HANNA instruments®

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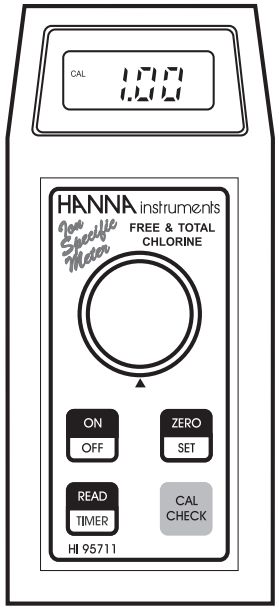
MAN95711R3 05/06

Instruction Manual

HI 95711C
Free & Total Chlorine
ISM



HANNA instruments®

www.hannainst.com

CE

This Instrument is in
Compliance with the CE Directives

Dear Customer,

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

TABLE OF CONTENTS

USER NOTES

Date	Parameter Code	Validation Value (mg/L)	Passed		Calibration	
			yes	not	yes	not

HANNA LITERATURE

Hanna publishes a wide range of catalogs and handbooks for an equally wide range of applications. The reference literature currently covers areas such as:

- **Water Treatment**
- **Process**
- **Swimming Pools**
- **Agriculture**
- **Food**
- **Laboratory**

and many others. New reference material is constantly being added to the library.

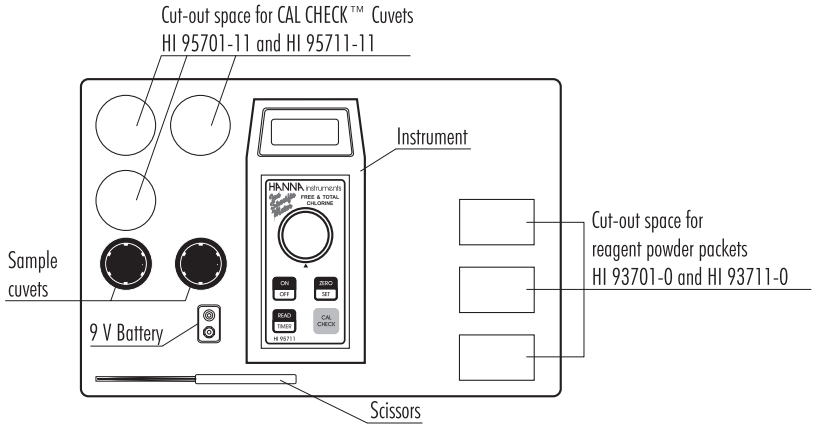
For these and other catalogs, handbooks and leaflets contact your dealer or the Hanna Customer Service Center nearest to you. To find the Hanna Office in your vicinity, check our home page at www.hannainst.com.

PRELIMINARY EXAMINATION

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

Each **HI 95711** Ion Selective Meter is supplied complete with:

- Two Sample Cuvets and Caps
- 9V Battery
- Scissors
- Three CAL CHECK™ Cuvets (HI 95701-11 & HI 95711-11) with Quality Certificate
- Tissue for wiping cuvets
- Instruction Manual and Quick Reference Guide
- Instrument Quality Certificate
- Rigid carrying case



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

GENERAL DESCRIPTION

The **HI 95711** 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 codes 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 or after 1 hour if left in the *calibration mode*.

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

The **HI 95711** 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 adaption of the USEPA METHOD 330.5 for wastewater, and Standard Method 4500-Cl G for drinking water.

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

ABBREVIATIONS

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

CE DECLARATION OF CONFORMITY

Recommendations for Users

Before using these products, make sure that they are entirely suitable for your specific application and for the environment in which they are used.

