Instruction Manual

HI 2300

**Auto-ranging
Microprocessor
EC/TDS/NaCl/°C
Bench Meter**

**HANNA
instruments**

www.hannainst.com
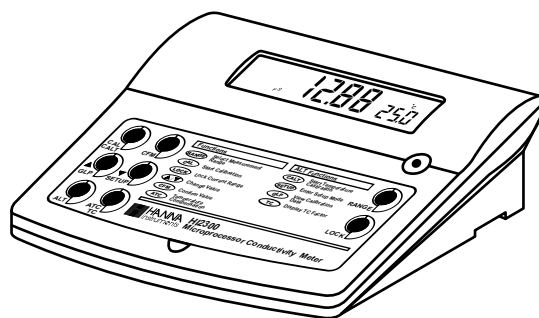
Dear Customer,

Thank you for choosing a Hanna Instruments product.

Please read this instruction manual carefully before using the instrument.

This manual will provide you with the necessary information for correct use of the instrument, as well as a precise idea of its versatility.

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

This instrument is in compliance with $C \epsilon$ directives.

WARRANTY

HI 2300 is 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 packaged for complete protection.

TABLE OF CONTENTS

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 Customer Service Center.

Each instrument is supplied with:

- **HI 76310** Conductivity / TDS probe
- 12V 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 2300** is a bench microprocessor-based Conductivity/TDS/NaCl/Temperature meter.

The autoranging feature of the EC and TDS ranges automatically sets the instrument to the scale with the highest possible resolution.

The conductivity measurements are manually or automatically compensated for temperature effect, with the temperature sensor inside the conductivity probe. It is also possible to disable the temperature compensation and measure the actual conductivity.

The temperature coefficient is user selectable.

The instrument is equipped with a stability indicator. With this feature the user will always know when to record a measurement.
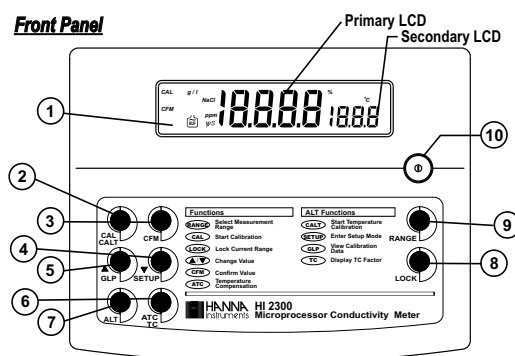
HI 2300 includes also GLP capability and data transfer to a computer through a RS232 port.

In addition, the meter allows the user to enter an ID code to uniquely identify the instrument.
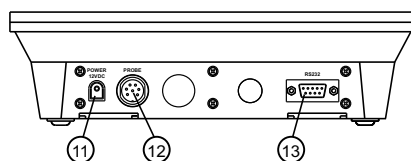
FUNCTIONAL DESCRIPTION

Front Panel

Rear Panel

1) Liquid Crystal Display (LCD).

2) **CAL** key, to enter/exit calibration mode.

   CALT key (alternate function), to enter temperature calibration mode.

3) **CFM** key, to confirm different values.

4) ▼ key, to manually decrease temperature value or other parameters.

   SETUP key (alternate function), to enter/exit SETUP mode.

5) ▲ key, to manually increase temperature value or other parameters.

   GLP key (alternate function), to display Good Laboratory Practice information.

6) **ATC** key, to select temperature compensation mode.

   TC key (alternate function), to view the temperature coefficient value.

7) **ALT** key, to select alternate key function.

8) **LOCK** key, to freeze current range on the LCD.

9) **RANGE** key, to select the measurement unit or to switch the focused data.

10) **ON/OFF** switch.

11) Power supply socket.

12) Probe connector.

13) RS232 serial communication connector.

