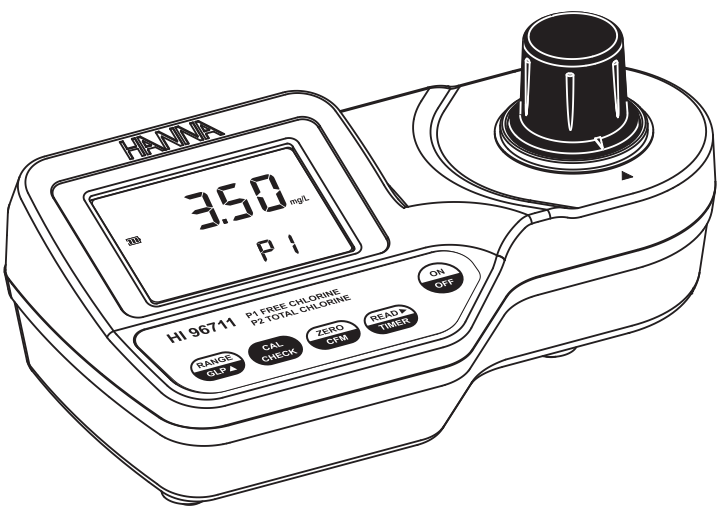
Instruction Manual

HI 96711C
Free and Total Chlorine
ISM



HANNA instruments
www.hannainst.com

GENERAL DESCRIPTION

The **HI 96711** is an auto diagnostic portable microprocessor meter that benefits from Hanna's years of experience as a manufacturer of analytical instruments. It has the advanced optical system based on a special tungsten lamp and a narrow band interference filter that allows most accurate and repeatable readings. All instruments are factory calibrated and the electronic and optical design minimizes the need of frequent calibration.

With the powerful CAL CHECK™ **validation** function, you are able to validate good performance of your instrument at any time. The validation procedure is extremely user friendly. Just use the exclusive HANNA ready-made, NIST traceable standards to verify the performance of the instrument and recalibrate if necessary.

All instruments are splash waterproof and the lamp and filter units are protected from dust or dirt by a transparent cup. This makes the instruments fulfill field applications. Display messages aid the user in routine operation. The meter has an auto-shut off feature that will turn off the instrument after 10 minutes of non use in *measurement mode* or after 1 hour if left in *calibration mode*.

The meter uses an exclusive positive-locking system to ensure that the cuvette is in the same position every time it is placed into the measurement cell. It is designed to fit a cuvette with a larger neck making it easier to add both sample and reagents. The cuvette is made from special optical glass to obtain best results.

The **HI 96711** meter measures the free and total chlorine (Cl_2) content in water samples in the 0.00 to 5.00 mg/L (ppm) range. The method is an adaptation of the USEPA Method 330.5 for wastewater, and Standard Method 4500-Cl G for drinking water.

The reagents are in powder form and supplied in packets. The amount of reagent is precisely dosed to ensure the maximum repeatability.

ABBREVIATIONS

°C: degree Celsius
°F: degree Fahrenheit
USEPA: US Environmental Protection Agency
mg/L: milligrams per liter. mg/L is equivalent to ppm (parts per million)
mL: milliliter
mV: millivolts

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.

TABLE OF CONTENTS

PRINCIPLE OF OPERATION

Absorption of Light is a typical phenomenon of interaction between electromagnetic radiation and matter. When a light beam crosses a substance, some of the radiation may be absorbed by atoms, molecules or crystal lattices.