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

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

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

HANNA instruments

CE

DECLARATION OF CONFORMITY

We

Hanna Instruments Italia Srl
Viale Delle Industrie, 12/A
35010 Villafranca Padovana- PD
ITALY

herewith certify that the meter:

HI 95711

Has been tested and found to be in compliance with EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC according to the following applicable normatives:

EN 61000-6-1: Electromagnetic Compatibility - Generic Immunity Standard
IEC 61000-4-2 Electrostatic Discharge
IEC 61000-4-3 RF Radiated

EN 61000-6-3: Electromagnetic Compatibility - Generic Emission Standard
EN 55022 Radiated, Class B

EN61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use

Date of Issue: 18-06-2002

A. Marsilio - Engineering Manager
On behalf of
Hanna Instruments Italia S.r.l.

WARRANTY

HI 95711 is warranted for two years against defects in workmanship and materials when used for its intended purpose and maintained according to the instructions.

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

Damages due to accident, misuse, tampering or lack of prescribed maintenance are not covered.

If service is required, contact your dealer. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charges incurred.

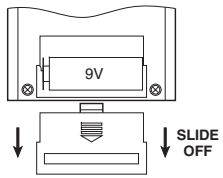
If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization Number from the Customer Service Department and then send it with shipment costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

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

BATTERY REPLACEMENT

Battery replacement must only take place in a non-hazardous area.

Simply slide off the battery cover on the back of the meter. Detach the battery from the terminals and attach a fresh 9V battery while paying attention to the correct polarity. Insert the battery and replace the cover.



ACCESSORIES

REAGENT SETS

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 ACCESSORIES

HI 95701-11	CAL CHECK™ Standard Cuvets for Free Chlorine (1 set)
HI 95711-11	CAL CHECK™ Standard Cuvets for Total Chlorine (1 set)
HI 710009	Blue rubber boot
HI 710010	Orange rubber boot
HI 721310	9V battery (10 pcs)
HI 731318	Tissue for wiping cuvets (4 pcs)
HI 731331	Glass cuvets (4 pcs)
HI 731335	Caps for cuvets (4 pcs)
HI 93703-50	Cuvets cleaning solution (230 mL).

SPECIFICATIONS

Range	Free Cl_2 0.00 to 5.00 mg/L Total Cl_2 0.00 to 5.00 mg/L
Resolution	0.01 mg/L from 0.00 to 3.50 mg/L; 0.10 mg/L above 3.50 mg/L
Precision	±0.02 mg/L @ 1.00 mg/L
Typical EMC Deviation	±0.01 mg/L
Light Source	Tungsten lamp with narrow band interference filter @ 525 nm
Light Detector	Silicon Photocell
Method	Adaptation of the USEPA method 330.5 and Standard Method 4500-Cl G. The reaction between chlorine and the DPD reagent causes a pink tint in the sample.
Environment	0 to 50°C (32 to 122°F); max 95% RH non-condensing
Battery Type	1 x 9 volt
Auto-Shut off	After 10' of non-use in *measurement mode*; after 1 hour of non-use in *calibration mode*.
Dimensions	180 x 83 x 46 mm (7.1 x 3.3 x 1.8")
Weight	290 g (10 oz.).

REQUIRED REAGENTS

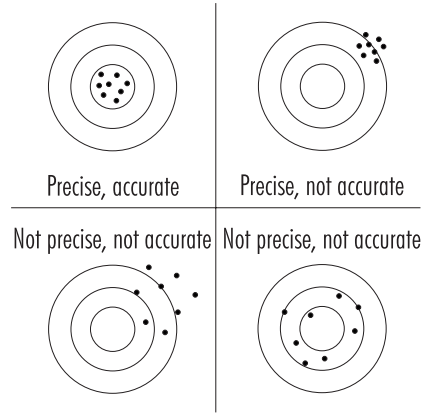
Code	Unit	Description	Quantity/test
HI 93701-0	Free Cl_2	Free Chlorine Reagent	1 packet
HI 93711-0	Total Cl_2	Total Chlorine Reagent	1 packet

PRECISION AND ACCURACY

Precision is how closely repeated measurements agree with each other. Precision is usually expressed as standard deviation (SD).

Accuracy is defined as the nearness of a test result to the true value.

Although good precision suggests good accuracy, precise results can be inaccurate. The figure explains these definitions. In a laboratory using a standard solution of 1.00 mg/L chlorine and a representative lot of reagent, an operator obtained with a single instrument a standard deviation of 0.02 mg/L.