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SPECIFICATIONS

RANGE	EC	0.00 to 29.99 μS/cm 30.0 to 299.9 μS/cm 300 to 2999 μS/cm 3.00 to 29.99 mS/cm 30.0 to 200.0 mS/cm up to 500.0 mS/cm (actual EC)*
	TDS	0.00 to 14.99 mg/L (ppm) 15.0 to 149.9 mg/L (ppm) 150 to 1499 mg/L (ppm) 1.50 to 14.99 g/L (ppt) 15.0 to 100.0 g/L (ppt) up to 400.0 g/L (actual TDS)* with 0.80 conversion factor
	NaCl	0.0 to 400.0%
	Temp	−9.9 to 120.0 °C
RESOLUTION	EC	0.01 μS/cm 0.1 μS/cm 1 μS/cm 0.01 mS/cm 0.1 mS/cm
	TDS	0.01 mg/L 0.1 mg/L 1 mg/L 0.01 g/L 0.1 g/L
	NaCl	0.1%
	Temp	0.1 °C
ACCURACY @ 20 °C/68 °F	EC	±1% of reading ±(0.05 μS/cm or 1 digit)
	TDS	±1% of reading ±(0.03 mg/L or 1 digit)
	NaCl	±1% of reading
	Temp	±0.4 °C
CALIBRATION	EC	Automatic, 1 point with 6 memorized values: 84.0, 1413 μS/cm 5.00, 12.88, 80.0, 111.8 mS/cm
	NaCl	1 point, with HI 7037 calibration solution
	Temp	2-point, at 0 and 50 °C (32 and 122 °F)

* Actual conductivity (or TDS) is the conductivity (or TDS) value without temperature compensation.

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SPECIFICATIONS (cont.)

|	
Temperature compensation	Automatic or manual, 0 to 60 ºC (32 to 140 ºF)
Temperature coefficient	Selectable from 0.00 to 6.00 %/ºC (EC and TDS only)
TDS conversion factor	Selectable from 0.40 to 0.80 (default value: 0.50)
Probe (included)	HI 76310 4-ring Platinum, internal temperature sensor
Computer Interface	RS232 opto-isolated
Auto-off	after 5 minutes of non-use (can be disabled)
Power supply	12 Vdc power adapter (included)
Dimensions	240 x 182 x 74 mm (9.4 x 7.1 x 2.9″)
Weight	1.1 Kg (2.4 lb)
Environment	0 – 50 ºC (32 - 122 ºF) max RH 95% non condensing
Warranty	2 years

CONNECTIONS

Plug the 12 VDC adapter into the power supply socket.

Note: This instrument use non volatile memory to retain the calibration parameters and all the other settings even when unplugged.

Connect the EC/TDS probe to the 7-pin connector. Tighten the threaded ring. Make sure the probe sleeve is properly inserted, as shown below:
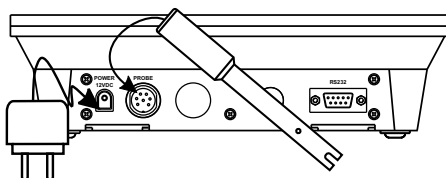
INSTRUMENT START-UP

• Turn the instrument on by pressing the **ON/OFF** switch.

• All LCD tags are displayed and a beep is generated while the instrument performs self test.

TAKING MEASUREMENTS

Immerse the probe into the solution to be tested. The sleeve holes must be completely submerged. Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.

If needed, press **RANGE** repeatedly until the desired range (EC, TDS, NaCl) is selected on the LCD (displaying μS[mS], ppm[g/L] or %).
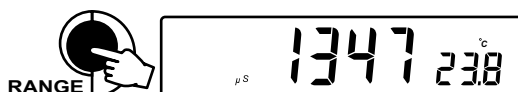
Allow for the reading to stabilize. The upper LCD displays the measurement in the selected range, while the temperature is displayed on the lower LCD.

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Notes:

- If the meter displays "----", the reading is out of range.

- If the stability indicator "~" blinks, the reading is unstable.

- Make sure the meter is calibrated before taking measurements.

- If measurements are taken successively in different samples, for accurate readings it is recommended to rinse the probe thoroughly with deionized water before immersing it into the samples.