If pure absorption occurs, the fraction of light absorbed depends both on the optical path length through the matter and on the physical-chemical characteristics of the substance according to the Lambert-Beer Law:

$$-\log \mathtt{I/I}_o = \varepsilon_\lambda \; c \; d$$

or

$$A = \varepsilon_\lambda \; c \; d$$

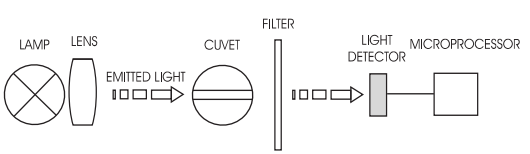
Where:

$-\log \mathtt{I/I}_o$	=	Absorbance (A)
$\mathtt{I}_o$	=	intensity of incident light beam
$\mathtt{I}$	=	intensity of light beam after absorption
ε_λ	=	molar extinction coefficient at wavelength λ
c	=	molar concentration of the substance
d	=	optical path through the substance

Therefore, the concentration "c" can be calculated from the absorbance of the substance as the other factors are known.

Photometric chemical analysis is based on the possibility to develop an absorbing compound from a specific chemical reaction between sample and reagents. Given that the absorption of a compound strictly depends on the wavelength of the incident light beam, a narrow spectral bandwidth should be selected as well as a proper central wavelength to optimize measurements.

The optical system of Hanna's **HI 96** series colorimeters is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.



HI 96 series block diagram (optical layout)

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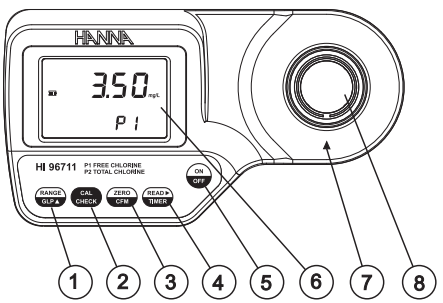

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7) Cuvette alignment indicator
8) Cuvette holder

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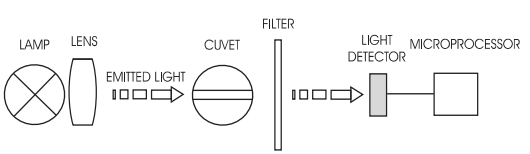

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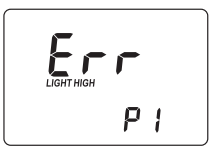
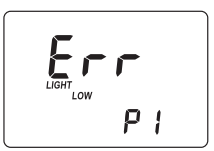
a) on zero reading



Light High: There is too much light to perform a measurement. Please check the preparation of the zero cuvette.



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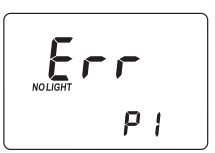
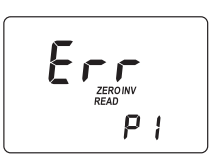
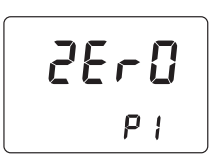


No Light: The instrument cannot adjust the light level. Please check that the sample does not contain any debris.

b) on sample reading



Inverted cuvettes: The sample and the zero cuvette are inverted.



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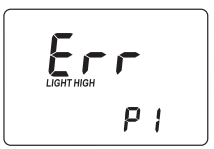

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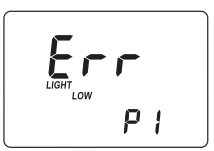

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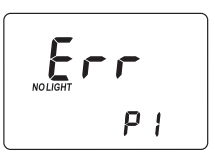

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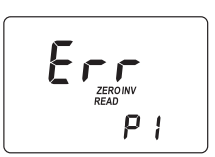

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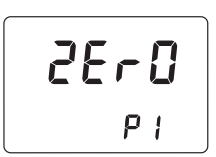

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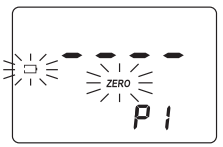

Battery low: The battery must be replaced soon.

Dead battery: This indicates that the battery is dead and must be replaced. Once this indication is displayed, normal operation of the instrument will be interrupted. Change the battery and restart the meter.

GENERAL TIPS FOR AN ACCURATE MEASUREMENT

The instructions listed below should be carefully followed during testing to ensure best accuracy.

- Color or suspended matter in large amounts may cause interference, therefore these should be removed by treatment with active carbon and by prior filtration.