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:

$$-\log I/I_o = \varepsilon_\lambda \, c \, d$$

or

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

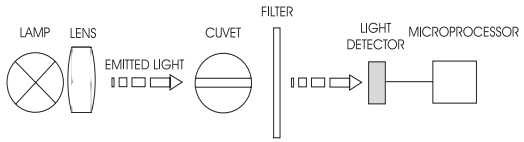
Where:

$-\log I/I_o$	=	Absorbance (A)
I_o	=	intensity of incident light beam
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 95** series colorimeters is based on special subminiature tungsten lamps and narrow-band interference filters to guarantee both high performance and reliable results.



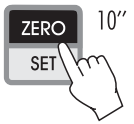
Block diagram (optical layout)

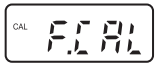
FACTORY CALIBRATION RESET

It is possible to restore factory calibration:

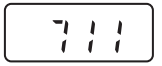
- Enter the *calibration mode* by holding CAL CHECK for three seconds.

- Hold ZERO/SET for 10 seconds. The display will show for 2 seconds "F.CAL" and the parameter code ("701" or "711") appears. The factory calibration is automatically restored and the instrument is ready for measurement.

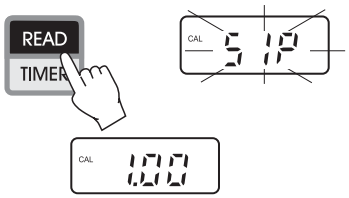




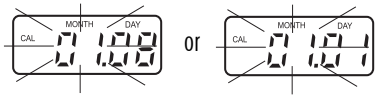
or



- Press READ/TIMER and "SIP" will blink on the display.

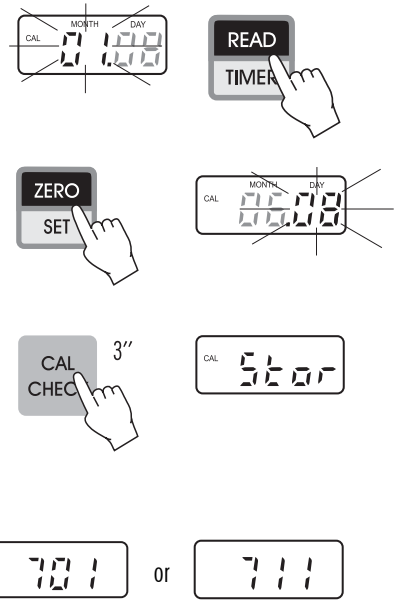


- The instrument will show for three seconds the CAL CHECK™ standard value.
  Then the date of last calibration (e.g.: "01.08") appears on the display, or "01.01" if the factory calibration was selected. In both cases the number of the month is blinking, ready for date input.
  Note: if display will show "ERR" the calibration procedure failed. Verify that the right CAL CHECK™ Standard Cuvet **B** is inserted, that both **A** and **B** cuvets are free from fingerprints or dirt and that they are inserted correctly.



DATE INPUT

- Keep READ/TIMER pressed to scroll to the desired month number (01-12).
- When the correct month has been set, press ZERO to confirm. Now the display will show the day number blinking. Keep READ/TIMER pressed to scroll to the desired day number (01-31).
  Note: it is possible to change from *day* to *month* and vice versa by pressing ZERO.
- When both the day and month have been selected, hold CAL CHECK for three seconds to store date and calibration values. The instrument will show for one second "Stor", to confirm that the new calibration data has been accepted.
- The instrument will return automatically to the measurement mode by displaying the parameter code ("701" or "711") on the LCD.



A microprocessor controlled special tungsten lamp emits radiation which is first optically conditioned and beamed to the sample contained in the cuvet. The optical path is fixed by the diameter of the cuvet. Then the light is spectrally filtered to a narrow spectral bandwidth, to obtain a light beam of intensity I_0 or I.

The photoelectric cell collects the radiation I that is not absorbed by the sample and converts it into an electric current, producing a potential in the mV range.

