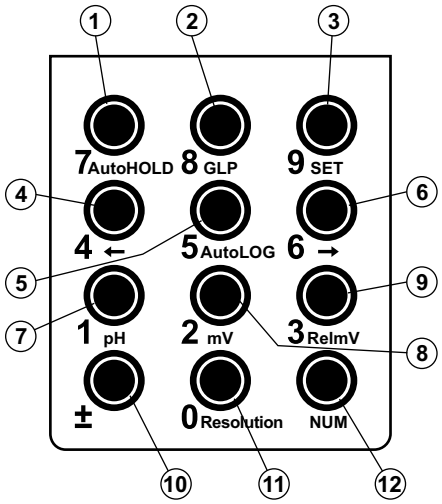


Rear Panel



1) Left Keyboard
2) **ON** switch
3) **OFF** switch
4) Right Keyboard
5) Pin input socket
6) BNC electrode connector
7) Temperature probe socket
8) Power adapter socket
9) RS232 serial communication connector
10) Printer

HI 120
KEYBOARD ON THE LEFT



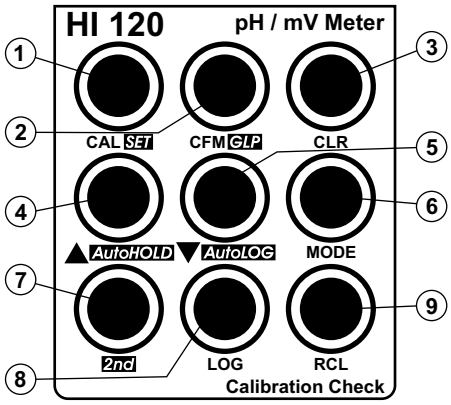
Shortcuts to alternate functions

1) **AutoHOLD** key, to freeze the first stable reading on the LCD.
2) **GLP** key, to display Good Laboratory Practice Information.
3) **SET** key, to enter/exit SETUP mode.
4) ← key, to toggle between parameters while in RECALL or SETUP modifying mode (backwards), to toggle between absolute mV and temperature while in Relative mV mode and between pH buffer and temperature while in pH calibration mode.
5) **AutoLOG** key, to start/stop AutoLOG mode.
6) → key, to toggle between parameters while in RECALL or SETUP modifying mode (forwards), to toggle between absolute mV and temperature while in Relative mV mode and between pH buffer and temperature while in pH calibration mode.
7) **pH** key, to select pH range.
8) **mV** key, to select mV range.
9) **RelmV** key, to select Relative mV range.
11) **Resolution** key, to select pH resolution.

Numerical keys

10) **±** key, to change sign.
12) **NUM** key, to activate the numerical keys (**0** to **9**).

HI 120
MAIN KEYBOARD ON THE RIGHT

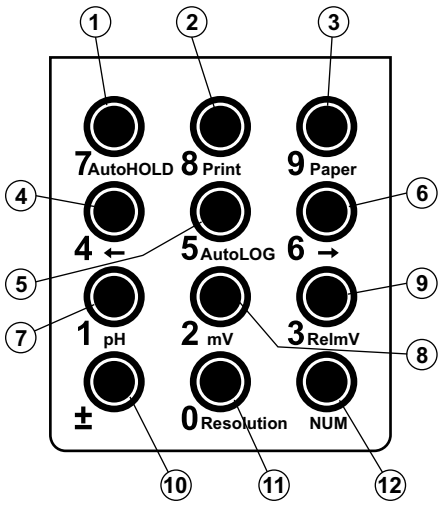


1) **CAL** key, to enter and exit/escape calibration mode.
   SET key (second function), to enter/exit SETUP mode.
2) **CFM** key, to confirm different values.
   GLP key (second function), to display Good Laboratory Practice Information.
3) **CLR** key, to clear calibration or logged data.
4) ▲ key, to manually increase temperature value or other parameters.
   AutoHOLD key (second function), to freeze the first stable reading on the LCD.
5) ▼ key, to manually decrease temperature value or other parameters.
   AutoLOG key (second function), to start/stop AutoLOG mode.
6) **MODE** key, to select the measurement unit or to switch focused data.
7) **2nd** key, to select second key function.
8) **LOG** key, to store measured data.
9) **RCL** key, to enter/exit view logged data mode.

Note: To select second key function, press **2nd** and then the desired key. The "2nd" tag will appear on the LCD until the desired key is pressed. To leave second key function selection, press **2nd** again.

HI 122

KEYBOARD ON THE LEFT



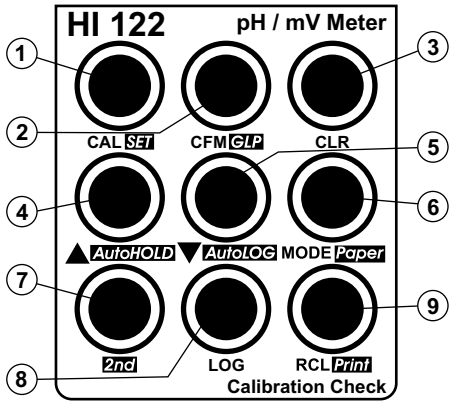
Shortcuts to alternate functions

1) **AutoHOLD** key, to freeze the first stable reading on the LCD.
2) **Print** key, to obtain a printout or to cancel printing.
3) **Paper** key, to pull out the paper.
4) ← key, to toggle between parameters while in RECALL or SETUP modifying mode (backwards), to toggle between absolute mV and temperature while in Relative mV mode and between pH buffer and temperature while in pH calibration mode.
5) **AutoLOG** key, to start/stop AutoLOG mode.
6) → key, to toggle between parameters while in RECALL or SETUP modifying mode (forwards), to toggle between absolute mV and temperature while in Relative mV mode and between pH buffer and temperature while in pH calibration mode.
7) **pH** key, to select pH range.
8) **mV** key, to select mV range.
9) **RelmV** key, to select Relative mV range.
11) **Resolution** key, to select pH resolution.

Numerical keys

10) **±** key, to change sign.
12) **NUM** key, to activate the numerical keys (**0** to **9**).

HI 122
MAIN KEYBOARD ON THE RIGHT



1) **CAL** key, to enter and exit/escape calibration mode.
   SET key (second function), to enter/exit SETUP mode.
2) **CFM** key, to confirm different values.
   GLP key (second function), to display Good Laboratory Practice Information.
3) **CLR** key, to clear calibration or logged data.
4) ▲ key, to manually increase temperature value or other parameters.
   AutoHOLD key (second function), to freeze the first stable reading on the LCD.
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6) **MODE** key, to select the measurement unit or to switch focused data.
   Paper key (second function), to pull out the paper.
7) **2nd** key, to select second key function.
8) **LOG** key, to store measured data.
9) **RCL** key, to enter/exit view logged data mode.
   Print key (second function), to obtain a printout or to cancel printing.

Note: To select second key function, press **2nd** and then the desired key. The "2nd" tag will appear on the LCD until the desired key is pressed. To leave second key function selection, press **2nd** again.

HI 120 AND HI 122 SPECIFICATIONS

RANGE	–2.00 to 16.00 pH –2.000 to 16.000 pH
	±999.9 mV ±2000 mV
	–20.0 to 120.0 °C (–4.0 to 248.0 °F)
RESOLUTION	0.01 pH 0.001 pH
	0.1 mV 1 mV
	0.1 °C (0.1 °F)
ACCURACY @ 20°C / 68°F	±0.01 pH ±0.002 pH
	±0.2 mV (±699.9 mV) ±0.5 mV (±999.9 mV) ±1 mV (± 2000 mV)
	±0.4 °C (±0.7 °F) (excluding probe error)
Relative mV offset range	±2000 mV
pH Calibration	Up to five-point calibration, 7 standard buffers available (1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45), and 2 custom buffers
Temperature compensation	Manual or Automatic from: –20.0 to 120.0 °C (–4.0 to 248.0 °F)
pH Electrode	HI 1131P
Temperature probe	HI 7662
Logging Interval	5 seconds to 180 minutes
Printer (HI 122 only)	Dot matrix, 44 mm wide paper
PC interface	opto-isolated RS232
Input impedance	10^{12} ohm
Power supply	12 VDC adapter
Dimensions	280x203x84 mm (11.0x8.0x3.3")
Weight	1.8 Kg (4.1 lb); kit with printer: 1.9 Kg (4.2 lb)
Environment	0 – 50 °C (32 – 122 °F) max. 95% RH non-condensing
Warranty	2 years

OPERATIONAL GUIDE

POWER CONNECTION

Plug the 12 VDC adapter into the power supply socket.

Notes:
- These instruments use non volatile memory to retain the pH, mV, temperature calibrations and all other settings, even when unplugged.
- Make sure a fuse protects the main line.

ELECTRODE AND PROBE CONNECTIONS

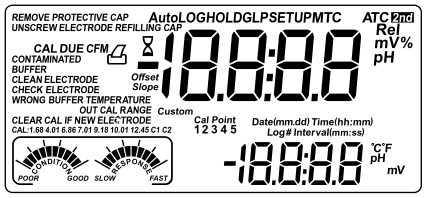
For HANNA P type pH or ORP electrodes (with internal reference) connect the electrode's BNC to the socket on the back of the instrument (#6 on page 4 and 5) and the pin to the appropiate socket (#5 on page 4 and 5).

Notes:
- Electrode condition and response information is displayed on the bar graph gauges during the day the calibration is performed only if HANNA P type (PIN) electrodes are used.
- If the electrode is not recognized as a HANNA P type electrode, the bar graph gauges will blink (25 seconds OFF, 4 seconds ON, full bar graph).

For temperature measurements and automatic temperature compensation, connect the temperature probe to the appropriate socket.

INSTRUMENT START-UP

- Turn the instrument on by pressing the **ON** switch.
- All LCD tags are displayed and a beep is heard while the instrument performs a self test.