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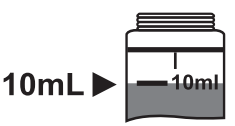

- Proper use of the powder reagent packet:
  (a) use scissors to open the powder packet;
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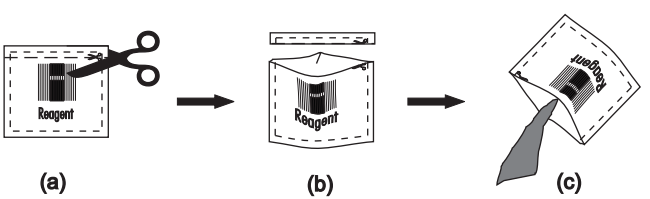

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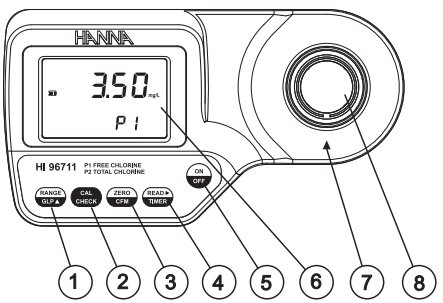

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STARTUP

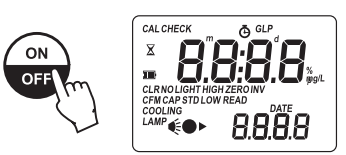
Prepare the instrument for measurement as follows:

- Unpack the instrument by removing the dust protection sleeve from the instrument cuvette holder.
- Place the battery in the instrument as described in the "BATTERY REPLACEMENT" chapter.
- Place the instrument on a flat table.
- Do not place the instrument under direct sun light.

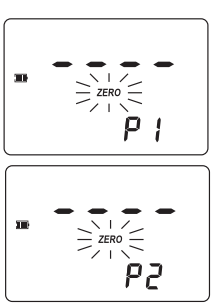
RANGE SELECTION

The **HI 96711** can measure Free chlorine when range P1 is selected or Total chlorine when range P2 is selected. To change the active range follow the procedure:

- Turn the meter on by pressing **ON/OFF**. The display briefly shows all tags on.

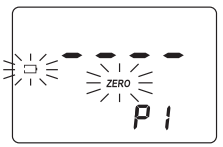


- After startup, the range identification number is displayed on the secondary LCD as P1 or P2.



Code	Parameter
P1	Free Chlorine
P2	Total Chlorine

- Press **RANGE/GLP/▲** to change the range.
  The range can be changed any time when the instrument is in *measurement mode*.
  The selected range is memorized and the selection remaines unchanged at power off or when the battery is removed.



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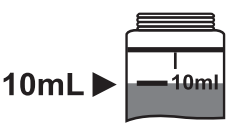

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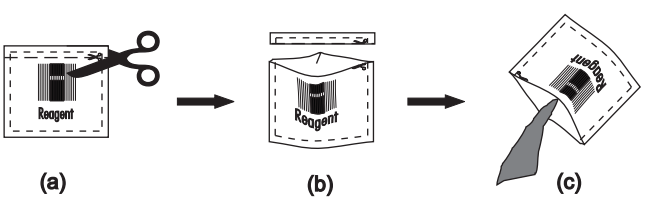
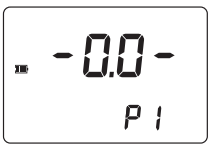


- After a few seconds, the display will show "**-0.0-**". The meter is now zeroed and ready for measurement.

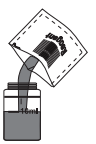


- Remove the cuvette.