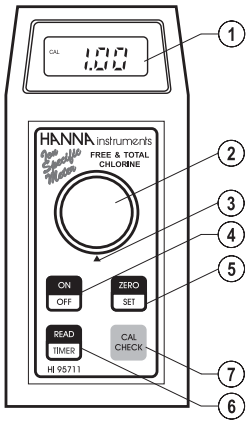
The microprocessor uses this potential to convert the incoming value into the desired measuring unit and to display it on the LCD.

The measurement process is carried out in two phases: first the meter is zeroed and then the actual measurement is performed.

The cuvet has a very important role because it is an optical element and thus requires particular attention. It is important that both the measurement and the calibration (zeroing) cuvets are optically identical to provide the same measurement conditions. Whenever possible use the same cuvet for both. It is necessary that the surface of the cuvet is clean and not scratched. This to avoid measurement interference due to unwanted reflection and absorption of light. It is recommended not to touch the cuvet walls with hands.

Furthermore, in order to maintain the same conditions during the zeroing and the measuring phases, it is necessary to close the cuvet to prevent any contamination.

FUNCTIONAL DESCRIPTION



1) Liquid Crystal Display
2) Cuvet Holder
3) Cuvet alignment indicator
4) ON/OFF key
5) ZERO/SET key
6) READ/TIMER key
7) CAL CHECK key

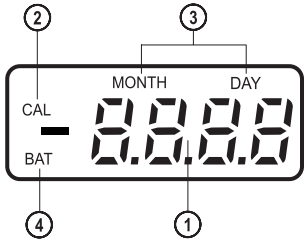
KEYPAD DESCRIPTION

- ON/OFF: to turn the meter on and off.
- ZERO/SET: this is a bi-functional key: press to zero the meter prior to measurement, or hold the key for 3 seconds to select the desired parameter (Free or Total Chlorine).
- READ/TIMER: this is a bi-functional key, just press for making a measurement, or hold the key for 3 seconds to start a pre-programmed countdown prior to measurement.
- CAL CHECK: this bi-functional key allows to perform validation of the instrument just pressing the CAL CHECK key, or hold the key for 3 seconds to enter the *calibration mode*.

OPERATING MODES

- *Measurement mode:* default operation mode, enables both **validation** and **measurement**.
- *Calibration mode:* may be entered by keeping CAL CHECK pressed for three seconds (the "CAL" icon appears), it enables **calibration** of the instrument.

DISPLAY ELEMENTS DESCRIPTION



1) four digit main display area.
2) CAL: appears when the instrument operates in the *calibration mode*.
3) the Month and Day icons appear above the number of month and day when a date is displayed.
4) the blinking "Battery" icon appears when the battery voltage is getting low.

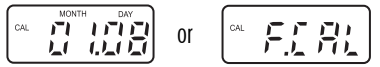
CALIBRATION PROCEDURE

Note: It is possible to interrupt calibration procedure at any time by pressing ON/OFF.
Warning: do not validate or calibrate the instrument with standard solutions other than the Hanna CAL CHECK™ Standards, otherwise erroneous results will be obtained.

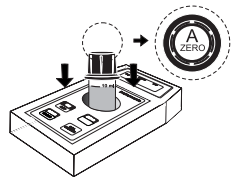
CALIBRATION PROCEDURE

- Select the parameter code for free chlorine "701" ot total chlorine "711" by holding ZERO/SET (see pag. 13).
- Enter the *calibration mode* by holding CAL CHECK for three seconds.

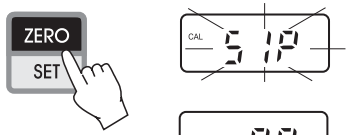
- The date of the last calibration appears (e.g.: month "01", day "08"). "F.CAL" means that the factory calibration is selected.
  Note: at this point it is possible to reset the instrument to restore FACTORY CALIBRATION, see instructions page 19.



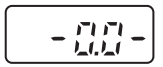
- Place the CAL CHECK™ Standard Cuvet **A** into the holder and ensure that the notch on the cap is positioned securely into the groove.