- TDS reading is obtained by multiplying the EC reading by the TDS factor, which has a default value of 0.50. It is possible to change the TDS factor in the 0.40 to 0.80 range by entering setup mode and selecting the "tdS" item (see SETUP for details).

- When the use of an alternate function (SETUP, TC, GLP or CALT) is requested, press and hold the ALT key first, and then the second key.

AUTORANGING

The EC and TDS scales are autoranging. The meter automatically sets the scale with the highest possible resolution.

By pressing **LOCK**, the autoranging feature is disabled and the current range is frozen on the LCD. "1" tag starts blinking. To restore the autoranging option press **LOCK** again.

Note: Autoranging is automatically restored if the range is changed, if the setup or calibration modes are entered, or if the meter is turned off and back on again.

TEMPERATURE COMPENSATION

Three options of compensating temperature are available:

Automatic (Atc): The EC probe has a built-in temperature sensor; the temperature value is used to automatically compensate the EC/TDS reading (from −9.9 °C to 120.0 °C), using the selected reference temperature.

Manual (Mtc): The temperature value, shown on the secondary LCD, can be manually set with the **ARROW** keys. The compensation is referenced at the selected reference temperature. The "°C" tag blinks when this option is active.
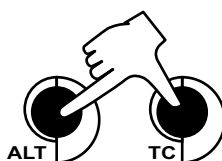
No Compensation (notc): The temperature value shown on the secondary LCD is not taken into account. The reading displayed on the primary LCD is the actual EC or TDS value. The "°C" tag blinks when this option is active.

Note: The default compensation mode is **ATC**.

To select the desired option press **ATC** until the option is displayed on the LCD.

If temperature compensation is active, measurements are compensated using the temperature coefficient (default value 1.90 %/°C).

To change the temperature coefficient, enter the setup mode and select the "tc" item (See SETUP for details, page 14). The current temperature coefficient can be quickly viewed by pressing **ALT + TC** keys. The value is briefly displayed on the secondary LCD.

- If the temperature reading is out of −9.9 °C - 120.0 °C interval and **Atc** or **Mtc** option is selected, the temperature limit range value will be displayed, together with the "°C" tag blinking and the instrument will do no temperature compensation.

EC/TDS CALIBRATION

EC calibration is a one-point procedure. Selectable calibration points are: 0.00 μS, 84.0 μS, 1413 μS, 5.00 mS, 12.88 mS, 80.0 mS, 111.8 mS.

To enter EC calibration, select the EC range and press **CAL**.

Note: TDS reading is automatically derived from the EC reading and no specific calibration for TDS is needed. Pressing **CAL** when TDS range is selected has no effect.

Rinse the probe with calibration solution or deionized water. Immerse the probe into the solution. The sleeve holes must be completely submerged. Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.

For zero calibration, just leave the dry probe in the air.

The "BUF" and "CAL" tags are displayed. The primary LCD displays the uncalibrated EC reading. The secondary LCD displays the buffer value. The "∼" tag blinks.
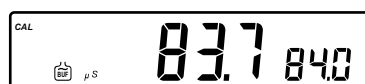
Select the desired value with the **ARROW** keys, if necessary.

When the reading is stable, "CFM" tag starts blinking on the LCD, asking for confirmation. Press **CFM** to confirm calibration.
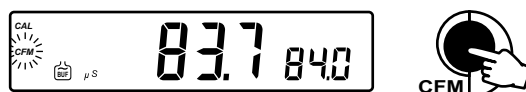
The instrument displays the "Stor Good" message and returns to measurement mode.

Notes:

- If the uncalibrated reading is too far from the expected value or the temperature value is out of 0 – 60 ºC range, calibration is not recognized. The "CFM" tag does not appear; the "∼" and "BUF" tags blink to signal wrong or contaminated calibration solution. If the temperature value is out of 0 – 60 ºC range, the "ºC" tag will also be displayed blinking on the LCD.