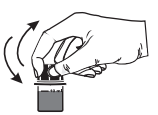
- Add the content of one packet of the specific test reagent, for:
  Free Chlorine: 1 packet of **HI 93701-0**

or

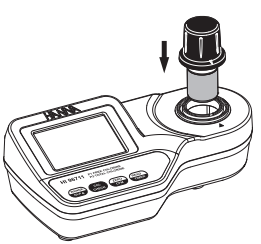
  Total Chlorine: 1 packet of **HI 93711-0**



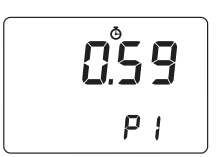
- Replace the cap and shake gently for 20 seconds (or 2 minutes in case of seawater analysis).

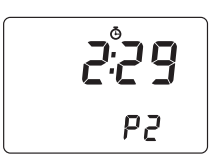


- Replace the cuvette into the cuvette holder and ensure that the notch on the cap is positioned securely into the groove.

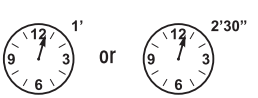


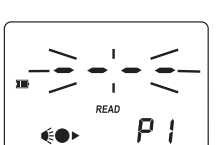
- Press and hold **READ/►/TIMER** for three seconds. The display will show the countdown prior to measurement. An audible "beep" indicates the end of countdown period.





- Alternatively, wait for 1 minute for free chlorine or 2'30" for total chlorine and just press **READ/►/TIMER.**
  In both cases, the lamp, cuvette and detector icons will appear on the display, depending on the measurement phase.





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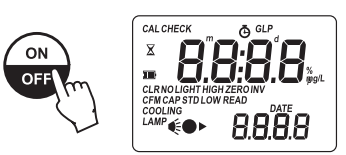
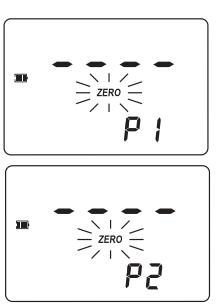


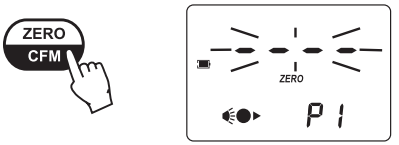
- After startup, the range identification number is displayed on the secondary LCD as P1 or P2.



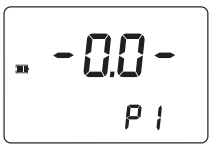
Code	Parameter
P1	Free Chlorine
P2	Total Chlorine

- Press **RANGE/GLP/▲** to change the range.
  The range can be changed any time when the instrument is in *measurement mode*.
  The selected range is memorized and the selection remaines unchanged at power off or when the battery is removed.

- Press **ZERO/CFM** and the lamp, cuvette and detector icons will appear on the display, depending on the measurement phase.



- After a few seconds, the display will show "**-0.0-**". The meter is now zeroed and ready for validation.

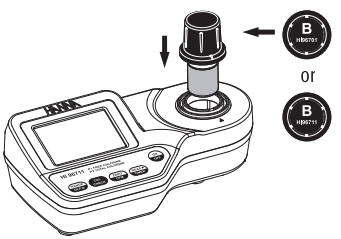


- Remove the cuvette.

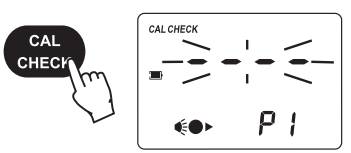
- Place the specific **CAL CHECK™** Standard Cuvette B into the cuvette holder, for:
  Free Chlorine: B, HI 96701-11

or

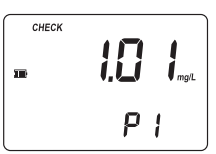
  Total Chlorine: B, HI 96711-11
  Ensure that the notch on the cap is positioned securely into the groove.



- Press **CAL CHECK™** and the lamp, cuvette and detector icons together with "**CAL CHECK**" will appear on the display, depending on the measurement phase.

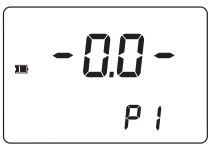


- At the end of the measurement the display will show the validation standard value.