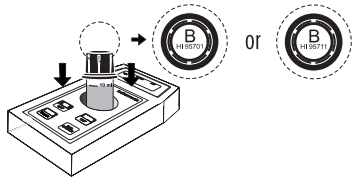
- Press ZERO and "SIP" will blink on the display.



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



- Remove the cuvet.
- Place the specific CAL CHECK™ Standard Cuvet **B** into the holder:
  Free Chlorine: **B**, HI 95701-11 **or** Total Chlorine: **B**, HI 95711-11
  Ensure that the notch on the cap is positioned securely into the groove.



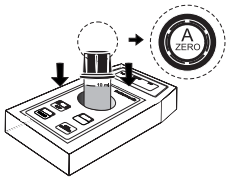
VALIDATION PROCEDURE

Use the validation procedure to ensure that the instrument is properly calibrated.

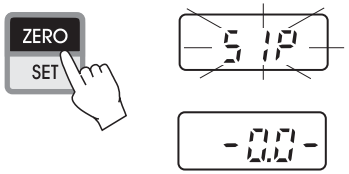
Warning: do not validate or calibrate the instrument with standard solutions other than the Hanna CAL CHECK™ Standards, otherwise erroneous results will be obtained.

Temperature correction for Validation: corrected value = read value × [1 + 0.002 × (20 – T(°C))]
corrected value = read value × [1 + 0.001 × (68 – T(°F))]

- Select the parameter code for free chlorine "701" ot total chlorine "711" by holding ZERO/SET (see pag. 13).
- Place the CAL CHECK™ Standard Cuvet **A** into the holder and ensure that the notch on the cap is positioned securely into the groove.



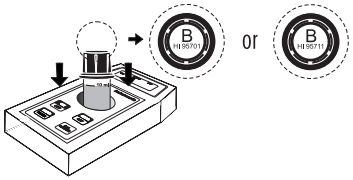
- Press ZERO and "SIP" will blink on the display.



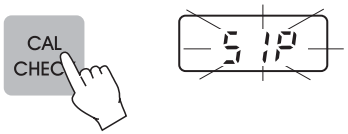
- After a few seconds the display will show "-0.0-". The meter is now zeroed and ready for validation.
- Remove the cuvet.
- Place the specific CAL CHECK™ Standard Cuvet **B** into the holder, for:

  Free Chlorine: **B**, HI 95701-11 **or** Total Chlorine: **B**, HI 95711-11

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



- Press CAL CHECK and "SIP" will blink during measurement.

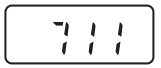


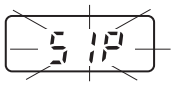
- Wait for a few seconds and the display will show the validation standard value.
  The reading should be within specifications as reported on the CAL CHECK™ Standard Certificate. If the value is found out of specifications, please check that the cuvets are free of fingerprints, oil or dirt and repeat validation. If results are still found out of specifications then recalibrate the instrument.

GUIDE TO DISPLAY CODES

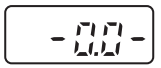
This prompt appears for 1 second each time the instrument is turned on.

The parameter code "701" or "711" indicates that the meter is in a ready state and zeroing can be performed.





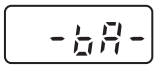
Sampling in Progress. This flashing prompt appears each time the meter is performing a measurement.



This indicates that the meter is in a zeroed state and measurement can be performed.

Light over range: the cuvet is not inserted correctly and an excess ambient light is reaching the detector. If the cover is properly installed, then contact your dealer or the nearest Hanna Customer Service Center.

The blinking "BAT" indicates that the battery voltage is getting low and the battery needs to be replaced.



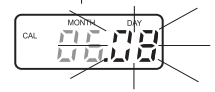
This indicates that the battery is dead and must be replaced. Once this indication is displayed, the meter will lock up. Change the battery and restart.

"Configuration": this indicates that the meter has lost its configuration. Contact your dealer or the nearest Hanna Customer Service Center.