- For best results choose an EC buffer value close to the sample to be measured.

- In order to minimize any EMC interferences, use plastic beakers.

- The meter uses 1.90 %/°C compensation factor during calibration. If the setup item "tc" has been set to a different value, when exiting calibration mode, the displayed value on the upper LCD might be different from the nominal buffer value.

- It is possible to set the cell constant value directly, without following the calibration procedure. To set the cell constant enter the setup mode and select "CEL" (see SETUP for details).
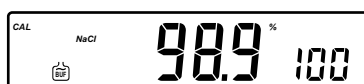
NaCl CALIBRATION

NaCl calibration is a one-point procedure at 100.0% NaCl. Use the **HI 7037L** calibration solution (sea water solution) as a 100% NaCl standard solution.

To enter NaCl calibration select the NaCl range and press **CAL**.

Rinse the probe with some of the calibration solution or deionized water. Immerse the probe into **HI 7037L** solution. The sleeve holes must be completely submerged. Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.

The "BUF" and "CAL" tags are displayed. The primary LCD displays the uncalibrated NaCl reading in percentage. The secondary LCD displays "100".

When the reading is stable, "CFM" tag starts blinking on the LCD, asking for confirmation. Press **CFM** to confirm calibration.

The instrument displays the "Stor Good" message and returns to measurement mode.

Notes:

- If the uncalibrated reading is too far from the expected value, calibration is not recognized. The "CFM" tag does not appear; the "∼" and "BUF" tags blink to signal wrong or contaminated calibration solution.

- The meter uses 1.90 %/°C compensation factor during calibration. If the setup item "tc" has been set to a different value, when exiting calibration mode, the displayed value on the upper LCD might be different from the nominal buffer value.

TEMPERATURE CALIBRATION
## (for technical personnel only)

The calibration is a 2-point procedure at 0.0 and 50.0 ºC.

- Immerse the probe in a 0 ºC temperature bath.
- Press **ALT**+**CALT** keys to enter temperature calibration mode.
- The lower LCD displays "0.0 ºC", "BUF" and "CAL" tags blinking.
- When the reading is stable, "CFM" tag starts blinking.
- Press **CFM** to confirm. The lower LCD displays 50.0 ºC.
- Immerse the probe in a 50 ºC temperature bath.
- When the reading is stable, "CFM" tag starts blinking.
- Press **CFM** to confirm. The meter returns to measurement mode.

TEMPERATURE ADJUSTMENT

The temperature reading can be manually fine-tuned following the next procedure:

Press **ALT** + **CALT** keys to enter temperature calibration mode.
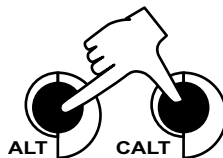
Press **CAL** to enter temperature adjustment mode. The primary and secondary LCD will display the current temperature reading.

Adjust the temperature reading on the primary LCD using the **ARROW** keys. The maximum adjustment is ±1 °C around current reading.
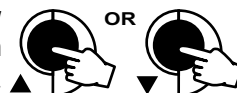
Press **CFM** to confirm. The meter returns to measurement mode and displays the new temperature.

Notes:

- Press **ALT** + **CALT** keys to escape without any changes.
- To enter temperature adjustment mode, the probe must be connected to the instrument.

CONDUCTIVITY VERSUS TEMPERATURE CHART

The conductivity of an aqueous solution is the measure of its ability to carry an electrical current by means of ionic motion.

The conductivity invariably increases with increasing temperature.

It is affected by the type and number of ions in the solution and by the viscosity of the solution itself. Both parameters are temperature dependent. The dependency of conductivity on temperature is expressed as a relative change per Celsius degree at a particular temperature, commonly as percent per ºC.

The following table lists the temperature dependence of the HANNA calibration buffers.