The reading should be within specifications as reported in the **CAL CHECK™** Standard Certificate. If the value is found out of the specifications, please check that the cuvettes are free of fingerprints, oil or dirt and repeat validation. If results are still found out of specifications, then recalibrate the instrument.

- After a few seconds, the display will show "**-0.0-**". The meter is now zeroed and ready for measurement.

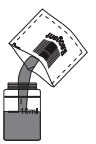


- Remove the cuvette.

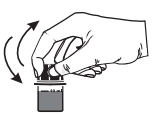
- Add the content of one packet of the specific test reagent, for:
  Free Chlorine: 1 packet of **HI 93701-0**

or

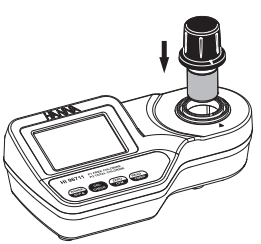
  Total Chlorine: 1 packet of **HI 93711-0**



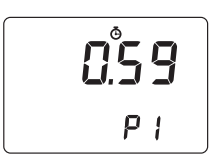
- Replace the cap and shake gently for 20 seconds (or 2 minutes in case of seawater analysis).

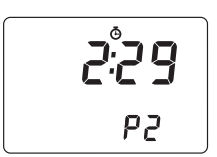


- Replace the cuvette into the cuvette holder and ensure that the notch on the cap is positioned securely into the groove.

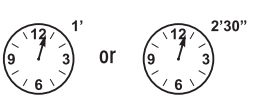


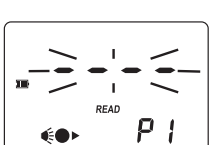
- Press and hold **READ/►/TIMER** for three seconds. The display will show the countdown prior to measurement. An audible "beep" indicates the end of countdown period.



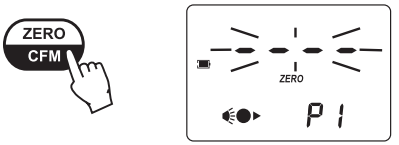


- Alternatively, wait for 1 minute for free chlorine or 2'30" for total chlorine and just press **READ/►/TIMER.**
  In both cases, the lamp, cuvette and detector icons will appear on the display, depending on the measurement phase.

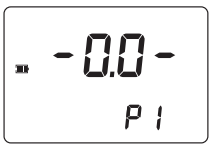




- Press **ZERO/CFM** and the lamp, cuvette and detector icons will appear on the display, depending on the measurement phase.



- After a few seconds, the display will show "**-0.0-**". The meter is now zeroed and ready for validation.

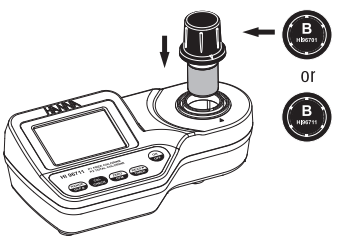


- Remove the cuvette.

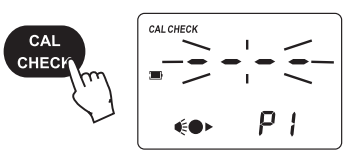
- Place the specific **CAL CHECK™** Standard Cuvette B into the cuvette holder, for:
  Free Chlorine: B, HI 96701-11

or

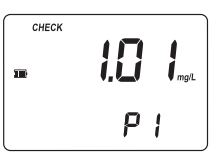
  Total Chlorine: B, HI 96711-11
  Ensure that the notch on the cap is positioned securely into the groove.



- Press **CAL CHECK™** and the lamp, cuvette and detector icons together with "**CAL CHECK**" will appear on the display, depending on the measurement phase.



- At the end of the measurement the display will show the validation standard value.



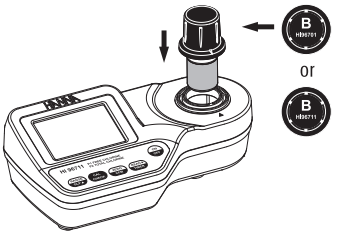
The reading should be within specifications as reported in the **CAL CHECK™** Standard Certificate. If the value is found out of the specifications, please check that the cuvettes are free of fingerprints, oil or dirt and repeat validation. If results are still found out of specifications, then recalibrate the instrument.