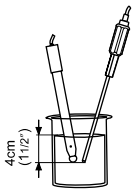
- The instrument displays then the date on the primary LCD and the time on the secondary LCD, along with the "Remove protective cap" and "Unscrew electrode refilling cap" messages alternatively blinking. These messages alert the user to follow displayed instructions in order to take proper measurements and to improve electrode response.
- The instrument automatically defaults to pH or mV measurement mode, if a HANNA P type pH or ORP electrode is detected.
- If no HANNA P type electrode is detected, the instrument starts in the same range as it was at power off.

pH MEASUREMENTS

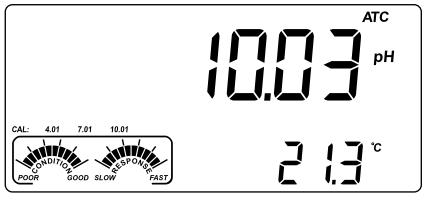
Make sure the instrument has been calibrated before taking pH measurements.

- Press **MODE** to enter pH mode.

Note: To change pH resolution, press **MODE** again or simply **Resolution** from the left keyboard.



- Submerge the electrode tip and the temperature probe approximately 4 cm (1½") into the sample to be tested. Allow time for the electrode to stabilize.
- The pH is displayed on the primary LCD and the temperature on the secondary LCD.



OUT CAL RANGE feature warns the user if the current reading is out of the calibrated area. The calibrated area is that part of the pH range in which the calibration point assures an accurate reading. If the reading is taken out of the calibration area, the "OUT CAL RANGE" message will blink. The calibrated area is calculated in according with the pH resolution used during the reading. To avoid having this message, the calibration points have to be well distributed in the desired measurement range.

If measurements are taken successively in different samples, it is recommended to rinse the electrode thoroughly with deionized water or tap water and then with some of the next sample to prevent cross-contamination and to condition the electrode before immersing it into the sample solution.

The pH reading is affected by temperature. In order to measure the pH accurately, the temperature effect must be compensated for. To use the **Automatic Temperature Compensation** 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.

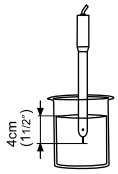
If the temperature of the sample is known, **manual temperature compensation** can be performed by disconnecting the temperature probe. The display will then show the default temperature of 25 °C (77 °F) or the last temperature reading with the "°C" (or "°F") tag blinking. The temperature can be adjusted with the **ARROW** keys or the numerical keypad (from –20.0 °C to 120.0 °C or from –4.0 °F to 248.0 °F).

Press **NUM** to change the temperature value with the numerical keys. The "2nd" tag will blink. Press **CLR** if you want to delete digits of the displayed value. The remaining digits will shift to right. Introduce the desired value. If the value is out of temperature range, a long beep will be heard. Press **NUM** to confirm the new value or CAL to escape without changing the temperature.

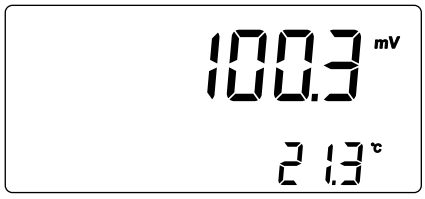
mV/ORP MEASUREMENTS

Oxidation-reduction potential (REDOX) measurements provide the quantification of the oxidizing or reducing power of the tested sample.

To correctly perform a redox measurement, the surface of the ORP electrode must be clean and smooth.



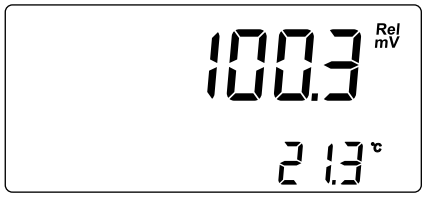
- Press **MODE** or simply **mV** from the left keyboard to enter mV range.
- Submerge the tip of the ORP electrode (4 cm/1½") into the sample to be tested and allow a few seconds for the reading to stabilize.
- The instruments display the mV reading on the primary LCD and the temperature on the secondary LCD.



- If the reading is out of range, the closest full-scale value will be displayed blinking on the primary LCD.

RELATIVE mV MEASUREMENTS

To enter Relative mV mode, press **MODE** or simply **RelmV** from the left keyboard. The relative mV reading will be displayed on the primary LCD and the current temperature value on the secondary LCD.



Note: Press ← or → from the left keypad to toggle between temperature and absolute mV reading on the secondary LCD.

The Relative mV reading is equal to the difference between the absolute mV input value and relative mV offset established in the relative mV calibration.

TEMPERATURE MEASUREMENTS

Connect the HI 7662-T temperature probe to the appropriate socket. Immerse the temperature probe into the sample and allow the reading on the secondary LCD to stabilize.

Note: The temperature can be displayed in Celsius degrees (°C) or in Fahrenheit degrees (°F) (see SETUP for details, page 27).

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.
- If "CAL DUE" tags are blinking during measurement.
- If "OUT CAL RANGE" message blinks during pH measurement (the measurement range is not covered by current calibration).

PREPARATION

Pour small quantities of the buffer solutions into clean beakers. If possible, use plastic or glass 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 first buffer and pH 4.01 or 1.68 as second buffer. If you are measuring in the alkaline range, use pH 7.01 or 6.86 as first buffer and pH 10.01/9.18 or 12.45 as second buffer.

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

PROCEDURE

If 0.001 pH resolution is selected, each selected standard buffer value can be updated in according with the value on the production lot certificate at 25 °C (77 °F). Press **2nd** then **SET** key when a standard pH buffer with 0.001 resolution is selected. The buffer value will start blinking and it can be changed with the ARROW keys in a ±0.020 pH window.

Calibration has a choice of 7 memorized buffers: pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45 and 2 custom buffers.

The custom buffers are a special option that allows the user to calibrate in a buffer solution different from a standard one. Up to two custom buffers can be set in SETUP menu (see page 27). When selected during calibration, the "CUSTOM C1" or "CUSTOM C2" tags are displayed on the LCD and the custom buffer value can be changed in a ±1.0 pH window, around the set value.

For accurate measurements it is recommended to perform a five-point calibration. However, at least a two-point calibration is suggested.

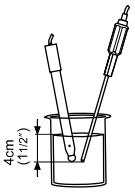
The instruments will automatically skip the buffers used during calibration and the buffers which are in a ±0.2 pH window, around one of the calibrated buffers.

All new calibrations will override existing stored calibration data, in a ±0.2 pH window, at these calibration points. The slopes adjacent to the calibration points will be reevaluated.

If the new calibration point has no correspondence in the existing stored calibration data, it is added to it if this is not full, or the instrument will ask which buffer will be replaced by the current buffer.

If at least a two-point calibration has been performed and an offset correction of the electrode is desired, keeping unchanged the existing slopes, perform a one-point calibration with "OFFS" option selected in SETUP menu. If "Pnt" option is selected, the slopes adjacent to the calibration points will be reevaluated.

FIVE-POINT CALIBRATION



- Immerse the pH electrode and the temperature probe approximately 4 cm (1½") into a buffer solution of your choice (pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45, custom buffer 1 or 2, if these were set) and stir gently. The temperature probe should be close to the pH electrode.

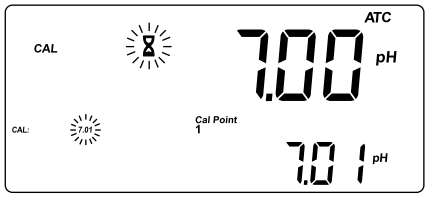
- Press **CAL**. The "CLEAR CAL IF NEW ELECTRODE" message will be displayed blinking on the LCD for a few seconds if the instrument was calibrated before and calibration was not cleared.

  Press **CLR** if you are using a new electrode or want to clear calibration history, or wait a few seconds to continue.

  Press **CAL** again or the **ARROW** keys to skip this message.

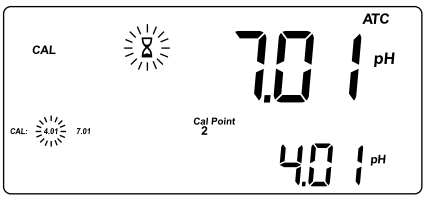
  Note: It is very important to clear calibration history when a new electrode is used because most errors and warning messages that appear during calibration depend on calibration history.

- The instruments will display the measured pH on the primary LCD and the "7.01" buffer on the secondary LCD, together with "CAL" and "Cal Point 1" tags and "7.01" tag blinking.



- If necessary, press the **ARROW** keys to select a different buffer value.

- The "⧖" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, "CFM" tag blinks.
- Press **CFM** to confirm calibration.
- The calibrated value is then displayed on the primary LCD and the secondary LCD will display the second expected buffer value, together with "CAL", "Cal Point 2" and "7.01" tags and the corresponding buffer tag blinking.



- After the first calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 4 cm (1½") into the second buffer solution and stir gently. The temperature probe should be close to the pH electrode.
- If necessary, press the **ARROW** keys to select a different buffer value.
- The "⧖" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, "CFM" tag blinks.
- Press **CFM** to confirm calibration.
- The calibrated value is then displayed on the primary LCD and the secondary LCD will display the third expected buffer value.
- After the second calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 4 cm (1½") into the third buffer solution and stir gently. The temperature probe should be close to the pH electrode.
- If necessary, press the **ARROW** keys to select a different buffer value.
- The "⧖" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, "CFM" tag blinks.
- Press **CFM** to confirm calibration.
- The calibrated value is then displayed on the primary LCD and the secondary LCD will display the fourth expected buffer value.

- After the third calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 4 cm (1½") into the fourth buffer solution and stir gently. The temperature probe should be close to the pH electrode.
- If necessary, press the **ARROW** keys to select a different buffer value.
- The "⧖" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, "CFM" tag blinks.
- Press **CFM** to confirm calibration.

- The calibrated value is then displayed on the primary LCD and the secondary LCD will display the fifth expected buffer value.
- After the fourth calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 4 cm (1½") into the fifth buffer solution and stir gently. The temperature probe should be close to the pH electrode.
- If necessary, press the **ARROW** keys to select a different buffer value.
- The "⧖" tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, "CFM" tag blinks.
- Press **CFM** to confirm calibration.