ºC	ºF	HI7030 HI8030 (μS/cm)	HI7031 HI8031 (μS/cm)	HI7033 HI8033 (μS/cm)	HI7034 HI8034 (μS/cm)	HI7035 HI8035 (μS/cm)	HI7039 HI8039 (μS/cm)
0	32	7150	776	64	48300	65400	2760
5	41	8220	896	65	53500	74100	3180
10	50	9330	1020	67	59600	83200	3615
15	59	10480	1147	68	65400	92500	4063
16	60.8	10720	1173	70	67200	94400	4155
17	62.6	10950	1199	71	68500	96300	4245
18	64.4	11190	1225	73	69800	98200	4337
19	66.2	11430	1251	74	71300	100200	4429
20	68	11670	1278	76	72400	102100	4523
21	69.8	11910	1305	78	74000	104000	4617
22	71.6	12150	1332	79	75200	105900	4711
23	73.4	12390	1359	81	76500	107900	4805
24	75.2	12640	1386	82	78300	109800	4902
25	77	12880	1413	84	80000	111800	5000
26	78.8	13130	1440	86	81300	113800	5096
27	80.6	13370	1467	87	83000	115700	5190
28	82.4	13620	1494	89	84900	117700	5286
29	84.2	13870	1521	90	86300	119700	5383
30	86	14120	1548	92	88200	121800	5479
31	87.8	14370	1575	94	90000	123900	5575

SETUP

Setup mode allows viewing and modifying the instrument parameters.

To enter setup press **ALT**＋**SETUP** keys when the meter is in measurement mode.
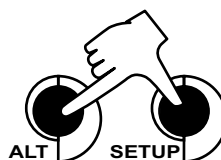
"Set" is displayed on the primary LCD.
The secondary LCD displays the code of the current setup item.

$$\boxed{\text{SEt} \quad \text{tc}}$$

Select the desired setup item using the **ARROW** keys. Press **CFM** to confirm.

Note: If **ALT**＋**SETUP** keys are pressed before item confirmation, the meter exits SETUP mode and returns to measurement mode.
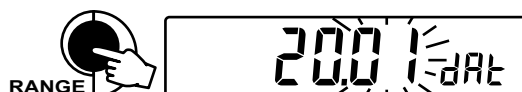
Once the desired setup item has been selected, its current value starts blinking (if it is a changeable parameter).

$$\boxed{\text{2001 dAt}}$$

Press the **ARROW** keys to change the value.

Press **RANGE**. The other item will start blinking (e.g. month in setting up the correct date).

$$\boxed{\text{2001 dAt}}$$

Press the **ARROW** keys to change the value.
Press **CFM** to confirm.

Note: Press **ALT** + **SETUP** keys before confirmation to escape without changing the previously set value.

The following table lists the setup items, their valid range of values and the factory settings (default):

| Item	Description	Valid values	Default
tc	Temp.compensation coeff.	0.00 to 6.00 %/°C	1.90
tcE	Temp.compensation mode	Atc, Mtc, notc	Atc
rEF	Reference temperature	20.0 °C, 25.0 °C	25.0 °C
tdS	TDS factor	0.40 to 0.80	0.50
CEL	Cell constant (K)	0.500 to 1.700	1.000
AoF	Auto-Off enabled	On, Off	Off
BeP	Beep on key pressed	On, Off	On
YEA	Year	1999 to 2098	1999
dAt	Date (DD.MM)	01.01 to 31.12	01.01
hou	Time (hh.mm)	01.01 to 23.59	01.01
id	Meter identification code	0000 to 9999	0000
vEr	Firmware release	x.x	

Notes:

• Once enabled, the Auto-Off time is fixed at 5 minutes.

• Assigning an ID code is helpful in identifying a particular meter from others.

GOOD LABORATORY PRACTICE

Good Laboratory Practice (GLP) is a set of functions that allows storage and retrieval of data regarding the status of the system.

After a successful calibration, the meter automatically stores the date and time of calibration, the used calibration solution and the resulting cell constant value. All this information can be recalled by the user.