- Remove the cuvette.

- Place the specific **CAL CHECK™** Standard Cuvette B into the cuvette holder, for:
  Free Chlorine: B, HI 96701-11

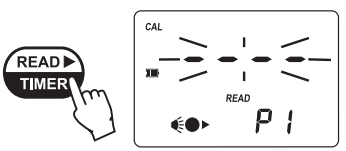
or

  Total Chlorine: B, HI 96711-11



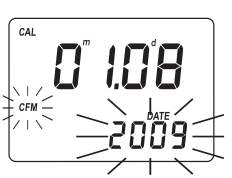
- Ensure that the notch on the cap is positioned securely into the groove.

- Press **READ/►/TIMER** and the lamp, cuvette and detector icons will appear on the display, depending on the measurement phase.



- After measurement the instrument will show for three seconds the **CAL CHECK™** Standard value.

Note: If the display shows **"STD HIGH"**, the standard value was too high. If the display shows **"STD LOW"**, the standard value was too low. Verify that both **CAL CHECK™** Standard Cuvettes, A and B are free from fingerprints or dirt and that they are inserted correctly.



- Then the date of the last calibration (e.g.: "01.08.2009") appears on the display, or "01.01.2009 if the factory calibration was selected before. In both cases the year number is blinking, ready for date input.

ACCESORIES

REAGENT SET

HI 93701-01	Reagents for 100 Free Chlorine tests
HI 93701-03	Reagents for 300 Free Chlorine tests
HI 93711-01	Reagents for 100 Total Chlorine tests
HI 93711-03	Reagents for 300 Total Chlorine tests

OTHER ACCESORIES

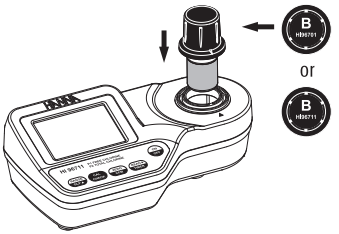
HI 96701-11	**CAL CHECK™** Standard Cuvettes for Free Chlorine (1 set)
HI 96711-11	**CAL CHECK™** Standard Cuvettes for Total Chlorine (1 set)
HI 721310	9V battery (10 pcs.)
HI 731318	Cloth for wiping cuvettes (4 pcs.)
HI 731331	Glass cuvettes (4 pcs.)
HI 731335	Caps for cuvettes (4 pcs.)
HI 741218	Carrying case
HI 93703-50	Cuvette cleaning solution (230 mL)

- Remove the cuvette.

- Place the specific **CAL CHECK™** Standard Cuvette B into the cuvette holder, for:
  Free Chlorine: B, HI 96701-11

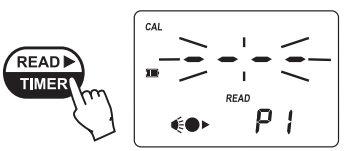
or

  Total Chlorine: B, HI 96711-11



- Ensure that the notch on the cap is positioned securely into the groove.

- Press **READ/►/TIMER** and the lamp, cuvette and detector icons will appear on the display, depending on the measurement phase.



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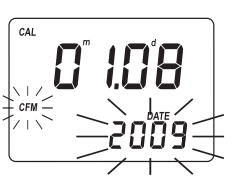


- Then the date of the last calibration (e.g.: "01.08.2009") appears on the display, or "01.01.2009 if the factory calibration was selected before. In both cases the year number is blinking, ready for date input.

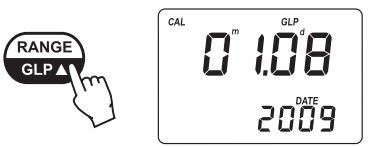
GLP

In *GLP mode*, the last user calibration date can be verified and the factory calibration can be restored.