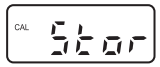
CALIBRATION MODE MESSAGES

The date of the last calibration appears on the LCD each time the *calibration mode* is entered. If calibration is performed for the first time, "F.CAL" appears.

This indicates that the factory calibration is selected.



The flashing digits indicate that:
1) the month can be set
2) the day can be set



"Storage": this prompt appears for 1 second at the end of the **calibration procedure**, to indicate that the calibration data has been stored.

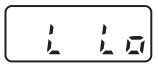
"Error": the concentration of the calibration solution used is not correct. Repeat the **calibration procedure** with the right standard solution, and verify it is not expired. If the calibration procedure fails again, contact your dealer or the nearest Hanna Customer Service Center.

ERROR MESSAGES

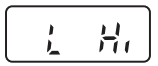
a) on zero reading

This indicates that the zeroing procedure failed due to a low signal-to-noise ratio. In this case press ZERO again.

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

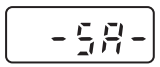


"Light Low": there is not enough light to perform a measurement. Please check the preparation of the zero cuvet.

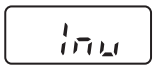


"Light High": there is too much light to perform a measurement. Please check the preparation of the zero cuvet.

b) on sample reading



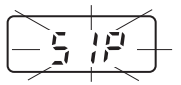
There is too much light for the sample measurement. Please check if the right sample cuvet is inserted.



"Inverted": the sample and the zero cuvet are inverted.

"Zero": a zero reading was not taken. Follow the instruction in the **measurement procedure** for zeroing the meter.

- Hold READ/TIMER for three seconds. The display will show the countdown prior to measurement.

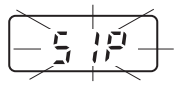


Alternatively, wait for:

Free Chlorine:		Total Chlorine:
1 minute	**or**	2 minutes and 30 seconds

or

Then just press READ/TIMER.
In both cases "SIP" will blink during measurement.



- The instrument directly displays concentration in mg/L of free or total chlorine on the Liquid Crystal Display.

INTERFERENCES

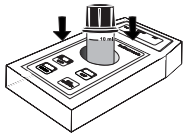
- Alkalinity: above 1,000 mg/L $CaCO_3$ if present as bicarbonate (HCO_3^-, sample pH < 8.3); above 250 mg/L $CaCO_3$ if present as carbonate (CO_3^{2-}, sample pH > 9.0).
  In both cases, it will not reliably develop the full amount of color or it may rapidly fade (negative error). To resolve this, neutralize the sample with diluted HCl.
- Acidity: above 150 mg/L $CaCO_3$. May not reliably develop the full amount of color or it may rapidly fade (negative error). To resolve this, neutralize the sample with diluted NaOH.
- Hardness: in case of water with hardness greater than 500 mg/L $CaCO_3$, shake the sample for approximately 2 minutes after adding the powder reagent.
- Bromine (Br_2): positive error.
- Chlorine dioxide (ClO_2): positive error.
- Iodine (I_2): positive error.
- Oxidized Manganese and Chromium: positive error.
- Ozone (O_3): positive error.

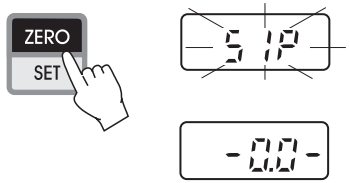
MEASUREMENT PROCEDURE

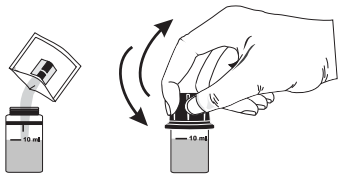
- Select the parameter code for free chlorine "701" ot total chlorine "711" by holding ZERO/SET (see pag. 13).
- Fill the cuvet with 10 mL of unreacted sample, up to the mark, and replace the cap.
- Place the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.
- Press ZERO/SET and "SIP" will blink on the display.
- After a few seconds the display will show "-0.0-". The meter is now zeroed and ready for measurement.
- Remove the cuvet.
- Add the content of one packet of the specific test reagent, for:

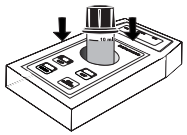
Free Chlorine:		Total Chlorine:
1 packet of HI 93701-0	**or**	1 packet of HI 93711-0

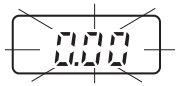
- Replace the cap and shake gently for 20 seconds (or 2 minutes in case of seawater analysis)
- Replace the cuvet into the holder and ensure that the notch on the cap is positioned securely into the groove.