To view the last calibration data, select the desired range (EC or NaCl) and press **ALT** + **GLP** keys.
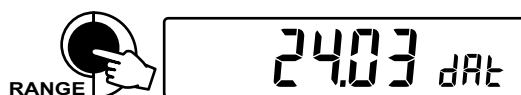

ALT   GLP
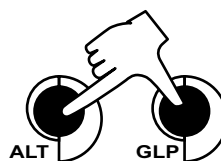
The first information appearing on the LCD is the meter "id" code.

427 id
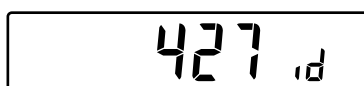
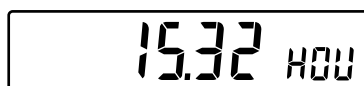By repeatedly pressing **RANGE**, GLP data is displayed in the following order:

Last calibration date:

24.03 dAt

Last calibration year:

2000 dAt

Last calibration time:

15.32 HOU

Cell constant value (K):

1.025 CEL

Offset value:

µS   0.23 OFF
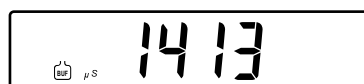
This information is displayed only if the last calibration was performed at 0.00 µS.
Calibration solution used:

BUF µS   1413

If the cell constant was changed after calibration (through the "CEL" setup function), this information is not displayed.

For NaCl GLP, the last parameter is not the nominal value of the calibration solution but the actual conductivity and the temperature of the used calibration solution.

BUF mS   44.3 ℃ 10.5
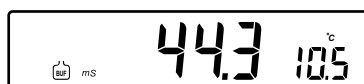
If **RANGE** is pressed when the last parameter is displayed, the meter returns to measurement mode.

Notes:

- To exit GLP mode at any time press **ALT**＋**GLP** keys.

- If the calibration procedure was never performed, after displaying the ID code the LCD will show the "no CAL" message blinking. Press **RANGE** or **ALT**＋**GLP** keys to return to measurement mode.

- Last calibration data is available for EC and NaCl only. No calibration data can be recalled for TDS. If the meter is in TDS mode, by pressing **ALT**＋**GLP** keys it is possible only to view the ID code. Press **ALT**＋**GLP** keys again to return to measurement mode.

- The meter has an internal lithium battery that allows to correctly update the date and time even if the power supply is disconnected.

DATA TRANSFER TO PC

Connect the meter to a PC through the RS232 output. Use **HI 920010** (9 to 9-pin) connection cable.

The meter must be in measurement mode to communicate.
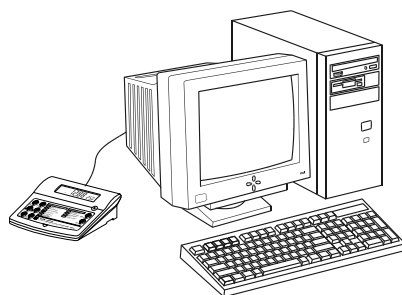
The meter port is optoisolated and transmits data with a Baud rate of 2400 bps.

The user can retrieve the GLP data, request meter's parameters and the current reading (current range only) from the PC directly. It is also possible to send a command from the PC to change ranges.

To communicate with the PC use the optional **HI 92000** communication software. The software is provided with an exclusive on-line guide of all the commands available and allows data printing, plotting and exporting.

PROBE MAINTENANCE

Rinse the probe with clean water after measurements. If more cleaning is required, remove the probe sleeve and clean the probe with a cloth or a nonabrasive detergent. Make sure to reinsert the sleeve onto the probe properly and in the right direction. After cleaning the probe, recalibrate the instrument.