- The instruments store the calibration values and return to normal measurement mode.

FOUR, THREE or TWO-POINT CALIBRATION

- Proceed as described in "FIVE-POINT CALIBRATION" section.
- Press **CAL** after the appropriate accepted calibration point. The instruments will return to measurement mode and will memorize the calibration data.

ONE-POINT CALIBRATION

Two SETUP selectable options are available: "Pnt" and "OFFS".

If the "Pnt" option is selected, the adjacent slopes will be reevaluated.

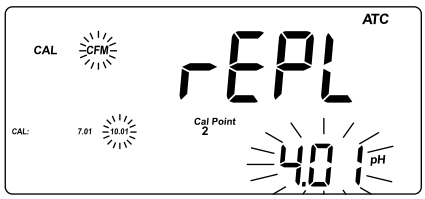
If the "OFFS" option is selected, an electrode offset correction is performed keeping unchanged the existing slopes.

- Proceed as described in "FIVE-POINT CALIBRATION" section.
- Press **CAL** after the first calibration point was confirmed. The instruments will memorize the one-point calibration data and will return to measurement mode.

Notes:
- Press **MODE** or ←/→ from the left keyboard to toggle between pH buffer and temperature reading during calibration.
- Each time a buffer is confirmed, the new calibration parameters replace the old calibration parameters of the corresponding buffer.

  If current confirmed buffer has no correspondence in the existing stored calibration and this is not full, the current buffer is added to the existing stored calibration.

If the existing stored calibration is full (five calibration points), the instrument asks which buffer will be replaced by current buffer.

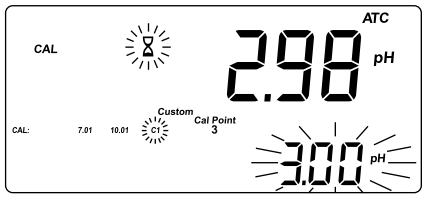


Press the **ARROW** keys to select another buffer to be replaced.
Press **CFM** to confirm the buffer that will be replaced.
Press **CAL** to leave calibration without replacing.

Note: The replaced buffer is not removed from calibration list and it can be selected for the next calibration points.

WORKING WITH CUSTOM BUFFERS

If at least one custom buffer was set in SETUP menu, it can be selected for calibration by pressing the **ARROW** keys. Press **2nd** then **SET** key if you want to adjust the buffer value. The buffer value, displayed on the secondary LCD, will start blinking.



Use the **ARROW** keys to change the buffer value.

After about 5 seconds you performed the last change, the buffer value is updated. Press **2nd** then **SET** key if you want to change it again.

Note: Custom buffer value can be adjusted in a ±1.00 pH window, around the set value.

CLEAR CALIBRATION

Press **CLR** in any moment during calibration. The "CLEAR CAL" tag will appear and "donE" message will be displayed on the secondary LCD.

All old calibrations, starting with current selected buffer are cleared and the instrument continues calibration.

If **CLR** is pressed when "CLEAR CAL IF NEW ELECTRODE" message is displayed blinking, the calibration history is deleted and the instrument will display "hiSt" message on the primary LCD and "donE" message on the secondary LCD, along with "CLEAR CAL" tags. The calibration process will continue starting with 7.01 pH buffer as first buffer.

Note: If **CLR** is pressed during the first calibration point, the instrument returns to measurement mode.

ENHANCED CALIBRATION MESSAGES

The stored calibration history to used issue error and warning messages during calibration to help ensure the highest accuracy.

As electrode aging is normally a slow process, substantial changes from previous calibrations are likely due to a temporary problem with the electrode or buffers. Calibrating under these conditions will result measurement errors.

ERROR MESSAGES

Error messages appear if one or all of the calibration parameters are out of accepted windows. When these messages are displayed, calibration cannot be confirmed.

WRONG BUFFER

This message appears when the difference between the pH reading and the value of the selected buffer is too big. If this error message is displayed, check if you have selected the proper calibration buffer.

WRONG BUFFER TEMPERATURE

This message appears if the temperature of the buffer is outside the defined buffer temperature range.

WRONG & CONTAMINATED BUFFER / CHECK ELECTRODE

This message appears if the buffer used is contaminated or the electrode is supposed to be either broken or very dirty.

WRONG & CHECK ELECTRODE / CLEAN ELECTRODE

This message appears if the electrode is supposed to be broken or very dirty.

WRONG & OLD / CLEAR CAL & OLD

This message appears as a result of an erroneous slope condition. If the slope between current calibration point and one of the previous calibration, that was not overriden in current calibration, exceeds slope window (80% to 110%), this message will appear. Press **CLR** to clear old parameters and continue calibration process or **CAL** to leave calibration.

WARNING MESSAGES

During calibration, the Calibration Check feature analyzes the electrode calibration history and warns the user when problems have been detected. It is possible to override the warning messages and confirm the calibration but it is not recommended.

CLEAR CAL IF NEW ELECTRODE

This warning is displayed any time you enter calibration and calibration is not cleared or the new calibration parameters are better than the previous ones. You can clear calibration history by pressing **CLR**, or continue by pressing **CAL**.

CLEAN ELECTRODE

This warning message appears in order to alert the user that some dirt or deposits could be on the electrode. Refer to the electrode Cleaning Procedure. This ensures the removal of film, dirt or deposits on the glass bulb and reference junction.

CONTAMINATED BUFFER

This warning message appears in order to alert that the buffer could be contaminated. Refresh your buffer and continue the calibration procedure.

CHECK ELECTRODE / CHECK BUFFER

This warning message appears when the electrode slope exceeds the highest accepted slope limit (110%). Check your electrode and use fresh buffers.

CLEAN ELECTRODE / CHECK BUFFER

This warning appears in order to alert the user that the electrode can be dirty or the buffer contaminated. Refer to the electrode Cleaning Procedure and use fresh buffers.

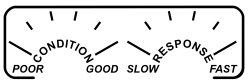
ELECTRODE CONDITION & ELECTRODE RESPONSE TIME

When using an appropriate HANNA BNC electrode with pin, the instrument will assess electrode condition and response time during each calibration and will display the calibration status for the rest of the day.

The digital gauge for electrode condition is a representation of the offset and slope performance of the electrode. The response gauge is a function of the stabilization time between the first and second calibration buffers. These gauges reflect electrode performance and should be expected to slowly decrease over the life of the electrode.

The condition and response gauges show the electrode's condition at the time of calibration only and are displayed for the rest of the day the calibration is performed. For a continuous display of electrode condition at the time of calibration, daily calibration is necessary. The electrode condition and response time are also visible when viewing GLP data.

If the instrument is not calibrated, it has been calibrated only in one point, or if calibration history was deleted, the electrode condition and response gauges will be empty.



The electrode response is evaluated only when calibration has been performed using pH 7.01 or pH 6.86, pH 4.01 and pH 10.01 or pH 9.18 buffers. When the instrument cannot evaluate the electrode response or pH 1.68/12.45 buffer was used as calibration buffer, the response gauge will be empty.

If the electrode is in a very poor condition, the first condition segment will blink.
If the electrode response is very slow, the first response segment will blink.

RELATIVE mV CALIBRATION

- Press **CAL** when the instrument is in RELATIVE mV measurement mode. The relative mV value is displayed on the primary LCD and the absolute mV value on the secondary LCD.
- Use the **ARROW** keys or the numerical keys if you want to change the displayed relative mV value.

Notes:
- Press **MODE** to select another resolution if the displayed value allows it (e.g. if 199.9 is displayed, by pressing **MODE** the value will change to 1999; if 19.9 is displayed, nothing will happen if pressing **MODE**).
- Pressing **CLR** the displayed value is set to 0.0 mV.
- Press **NUM** from the left keyboard if you want to change the value using the numerical keys. The "2nd" tag will blink.
- Press **CLR** to delete the last digit.
- Press **MODE** to select another resolution (see above).
- Press **NUM** again to leave the numerical keyboard.

- When the reading is stable, in mV range and the Relative mV offset is inside the offset window (±2000 mV), "CFM" tag blinks.
- Press **CFM** to confirm relative mV calibration. The instrument will return to measurement mode.
- If the absolute mV reading is out of range or the Relative mV offset is out of the offset window, "WRONG" tag will blink. Change the input value or the Relative mV offset to complete the calibration process.

GOOD LABORATORY PRACTICE (GLP)

GLP is a set of functions that allows storage and retrival of data regarding the maintenance and status of the electrode.

All data regarding pH and Rel mV calibration is stored for the user to review when necessary.

CALIBRATION ALARM TIME OUT

For pH calibration, all the instruments allow the user to set the number of days before the next required pH calibration. This value can be set from 1 to 7 days. The default setting is **OFF** (disabled).

The instrument checks if the time-out has expired. If the time elapsed, "CAL DUE" tags will blink as a reminder.

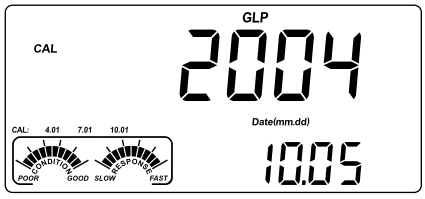
Note: If the instrument was not calibrated or all calibration parameters were cleared, "CAL" "DUE" tags will be displayed even if the feature is disabled in SETUP menu.

LAST pH CALIBRATION DATA

The last pH calibration data is stored automatically after a successful calibration.

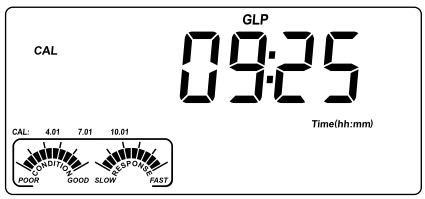
To view the pH calibration data, press **2nd** then **GLP** key or simply **GLP** from the left keyboard (**HI 120**) when the instrument is in pH (mV) measurement mode.