LAST CALIBRATION DATE

To display the calibration date:

- Press and hold for three seconds **RANGE/GLP/▲** to enter *GLP mode*. The calibration month and day will appear on the main display and the year on the secondary display.

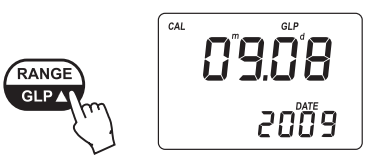


- If no calibration was performed, the factory calibration message, "**F.CAL**" will appear on the main display and the instrument returns to *measurement mode* after three seconds.

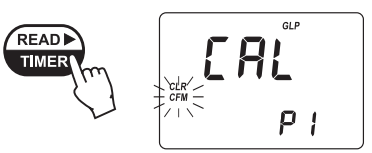
FACTORY CALIBRATION RESTORE

It is possible to delete the calibration and restore factory calibration.

- Press and hold for three seconds **RANGE/GLP/▲** to enter *GLP mode*.

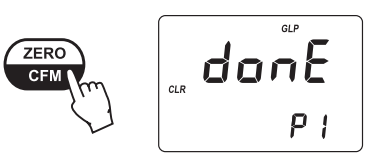


- Press **READ/►/TIMER** to enter in the factory calibration restore screen. The instrument asks for confirmation of user calibration delete.



- Press **ZERO/CFM** to restore the factory calibration or press **RANGE/GLP/▲** again to abort factory calibration restore.

- The instrument briefly indicates "**donE**" upon restoration of factory calibration prior to returning to *measurement mode*.



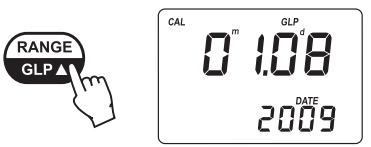
GLP

In *GLP mode*, the last user calibration date can be verified and the factory calibration can be restored.

LAST CALIBRATION DATE

To display the calibration date:

- Press and hold for three seconds **RANGE/GLP/▲** to enter *GLP mode*. The calibration month and day will appear on the main display and the year on the secondary display.



- If no calibration was performed, the factory calibration message, "**F.CAL**" will appear on the main display and the instrument returns to *measurement mode* after three seconds.

FACTORY CALIBRATION RESTORE

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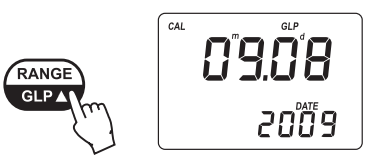
- Press and hold for three seconds **RANGE/GLP/▲** to enter *GLP mode*.



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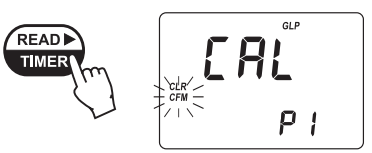

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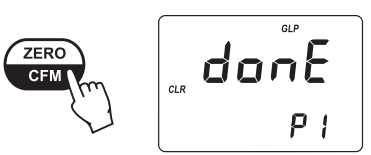

ACCESORIES

REAGENT SET

HI 93701-01	Reagents for 100 Free Chlorine tests
HI 93701-03	Reagents for 300 Free Chlorine tests
HI 93711-01	Reagents for 100 Total Chlorine tests
HI 93711-03	Reagents for 300 Total Chlorine tests

OTHER ACCESORIES

HI 96701-11	**CAL CHECK™** Standard Cuvettes for Free Chlorine (1 set)
HI 96711-11	**CAL CHECK™** Standard Cuvettes for Total Chlorine (1 set)
HI 721310	9V battery (10 pcs.)
HI 731318	Cloth for wiping cuvettes (4 pcs.)
HI 731331	Glass cuvettes (4 pcs.)
HI 731335	Caps for cuvettes (4 pcs.)
HI 741218	Carrying case
HI 93703-50	Cuvette cleaning solution (230 mL)