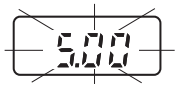








Under range. A blinking "0.00" indicates that the sample absorbs less light than the zero reference. Check the procedure and make sure you use the same cuvet for reference (zero) and measurement.



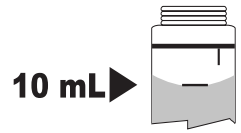
A flashing value of the maximum concentration indicates an over range condition. The concentration of the sample is beyond the programmed range: dilute the sample and re-run the test.

A flashing value lower than the maximum concentration indicates a low signal-to-noise ratio condition. In this case accuracy of the result is not guaranteed. Repeat the **measurement procedure**.

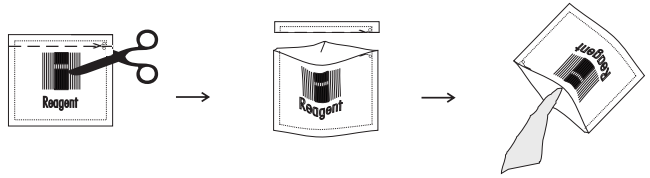
GENERAL TIPS FOR AN ACCURATE MEASUREMENT

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

- For a correct filling of the cuvet: the liquid in the cuvet forms a convexity on the top; the bottom of this convexity must be at the same level of the 10 mL mark.

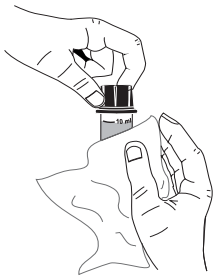


- Proper use of the powder reagent packet:
  (a) use scissors to open the powder packet;
  (b) push the edges of the packet to form a spout;
  (c) pour out the content of the packet.



(a) (b) (c)

- It is important that the sample does not contain any debris. This would corrupt the reading.
- Each time the cuvet is used, the cap must be tightened to the same degree.
- Whenever the cuvet is placed into the measurement cell, it must be dry outside, and completely free of fingerprints, oil or dirt. Wipe it thoroughly with **HI 731318** or a lint-free cloth prior to insertion.
- Shaking the cuvet can generate bubbles in the sample, causing higher readings. To obtain accurate measurements, remove such bubbles by swirling or by gently tapping the vial.
- Do not let the reacted sample stand too long after reagent is added, or accuracy will be lost.
- It is possible to take multiple readings in a row, but it is recommended to take a new zero reading for each sample and to use the same cuvet for zeroing and measurement.
- After the reading it is important to discard immediately the sample, otherwise the glass might become permanently stained.
- All the reaction times reported in this manual are referred to 20°C (68°F). As a general rule of thumb, they should be doubled at 10°C (50°F) and halved at 30°C (86°F).
- In order to maximize accuracy, prior to a measurement follow the **validation procedure** to be sure that the instrument is properly calibrated. If necessary, calibrate the instrument.

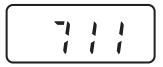


OPERATIONAL GUIDE

- Turn the meter on by pressing ON/OFF.

- When the LCD displays “701” or “711” it is ready. The display code that appears is the last selected parameter.

or



Code	Parameter
701	Free Chlorine
711	Total Chlorine

- Keep ZERO/SET pressed to change parameter. The parameter code will change every three seconds, until the key is released. Select the program for free chlorine “701” or total chlorine “711”.

- After the desired parameter code appears on the display, perform either MEASUREMENT, VALIDATION, or CALIBRATION PROCEDURE following the instructions reported in the related chapter.