The instrument will display the date (yyyy.mm.dd) of the last calibration.

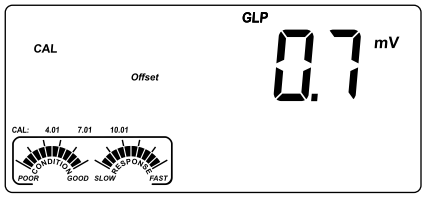


Press the **ARROW** keys to view the next calibration parameter (pressing the ▲ key):

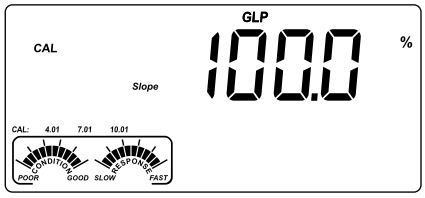
- The time (hh:mm) of the last calibration.



- The pH calibration offset.

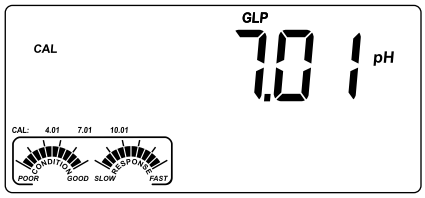


- The pH calibration slope (the GLP slope is the average of the calibration slopes; the percentage is referred to the ideal value of 59.16 mV/pH).

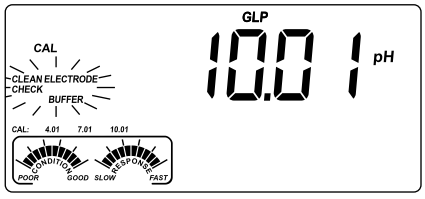


- The calibration buffers in calibrating order, with the corresponding warnings.

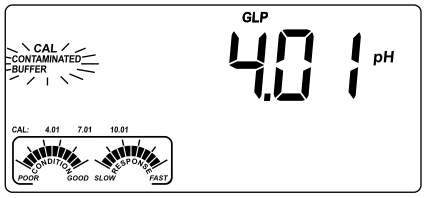
  The first pH calibration buffer:



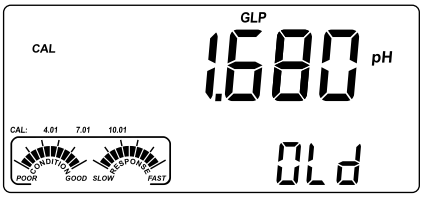
  The second pH calibration buffer:



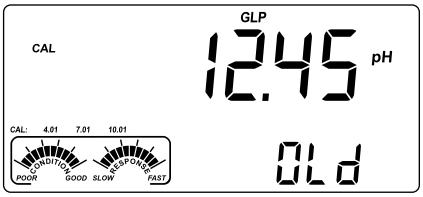
  The third pH calibration buffer:



The fourth pH calibration buffer:



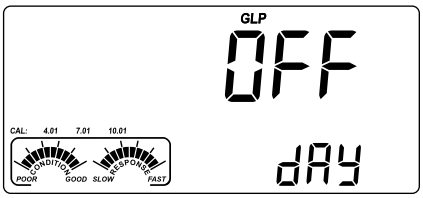
The fifth pH calibration buffer:



Notes:
- The "OLd" message displayed beside the pH value means that this buffer was not used during last calibration. Press **2nd** then **SET** key if you want to see calibration date (or time, if old calibration was performed in the same day with current calibration).
- Each calibration buffer is displayed with the resolution from calibration moment.
- If "no bUF" message appears on the LCD, the instrument informs you that calibration was performed in less than five points.

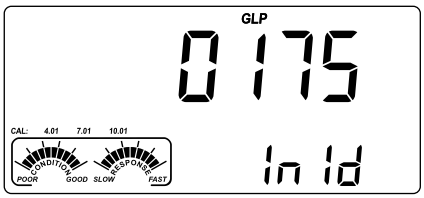
- The Calibration Alarm Time Out status.

  If disabled,



  or the number of days until the calibration alarm will be displayed (e.g. 5 days), or from the time calibration expired (e.g. –3 days).

- The instrument ID.



LAST RELATIVE mV CALIBRATION DATA

Last Relative mV calibration data is stored automatically after a successful calibration.

To view the Relative mV calibration data, press **2nd** then **GLP** key or simply **GLP** from the left keyboard (**HI 120**) while in Relative mV measurement mode.

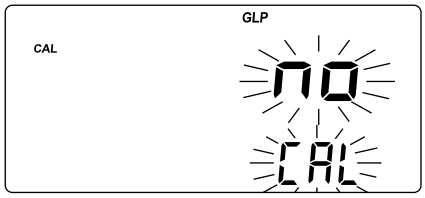
The instrument will display the Relative mV GLP information.

- The date (yyyy.mm.dd) of the last calibration as in pH GLP mode.

Press the **ARROW** keys to view the next logged calibration parameter (pressing the ▲ key):

- The Relative mV calibration offset and time (hh:mm) as in pH GLP mode.
- The instrument ID as in pH GLP mode.

Notes:
- Press **2nd** then **GLP** key at any moment and the instrument will return to measurement mode.
- If calibration has not been performed, the instrument displays "no CAL" message blinking.



SETUP

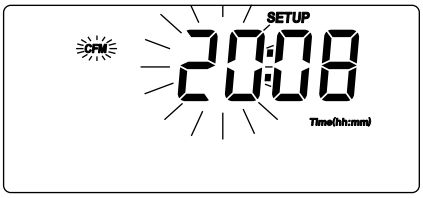
Setup mode allows viewing and modifying the following parameters:

- Calibration Alarm Time Out
- One-point calibration behaviour
- Custom Buffer 1
- Custom Buffer 2
- Alarm High Limit
- Alarm Low Limit
- AutoLOG Start Condition
- AutoLOG End Condition
- AutoLOG Interval
- Temperature Unit
- Current Date (yyyy.mm.dd)
- Current Time (hh:mm)
- Printing Language (**HI 122** only)
- Printer Status (**HI 122** only)
- Beep Status
- Baud Rate (serial communication)
- Command prefix (serial communication)
- Instrument ID

To enter SETUP mode, press **2nd** then **SET** key, or simply **SET** from the left keyboard (**HI 120** only), while the instrument is in measurement mode.

Select the desired setup parameter using the **ARROW** keys.

Press **CAL** if you want to change the item value. The selected item (e.g. hour, in setting up the correct time) and "CFM" tag will start blinking.

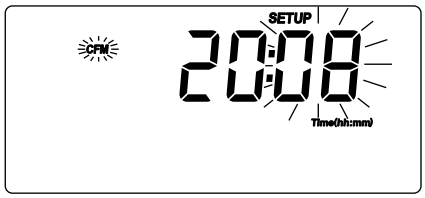


Press the **ARROW** keys to change the displayed value or simply use the numerical keys for all numerical parameters.

Note: To use the numerical keys, press **NUM** from the left keyboard. The "2nd" tag will blink. Set the desired number digit by digit. The new introduced digit is always the last one. All the previous digits will shift to left.

To delete digits press **CLR**. Last introduced digit will be deleted and the number will shift to right.

If there is another item to be set (e.g. minutes), press **MODE** or ←/→ from the left keyboard. The other item will start blinking.



Press the **ARROW** keys to change the displayed value or simply use the numerical keys for all numerical parameters.

Press **CFM** to confirm or **CAL** to escape.

Press the **ARROW** keys to select the next/previous parameter.

Press **2nd** then **SET** key, or simply **SET** from the left keyboard (**HI 120** only) to exit SETUP menu at any time. The instrument asks for printing a Setup Report (**HI 122** only). Press **CFM** to print the Setup Report or **CAL** to return to measurement mode.

The following table lists the SETUP parameters, their valid values range and the factory settings (default):

Item	Description	Valid values	Default
CAL DUE	Alarm Time Out	OFF or 1 to 7 days	OFF
1Pnt	One-point cal. behaviour	Pnt or OFFS	Pnt
CustomC1	Custom Buffer 1	-2.00 to 16.00 pH	no
CustomC2	Custom Buffer 2	-2.00 to 16.00 pH	no
AL.HI	Alarm High Limit	pH/mV/RelmV ranges	no
AL.LO	Alarm Low Limit	pH/mV/RelmV ranges	no
Strt	AutoLOG Start Condition	See Time/Date or "btn"	"btn"
End	AutoLOG End Condition	"dur", "SAMP", "rdG"	"dur"
Interval	AutoLOG Interval	5 s to 180 min	5 s
tEMP	Temperature Unit	°C or °F	°C
Date	Date (yyyy.mm.dd)	2000.01.01 to 2099.12.31	2004.01.01
Time	Time (hh:mm)	00:00 to 23:59	00:00
LAnG	Printing Language	EnG, ItA, ESP, FrA	English USA
🖷	Printer Status	ON/OFF	OFF
bEEP	Beep Status	ON/OFF	OFF
bAUd	Baud Rate	600; 1200; 2400; 4800; 9600	2400
PrEF	Command Prefix	0 to 47	16
In Id	Instrument ID	0000 to 9999	0000

Notes:
- The custom buffers can be set only with 0.001 pH resolution. If 0.01 pH resolution is selected during calibration, the displayed custom buffer value is a rounded one.
- For calibration alarm time out, custom buffers, alarm limits, start and stop condition items, if pressing **CLR** while in changing mode, the selected item will be set to default.
- Printer status and printing language items appear only for **HI 122**. The available printing languages are: **EnG** (English), **ItA** (Italiano), **ESP** (Español) and **FrA** (Français).

ALARMS SETUP

- Select one of the alarm items. The displayed alarm value will be the previous set one.
- Press **MODE** to select the range for alarm. The corresponding range tag will blink.
- Press **CAL** to enter in changing mode. Set the new value using the **ARROW** or the numerical keys.

Notes:
- Press **MODE** while in changing mode to select another resolution if the displayed value allows it (e.g. if 199.9 is displayed, by pressing **MODE** the value will change to 1999; if 19.9 is displayed, nothing will happen if pressing **MODE**).
- Pressing **CLR** the displayed value will be set to default ("no"). The first displayed value after "no", if one of the **ARROW** keys is pressed, will be 7.00 pH or 0.0 mV, in according with the selected range.
- Press **NUM** from the left keyboard if you want to change the value using the numerical keys. The "2nd" tag will blink.
- Press **CLR** to delete the last digit.
- Press **MODE** to select another resolution (see above).
- Press **NUM** or **CFM** to confirm the introduced value from the numerical keyboard.

When in normal measurement mode:

- If only "AL.LO" item is set, the instrument will beep when the reading is below alarm low value.
- If only "AL.HI" item is set, the instrument will beep when the reading is above alarm high value.
- If both alarms are set, the instrument will beep when the reading is above alarm high value or below alarm low value.

Note: If "AL.HI" item is less than or equal to "AL.LO" item, "WRONG" tag will blink.

AutoLOG SETUP

AutoLOG Start Condition

- Select the "Strt" item. The displayed AutoLOG start condition will be the previous set one. The default value is "btn" – button (start with key).
- Press and keep hold down **MODE** while in view mode, when time is displayed, to view the set date.
- If pressing CAL while in view mode, the start time will be displayed.

Notes: • Pressing **CLR** while in changing mode, the start condition will be set to default ("btn").
• The first displayed value after "btn" will be the current time/date.

AutoLOG End Condition

- Select the "End" item. The displayed AutoLOG end condition will be the previous set one. One of the following options will be available: "dur" (duration), "SAMP" (samples number), "rdG" (reading limits).
- Pressing **MODE** while in view mode, the instrument will display one of the options: "dur", "SAMP", "rdG" & "pH", "rdG" & "mV", "rdG" & "Rel mV".
- Pressing CAL, the instrument will enter in changing mode in according with the selected option and will display one of the following messages:
  - **"dur"** on the secondary LCD and duration (hh:mm) on the primary LCD, along with "TIME" tag. The default value is 3 hours. The duration can be set from 1 minute to 199 hours and 59 minutes.
    Note: Pressing **CLR** while in changing mode, the end condition value will be set to default (3 hours).
  - **"SAMP"** on the secondary LCD and sample number on the primary LCD. The default value is 1000 samples.
    Note: Pressing **CLR** while in changing mode, the end condition value will be set to default (1000 samples).
  - **"rdG"** on the secondary LCD and last set limit value on the primary LCD, with the corresponding range tag blinking. The default value is 7.00 pH or 0.0 mV, in according with the selected range.
    Notes: • Pressing **MODE** while in view mode, another resolution is selected.
    • Pressing **CLR** while in changing mode, the end condition will be set to default (7.00 pH or 0.0 mV).

The AutoLOG will be started in according with "Strt" item, from button ("btn") by pressing **AutoLOG** or when the starting time condition is reached.

The AutoLOG will stop in according with the selected option for "AutoLOG End Condition" item or when **AutoLOG** is pressed.

LOGGING

This feature allows the user to log pH and Rel mV, together with temperature automatically. All logged data can be transferred to a PC through the RS232 port.

The maximum logging space is 1000 record locations (samples). This can be divided in 1 up to 50 lots (one lot can use all the free space). The lot ID (number) is between 1 and 99 (after 99 it restarts from 1). Only up to 50 lots can be memorized at one time, even if there is free space available.

Note: When the logged lots are more than one, the total number of samples can be less than 1000, even with full memory, due to the fact that logging memory is divided in pages of 20 samples each.

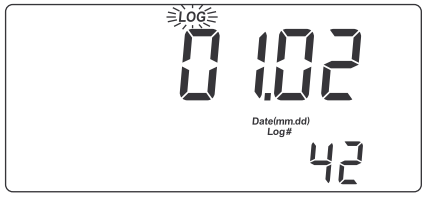
The appropriate logging interval can be set from 5 seconds to 180 minutes (see SETUP for details, page 27).

Up to 50 record locations are also provided.

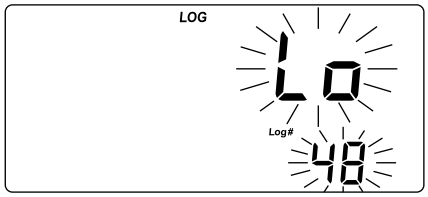
LOGGING THE CURRENT DATA (LOG ON DEMAND)

To store the current reading into memory, press LOG while in measurement mode.

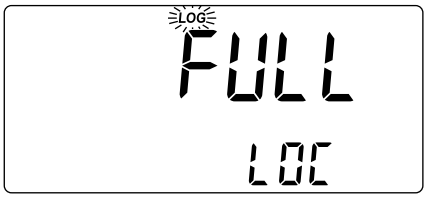
The instrument will display the current date (mm.dd) on the primary LCD, the record number on the secondary LCD, the "LOG" tag blinking for a few seconds and then the free locations number.



If there are less than 6 memory locations remaining, the record number and "Lo" message will blink for a few seconds to alert the user and then the free locations number is displayed on the LCD.



If the LOG space is full, "FULL LOC" message will be displayed on the LCD for a few seconds with "LOG" tag blinking, and then "FrEE 0" message.



The instrument returns to normal measurement mode.

AutoLOGGING

The setable AutoLOG modes make these instruments very useful in a wide range of applications:

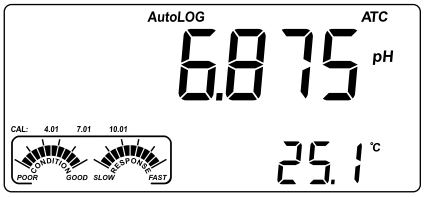
- Start at button or set time/date; stop after a set duration.
- Start at button or set time/date; stop when a set value is reached.
- Start at button or set time/date; stop when a set sample number is reached.

To start autologging using the keyboard, press **2nd** then **AutoLOG** key or simply **AutoLOG** from the left keyboard while the instrument is in measurement mode.

The instrument will display for a few seconds the lot number on the primary LCD and the AutoLOG interval on the secondary LCD, together with "AutoLOG" tag.

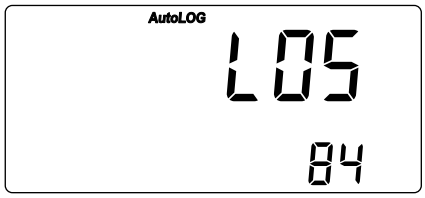
Notes:
- For the other AutoLOG modes, the autologging starts/stops automatically after the set start/stop condition in SETUP menu is reached and the stop condition is correct.
- The "AutoLOG" tag will blink if one of these modes is selected and the start condition is not reached.

After data logging is started, the current value is displayed on the primary LCD and the temperature on the secondary LCD, along with "AutoLOG" tag.



To stop autologging, press **2nd** then **AutoLOG** key again, or simply **AutoLOG** from the left keyboard.

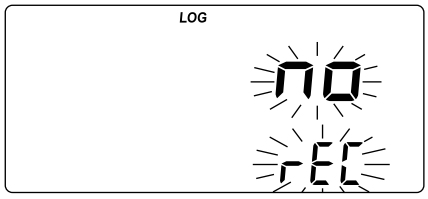
The instrument will display for a few seconds the lot number on the primary LCD and the sample number on the secondary LCD, together with "AutoLOG" tag, and will return to measurement mode.



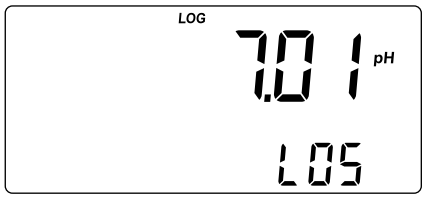
Notes:
- If printer is ON, each logged sample is printed only if the AutoLOG interval is at least 30 s (**HI 122** only).
- If the AutoLOG pages are full, the "FULL LOC" message will be displayed on the LCD, as in Log on demand mode.

VIEW LOGGED DATA

Press **RCL** to retrieve the information stored while in measurement mode.
If no data were logged, the instrument displays:



Otherwise, the instrument will display the last **pH** or **Rel mV** memorized reading on the primary LCD and the lot number on the secondary LCD.



Note: If LOG mode was invoked while the instrument was in mV/Relative mV measurement range, the corresponding memorized reading will be displayed on the primary LCD, along with "RelmV" tag.

Press **2nd** then **SET** key while in RECALL mode and the instrument will toggle between the lot or record number on the secondary LCD. Use the **ARROW** keys to select another lot or record.

Press **MODE** or → from the left keyboard and the instrument will display the next logged parameter as shown in the table below:

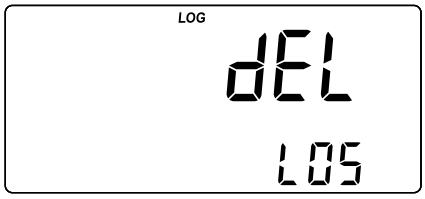
Parameter	Primary LCD	Secondary LCD
mV	mV reading	Temperature
TIME	Hour & minutes	Seconds
DATE	Year	Month & day
OFFSET	Offset value	Lot (or record) number
SLOPE	Slope value	Lot (or record) number

Notes: • If pressing ← from the left keyboard, the previous logged parameter will be displayed.

• If in Rel mV RECALL mode regarding the slope, the instrument will display "----" message on the primary LCD.

• The record number refers to an identification number inside a lot.

Last displayed parameter is "dEL" message on the primary LCD and the lot number on the secondary LCD.



Notes: • The "LdM" message on the secondary LCD shows that data has been stored in Log on demand mode.

• Pressing **2nd** then **SET** key, the instrument toggles between lot number, record number (Log on demand only) or all lots.

• Press **CLR** to delete the selected lot/record or all lots.

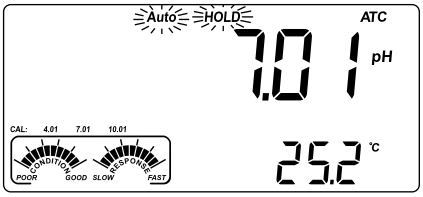
Note: Positions remain free in the Log on demand lot by deleting the last logged samples or all the lot.

• If "dEL ALL" option was selected, all logged data is deleted and the instrument returns to measurement mode.

Press **RCL** at any time to return to measurement mode.

AutoHOLD

To freeze the first stable reading on the LCD press **2nd** then **AutoHOLD** key, or simply **AutoHOLD** from the left keyboard while the instrument is in measurement mode. The "Auto" "HOLD" tags will be displayed blinking on the LCD until the reading will stabilize.



When the reading is stable, the "Auto" "HOLD" tags stop blinking and the reading is frozen.

Press **2nd** then **AutoHOLD** key again, or simply **AutoHOLD** from the left keyboard to return to normal measurement mode.

Note: Pressing **MODE** or the specific range keys from the left keyboard, the instrument will skip to the displayed range, without leaving AutoHOLD mode. The **LOG** key also holds AutoHOLD mode.

Pressing **2nd** then **SET**, **GLP** or **RCL** key, the instrument leaves AutoHOLD mode and performs the selected function.

PRINTING (HI 122 only)

A complete set of information based on the measured, set or recorded data can be printed.

Data can be printed on demand (for current reading in measurement mode, GLP and SETUP modes) by pressing **2nd** then **Print** key, or simply **Print** from the left keyboard, or automatic (for AutoLOG and Log on demand modes).

Automatic data printing is possible in AutoLOG mode only if the printer is ON and the AutoLOG interval is greater than 30 seconds.

Note: To cancel printing, press **2nd** then **Print** key again or simply **Print** from the left keyboard.

When in pH measurement mode, the printout provides the following information:

```
Date  2004/10/15
Time    14:24:55
pH          7.00
mV           0.0
°C          25.0
```

Note: For Relative mV measurement mode, the Rel. mV value will be printed.

When in GLP mode, the printout provides the following information:

- For pH range:

```
      GLP pH
Instr ID    0002
Date  2004/10/15
Time    15:30:05
Cal Time Out OFF
Offset     0.6mV
Slope      99.7%
Cal Buffers
pH          7.01
pH          4.01
pH         10.01
```

- For Rel mV range:

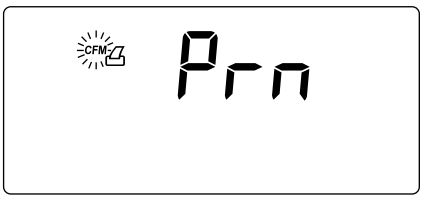
```
    GLP Rel mV
Instr ID    0002
Date  2004/10/15
Time    14:20:05
Off.RelmV    0.3
```

When in SETUP mode, the following information can be printed:

- If **2nd** then **Print** key are the first keys pressed after entering SETUP mode, a SETUP table of contents will be printed:

```
INSTRUMENT SETUP
Calibration
 Alarm Time Out
One-point cal
 behaviour
pH Custom Buf.1
pH Custom Buf.2
Beep Alarms:
 Alarm high
 Alarm low
AutoLOG:
 Start condition
 End condition
 Interval
Current Date
Current Time
Printing
 Language
Printer ON/OFF
Beep ON/OFF
Baud rate
Command prefix
Instrument ID
Active Keys:
▲  -next item
▼  -prev. item
CAL-enter in
  modifying mode
SET-exit SETUP
MODE-select
    parameter
 See also items
 Help printings
```

- When exiting SETUP mode, the instrument asks if a SETUP REPORT shall be print. The "Prn" message will be displayed on the LCD, together with "🖨" tag and "CFM" tag blinking.



- Press **CFM** to print the SETUP REPORT or **CAL** to escape without printing.

```
   SETUP REPORT
Instr ID    0002
Cal Time Out OFF
One-Cal Point
           Pnt
Custom Buffer
Cb1         3.00
Cb2  Not defined
Date  2004/10/15
Time    16:25:31
Printer       ON
Language     ENG
Beep          OFF
ALARM HIGH LIMIT
pH             no
mV             no
Rel mV         no
ALARM LOW LIMIT
pH             no
mV             no
Rel mV         no
AUTOLOG:
Interval   00:30
START Condition:
Date  2004/10/15
Time    16:20:00
END Condition:
Sample No     20
```

When in SETUP mode, if pressing **CAL**, then **Print** for a chosen parameter, a help printout will come out, providing the following information (e.g. AutoLOG Interval):

```
    SET AUTOLOG
     INTERVAL
   (5s to 180min)
Active Keys:
▲  -increment
▼  -decrement
CAL-exit,no save
MODE-select
    parameter
CFM-save & exit
```

When in LOG mode, a printout will automatically come out, providing the following information:

- For pH/mV Log on demand:

```
   LOG ON DEMAND
Instr ID    0002
Date  2004/10/15
Time    17:38:25
Sample No      5
pH          7.01
mV           0.0
°C          25.0
Offset     0.9mV
Slope      99.7%
```

- For AutoLOG mode:

```
  START AUTOLOG
Instr ID    0002
Lot          L03
Date  2004/10/15
Time    18:05:01
Interval   00:30
Slope      99.7%
Offset     0.1mV


Sample No      1
pH          7.02
mV          -0.5
°C          25.0


Sample No      2
pH          7.01
mV          -0.2
°C          25.0


Sample No      3
pH          6.97
mV           1.9
°C          24.9


  STOP AUTOLOG
Date  2004/10/15
Time    18:06:51
```

Note: If selecting a different printing language, all data will be print in the selected language.

TEMPERATURE CALIBRATION (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 below.

- Prepare a vessel containing ice and water and another one containing hot water (at approximately 50 °C or 122 °F). Place insulation material around the vessels to minimize temperature changes.
- Use a calibrated thermometer with a resolution of 0.1 °C or 0.1 °F as a reference thermometer. Connect the **HI 7662-T** temperature probe to the appropriate socket.
- With the instrument off, press and hold down the **CAL** & ▲ keys, then power on the instrument. The "CAL" tag will appear and the secondary LCD will show 0.0 °C or 32.0 °F. The primary LCD will display the measured temperature or the "----" message, if the measured temperature is out of range.
- Immerse the temperature probe into the vessel with ice and water as close as possible to the reference thermometer. Allow a few seconds for the probe to stabilize.
- Use the **ARROW** keys to set the reading on the secondary LCD to that of ice and water, measured by the reference thermometer. When the reading is stable and close to the selected calibration point, "CFM" tag will blink.

- Press **CFM** to confirm. The secondary LCD will display 50.0 °C or 122.0 °F.

- Immerse the temperature probe into the second vessel as close as possible to the reference thermometer. Allow a few seconds for the probe to stabilize.
- Use the **ARROW** keys to set the reading on the secondary LCD to that of the hot water.
- When the reading is stable and close to the selected calibration point, "CFM" tag will blink.

- Press **CFM** to confirm. The instrument returns to measurement mode.

Note: If the reading is not close to the selected calibration point, "WRONG" tag will blink. Change the temperature probe and restart calibration.

mV CALIBRATION (for technical personnel only)

All the instruments are factory calibrated for mV.

Hanna's ORP electrodes are interchangeable and no mV calibration is needed when they are replaced.

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

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

A two or three-point calibration can be performed at 0.0 mV, 600.0 mV and 1800.0 mV.

- Attach to the BNC connector (#6 on page 4 and 5) a mV simulator with an accuracy of ±0.1 mV.
- With the instrument off, press and hold down the **CFM & LOG** keys, then power on the instrument. The "CAL" tag will appear and the secondary LCD will show 0.0 mV.
- Set 0.0 mV on the simulator. When the reading is stable and close to the selected calibration point, "CFM" tag will blink.
- Press **CFM** to confirm. The secondary LCD will display 600 mV.
- Set 600.0 mV on the simulator. When the reading is stable and close to the selected calibration point, "CFM" tag will blink.
- Press **CFM** to confirm. The secondary LCD will display 1800 mV.
- Set 1800.0 mV on the simulator. When the reading is stable and close to the selected calibration point, "CFM" tag will blink.
- Press **CFM** to confirm. The instrument returns to measurement mode.

Notes:
- If the reading is not close to the selected calibration point, "WRONG" tag will blink. Verify calibration condition or contact your vendor if you can not calibrate.
- Press **CAL** in any moment of the calibration process. The instrument will return to measurement mode. If calibration process is stopped after 600 mV is confirmed, the 600 mV range is calibrated and calibration parameters are memorized.

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. Make sure that your instrument is switched off and plug one connector to the instrument RS232C socket and the other to the serial port of your PC.

Notes:
- Other cables than **HI 920010** may use a different 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 the scheme is:

<command prefix> <command> <CR>

where: <command prefix> is a selectable ASCII character between 0 and 47 (default 16).

<command> is the command code.

Note: Either small or capital letters can be used.

SIMPLE COMMANDS

MOD	Is equivalent to pressing **MODE**
CAL	Is equivalent to pressing **CAL**
CFM	Is equivalent to pressing **CFM**
UPC	Is equivalent to pressing the **UP** arrow key
DWC	Is equivalent to pressing the **DOWN** arrow key
LOG	Is equivalent to pressing **LOG**
RCL	Is equivalent to pressing **RCL**
ALG	Is equivalent to pressing **AutoLOG**
SET	Is equivalent to pressing **SET**
PRT	Is equivalent to pressing **PRINT** (**HI 122** only)
CLR	Is equivalent to pressing **CLR**
OFF	Is equivalent to pressing **OFF**
AHD	Is equivalent to pressing **AutoHOLD**

CHR xx Change the instrument range according with the parameter value (xx):

- xx=00 pH range/0.001 resolution
- xx=01 pH range/0.01 resolution
- xx=03 mV range
- xx=04 Relative mV range

The meter will answer for these commands with:

<STX> <answer> <ETX>

where: <STX> is 02 ASCII code character (start of text)
<ETX> is 03 ASCII code character (end of text)
<answer>:
<ACK> is 06 ASCII code character (recognized command)
<NAK> is 21 ASCII code character (unrecognized command)
<CAN> is 24 ASCII code character (corrupted command)

COMMANDS REQUIRING AN ANSWER

RAS Causes the instrument to send a complete set of readings in according with the current range:

- pH, mV and temperature reading on pH range.
- mV and temperature reading on mV range.
- Rel mV, absolute mV and temperature reading on Rel mV range.

Note: The temperature is sent with two decimals and in Celsius degrees, even if the set temperature unit was Fahrenheit degrees.

DA? Requests the date.
TI? Requests the time.
MDR Requests the instrument model name and firmware code.
GLP Requests the calibration data record.
PAR Requests the setup parameters setting.
NSL Requests the number of logged samples.
?ML Requests the information about AutoLOG.
/MLPxxx Selects the lot.
?DM Downloads the selected AutoLOG.
LODPxxx Requests the xxxth record logged data.
LODPALL Requests all Log on demand.

Notes:

- "Err8" is sent if the instrument is not in measurement mode.
- "Err7" is sent if a different range is requested during AutoLOGGING mode (for **CHR xx** command only).
- "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.

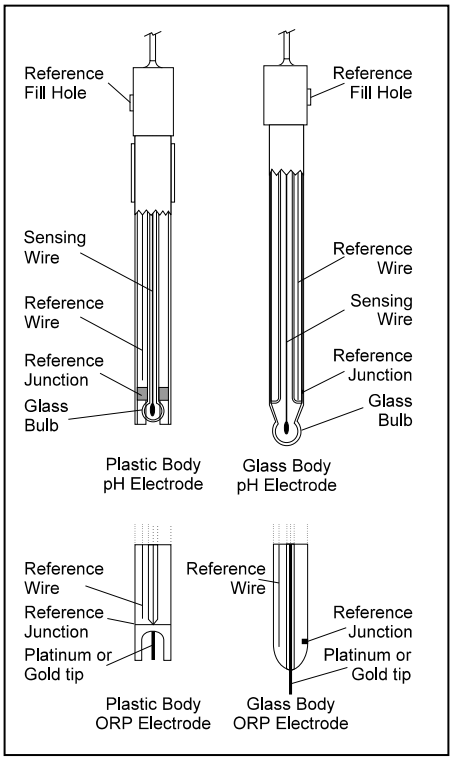
pH BUFFER TEMPERATURE DEPENDENCE

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	1.679	4.010	6.862	7.010	9.177	10.010	12.454
0	32	1.670	4.007	6.982	7.130	9.459	10.316	13.379
5	41	1.670	4.002	6.949	7.098	9.391	10.245	13.178
10	50	1.671	4.000	6.921	7.070	9.328	10.180	12.985
15	59	1.673	4.001	6.897	7.046	9.273	10.118	12.799
20	68	1.675	4.004	6.878	7.027	9.222	10.062	12.621
25	77	1.679	4.010	6.862	7.010	9.177	10.010	12.450
30	86	1.683	4.017	6.851	6.998	9.137	9.962	12.286
35	95	1.688	4.026	6.842	6.989	9.108	9.919	12.128
40	104	1.693	4.037	6.837	6.983	9.069	9.881	11.978
45	113	1.700	4.049	6.834	6.979	9.040	9.847	11.834
50	122	1.707	4.062	6.834	6.978	9.014	9.817	11.697
55	131	1.715	4.076	6.836	6.979	8.990	9.793	11.566
60	140	1.724	4.091	6.839	6.982	8.969	9.773	11.442
65	149	1.734	4.107	6.844	6.987	8.948	9.757	11.323
70	158	1.744	4.123	6.850	6.993	8.929	9.746	11.211
75	167	1.755	4.139	6.857	7.001	8.910	9.740	11.104
80	176	1.767	4.156	6.865	7.010	8.891	9.738	11.003
85	185	1.780	4.172	6.873	7.019	8.871	9.740	10.908
90	194	1.793	4.187	6.880	7.029	8.851	9.748	10.819
95	203	1.807	4.202	6.888	7.040	8.829	9.759	10.734

During calibration the instrument will display the pH buffer value at 25 °C (77 °F).

ELECTRODE CONDITIONING & MAINTENANCE



PREPARATION PROCEDURE

Remove the protective cap of the pH electrode.

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

During transport, tiny bubbles of air may form inside the glass bulb affecting proper functioning of the electrode. These bubbles can be removed by "shaking down" the electrode as you would do with a glass thermometer.

If the bulb and/or junction is dry, soak the electrode in **HI 70300** or **HI 80300** Storage Solution for at least one hour.

For refillable electrodes:

If the filling solution (electrolyte) is more than 2½ cm (1") below the fill hole, add **HI 7082** or **HI 8082** 3.5M KCl Electrolyte Solution for double junction or **HI 7071** or **HI 8071** 3.5M KCl+AgCl Electrolyte Solution for single junction electrodes.

For faster response, unscrew the fill hole screw during measurements.

For AmpHel® electrodes:

If the electrode does not respond to pH changes, the battery run down and the electrode should be replaced.

MEASUREMENT

Rinse the pH electrode tip with distilled water. Immerse the tip (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.

See that the sleeve holes of the ORP probe are completly submerged. Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.

STORAGE PROCEDURE

To minimize clogging and assure a quick response time, the glass bulb and the junction of pH electrode should 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 or, in its absence, Filling Solution (**HI 7071** or **HI 8071** for single junction and **HI 7082** or **HI 8082** for double junction electrodes). Follow the Preparation Procedure on page 45 before taking measurements.

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

PERIODIC MAINTENANCE

Inspect the electrode and the cable. 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 Probe Maintenance

For refillable electrodes:

Refill the reference chamber with fresh electrolyte (**HI 7071** or **HI 8071** for single junction or **HI 7082** or **HI 8082** for double junction electrodes). Allow the electrode to stand upright for 1 hour.

Follow the Storage Procedure above.

pH CLEANING PROCEDURE

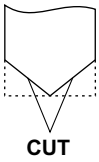
- *General* Soak in Hanna **HI 7061** or **HI 8061** General Cleaning Solution for approximately ½ hour.
- *Protein* Soak in Hanna **HI 7073** or **HI 8073** Protein Cleaning Solution for 15 minutes.
- *Inorganic* Soak in Hanna **HI 7074** Inorganic Cleaning Solution for 15 minutes.
- *Oil/grease* Rinse with Hanna **HI 7077** or **HI 8077** Oil and Fat Cleaning Solution.

IMPORTANT: After performing any of the cleaning procedures, rinse the electrode thoroughly with distilled water, refill the reference chamber with fresh electrolyte (not necessary for gel-filled electrodes) and soak the electrode in **HI 70300** or **HI 80300** Storage Solution for at least 1 hour before taking measurements.

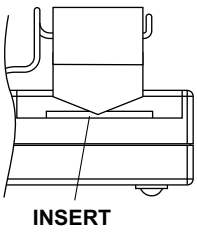
PRINTER MAINTENANCE (HI 122 only)

HI 122 instrument uses plain paper rolls 44 mm width. To insert a new paper roll, follow the procedure below:

- For an easier insertion, cut the paper edge as shown in the next figure:

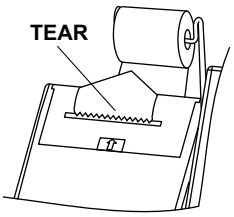


- Put the paper roll on the paper holder attached to the printer.
- Insert the paper edge into the printer slot as shown below:



- Simply press **Paper** from the left keyboard to feed the printer. Allow about 5 cm (2") to exit from the printer.

- Tear the paper out for its edge to be straight, as shown below:



The paper is now properly inserted and the printer is ready to print.

TROUBLESHOOTING GUIDE

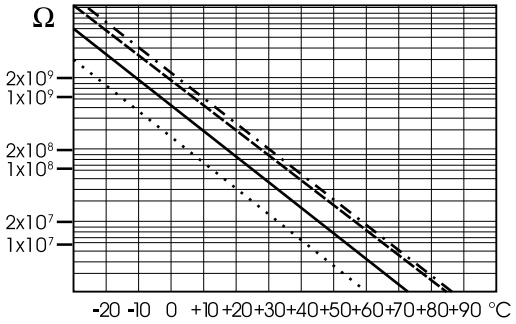
SYMPTOMS	PROBLEM	SOLUTION
Slow response/excessive drift.	Dirty pH electrode.	Soak the electrode tip in HI 7061 solution for 30 minutes and then clean the electrode.
Readings fluctuate up and down (noise).	Clogged/dirty junction. Low electrolyte level (refillable electrodes only).	Clean the electrode. Refill with fresh solution (for refillable electrodes only).
The display shows blinking dashes during pH measurements.	Out of range in the pH scale.	Make sure the pH sample is in the specified range. Recalibrate. Check the electrolyte level and the general state of the pH electrode.
The display shows blinking reading during measurements.	Reading out of range.	Electrode not connected.
Out of range in the mV scale.	Dry membrane/junction.	Soak in HI 70300 Storage solution for at least one hour.
The meter does not work with the temperature probe.	Out of order temperature probe.	Replace the probe.
The meter fails to calibrate or gives faulty readings.	Broken or out of order pH electrode.	Replace the electrode.
Explicit warnings are displayed during pH calibration.	Dirty/broken pH electrode, contaminated reference or buffers.	Follow displayed instructions.
The electrode condition and response gauges are not displayed after calibration.	Electrode without pin or pin is not connected.	Use Hanna P type pH electrode and check the pin connection.
The electrode condition and response gauges are empty.	The meter has not been calibrated on the current day. Only one-point calibration has been performed.	Perform a two-point calibration procedure. Calibrate using pH 7.01 and pH 4.01 buffers.

TROUBLESHOOTING GUIDE (cont.)

SYMPTOMS	PROBLEM	SOLUTION
The meter displays empty Electrode Response scale.	Not enough data available to evaluate the response time.	Repeat calibration more carefully.
At startup the meter displays all LCD permanently.	One of the keys is blocked.	Check the keyboard or contact the vendor.
Long beep heard when pressing a key.	Key without function in current mode. End of range reached with the ARROW keys.	Don't press keys without function in current mode.
Digits can not be introduced with the numeric keys.	Maximum value reached for corresponding range.	Delete digits.
"Prn Eror" message displayed.	Printer error.	Turn off the meter and then turn it on. If the error persist, contact the vendor.
"Err xx" error message displayed.	Internal error.	Turn off the meter and then turn it on. If the error persist, contact the vendor.

TEMPERATURE CORRELATION FOR pH SENSITIVE GLASS

The resistance of glass electrodes partially depends on the temperature. The lower the temperature, the higher the resistance. It takes more time for the reading to stabilize if the resistance is higher. In addition, the response time will suffer to a greater degree at temperatures below 25 °C (77 °F).



Since the resistance of the pH electrode is in the range of 50 – 200 Mohm, the current across the membrane is in the pico Ampere range. Large currents can disturb the calibration of the electrode for many hours.

For these reasons high humidity environments, short circuits and static discharges are detrimental to a stable pH reading.

The pH electrode's life also depends on the temperature. If constantly used at high temperatures, the electrode life is drastically reduced.

Typical Electrode Life

Ambient Temperature	1 – 3 years
90 °C (194 °F)	Less than 4 months
120 °C (248 °F)	Less than 1 month

Alkaline Error

High concentrations of sodium ions interfere with readings in alkaline solutions. The pH at which the interference starts to be significant depends upon the composition of the glass. This interference is called alkaline error and causes the pH to be underestimated. Hanna's glass formulations have the indicated characteristics.

Sodium Ion Correction for the Glass at 20-25 °C (68-77 °F)		
Concentration	pH	Error
0.1 Mol L^{-1} Na^+	13.00	0.10
	13.50	0.14
	14.00	0.20
1.0 Mol L^{-1} Na^+	12.50	0.10
	13.00	0.18
	13.50	0.29
	14.00	0.40

ACCESSORIES

pH BUFFER SOLUTIONS

HI 70004P pH 4.01 Buffer Sachets, 20 mL, 25 pcs
HI 70007P pH 7.01 Buffer Sachets, 20 mL, 25 pcs
HI 70010P pH 10.01 Buffer Sachets, 20 mL, 25 pcs
HI 7001L pH 1.68 Buffer Solution, 500 mL bottle
HI 7004L pH 4.01 Buffer Solution, 500 mL bottle
HI 7006L pH 6.86 Buffer Solution, 500 mL bottle
HI 7007L pH 7.01 Buffer Solution, 500 mL bottle
HI 7009L pH 9.18 Buffer Solution, 500 mL bottle
HI 7010L pH 10.01 Buffer Solution, 500 mL bottle
HI 7001L pH 1.68 Buffer Solution in FDA approved bottle, 500 mL
HI 8004L pH 4.01 Buffer Solution in FDA approved bottle, 500 mL
HI 8006L pH 6.86 Buffer Solution in FDA approved bottle, 500 mL
HI 8007L pH 7.01 Buffer Solution in FDA approved bottle, 500 mL
HI 8009L pH 9.18 Buffer Solution in FDA approved bottle, 500 mL
HI 8010L pH 10.01 Buffer Solution in FDA approved bottle, 500 mL

ELECTRODE STORAGE SOLUTIONS

HI 70300L Storage Solution, 460 mL bottle
HI 80300L Storage Solution in FDA approved bottle, 460 mL

ELECTRODE CLEANING SOLUTIONS

HI 70000P Electrode Rinse Sachets, 20 mL, 25 pcs
HI 7073L Protein Cleaning Solution, 460 mL bottle
HI 7074L Inorganic Cleaning Solution, 460 mL bottle
HI 7077L Oil & Fat Cleaning Solution, 460 mL bottle
HI 8073L Protein Cleaning Solution in FDA approved bottle, 460 mL
HI 8077L Oil & Fat Cleaning Solution in FDA approved bottle, 460 mL

ELECTRODE REFILL ELECTROLYTE SOLUTIONS

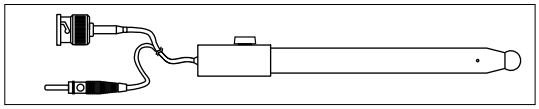
HI 7071 3.5M KCl + AgCl Electrolyte, 4x30 mL, for single junction electrodes
HI 7072 1M KNO_3 Electrolyte, 4x30 mL
HI 7082 3.5M KCl Electrolyte, 4x30 mL, for double junction electrodes
HI 8071 3.5M KCl + AgCl Electrolyte in FDA approved bottle, 4x30 mL, for single junction electrodes
HI 8072 1M KNO_3 Electrolyte in FDA approved bottle, 4x30 mL
HI 8082 3.5M KCl Electrolyte in FDA approved bottle, 4x30 mL, for double junction electrodes

ORP PRETREATMENT SOLUTIONS

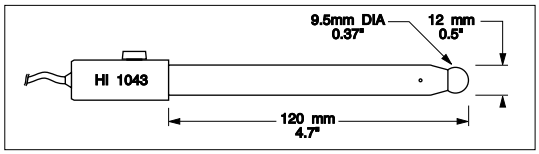
HI 7091L Reducing Pretreatment Solution, 460 mL bottle
HI 7092L Oxidizing Pretreatment Solution, 460 mL bottle

pH ELECTRODES

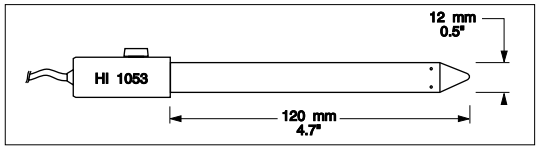
All electrodes with code ending with P are supplied with BNC & pin connectors and 1 m (3.3') cable, as shown below:



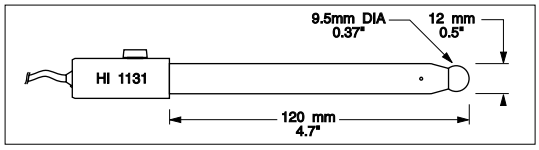
HI 1043P
Glass-body, double junction, refillable, combination **pH** electrode.
Use: strong acid/alkali.



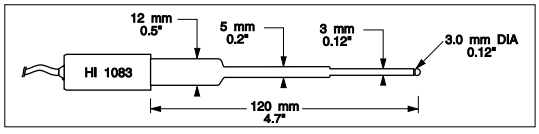
HI 1053P
Glass-body, triple ceramic, conic shape, refillable, combination **pH** electrode.
Use: emulsions.



HI 1131P
Glass-body, single junction, refillable, combination **pH** electrode.
Use: general purpose.



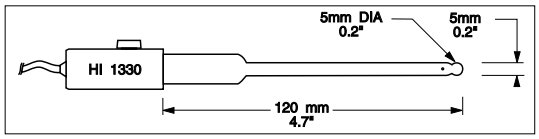
HI 1083P
Glass-body, micro, Viscolene, non-refillable, combination **pH** electrode.
Use: biotechnology, micro titration.



HI 1330P

Glass-body, semimicro, single junction, refillable, combination **pH** electrode.

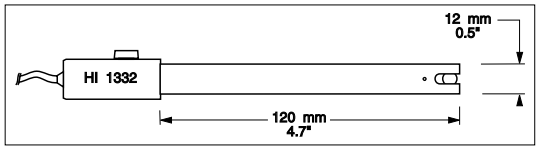
Use: laboratory, vials.



HI 1332P

Plastic-body (Ultem®), double junction, refillable, combination **pH** electrode.

Use: general purpose.

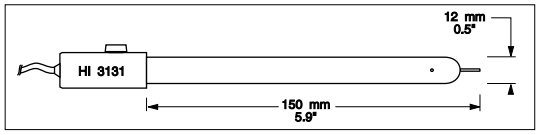


ORP ELECTRODES

HI 3131P

Glass-body, refillable, combination platinum **ORP** electrode.

Use: titration.



Consult the Hanna General Catalog for more electrodes with BNC and pin connectors.

OTHER ACCESSORIES

HI 710005	Voltage adapter from 115 VAC to 12 VDC (USA plug)
HI 710006	Voltage adapter from 230 VAC to 12 VDC (European plug)
HI 710012	Voltage adapter from 240 VAC to 12 VDC (UK plug)
HI 710013	Voltage adapter from 230 VAC to 12 VDC (South African plug)
HI 710014	Voltage adapter from 230 VAC to 12 VDC (Australian plug)
HI 8427	pH and ORP electrode simulator with 1 m (3.3') coaxial cable ending in female BNC connectors
HI 931001	pH and ORP electrode simulator with LCD and 1 m (3.3') coaxial cable ending in female BNC connectors
HI 7662-T	Temperature probe with 1 m (3.3') cable
HI 710032	Pack of 10 plain paper spare rolls (**HI 122**)
HI 710033	Replacement ink cartridge (**HI 122**)
HI 740157	Plastic electrode refilling pipet (20 pcs)
HI 92000	Windows® compatible software
HI 920010	9 to 9-pin RS232 cable

RECOMMENDATIONS FOR USERS

Before using these products, make sure they are entirely suitable for the environment in which they are used.

Operation of these instruments in residential areas could cause unacceptable interferences to radio and TV equipment, requiring the operator to follow all necessary steps to correct interferences.

The glass bulb at the end of the pH electrode is sensitive to electrostatic discharges. Avoid touching this glass bulb at all times.

During operation, ESD wrist straps should be worn to avoid possible damage to the electrode by electrostatic discharges.

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

To avoid electrical shock, do not use these instruments when voltages at the measurement surface exceed 24 VAC or 60 VDC.

To avoid damage or burns, do not perform any measurements in microwave ovens.

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

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