The platinum rings are sustained with glass. Take great care while handling the probe.
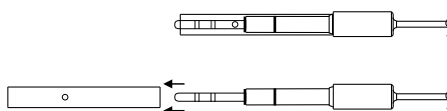
ACCESSORIES

CONDUCTIVITY BUFFER SOLUTIONS

HI 70030P	12880 μS/cm (μmho/cm), 20 mL sachets (25 pcs.)
HI 7030L	12880 μS/cm (μmho/cm), 460 mL bottle
HI 7030M	12880 μS/cm (μmho/cm), 230 mL bottle
HI 70031P	1413 μS/cm (μmho/cm), 20 mL sachets (25 pcs.)
HI 7031L	1413 μS/cm (μmho/cm), 460 mL bottle
HI 7031M	1413 μS/cm (μmho/cm), 230 mL bottle
HI 70033P	84 μS/cm (μmho/cm), 20 mL sachets (25 pcs.)
HI 7033L	84 μS/cm (μmho/cm), 460 mL bottle
HI 7033M	84 μS/cm (μmho/cm), 230 mL bottle
HI 7034L	80000 μS/cm (μmho/cm), 460 mL bottle
HI 7034M	80000 μS/cm (μmho/cm), 230 mL bottle
HI 7035L	111800 μS/cm (μmho/cm), 460 mL bottle
HI 7035M	111800 μS/cm (μmho/cm), 230 mL bottle
HI 70039P	5000 μS/cm (μmho/cm), 20 mL sachets (25 pcs.)
HI 7039L	5000 μS/cm (μmho/cm), 460 mL bottle
HI 7039M	5000 μS/cm (μmho/cm), 230 mL bottle
HI 8030L	12880 μS/cm (μmho/cm), 460 mL FDA approved bottle
HI 8031L	1413 μS/cm (μmho/cm), 460 mL FDA approved bottle
HI 8033L	84 μS/cm (μmho/cm), 460 mL FDA approved bottle
HI 8034L	80000 μS/cm (μmho/cm), 460 mL FDA approved bottle
HI 8035L	111800 μS/cm (μmho/cm), 460 mL FDA approved bottle
HI 8039L	5000 μS/cm (μmho/cm), 460 mL FDA approved bottle
HI 7037L	100% NaCl sea water standard solution, 460 mL

PROBE CLEANING SOLUTIONS

HI 7061M   General Cleaning Solution, 230 mL bottle

HI 7061L   General Cleaning Solution, 460 mL bottle

HI 8061M   General Cleaning Solution, 230 mL FDA approved bottle

HI 8061L   General Cleaning Solution, 460 mL FDA approved bottle

OTHER ACCESSORIES

HI 76310   Platinum 4-ring Conductivity/TDS probe with temperature sensor and 1 m (3.3') cable.

HI 710005   12VDC voltage adapter (US plug)

HI 710006   12VDC voltage adapter (European plug)

HI 920010   9 to 9-pin connection cable

HI 92000   Windows® compatible software

RECOMMENDATIONS FOR USERS

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

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

The metal bonds of the probe are sensitive to electrostatic discharges. Avoid touching these metal bands at all times.

To maintain the EMC performance of this equipment, the recommended cables must be used. Any variation introduced by the user to the supplied equipment may degrade the instrument's EMC performance.

To avoid electrical shock, do not use this instrument 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.

SALES AND TECHNICAL SERVICE CONTACTS

Australia:
Tel. (03) 9769.0666 • Fax (03) 9769.0699

China:
Tel. (10) 88570068 • Fax (10) 88570060

Egypt:
Tel. & Fax (02) 2758.683

Germany:
Tel. (07851) 9129-0 • Fax (07851) 9129-99

Greece:
Tel. (210) 823.5192 • Fax (210) 884.0210

Indonesia:
Tel. (21) 4584.2941 • Fax (21) 4584.2942

Japan:
Tel. (03) 3258.9565 • Fax (03) 3258.9567

Korea:
Tel. (02) 2278.5147 • Fax (02) 2264.1729

Malaysia:
Tel. (603) 5638.9940 • Fax (603) 5638.9829

Singapore:
Tel. 6296.7118 • Fax 6291.6906

South Africa:
Tel. (011) 615.6076 • Fax (011) 615.8582

Taiwan:
Tel. 886.2.2739.3014 • Fax 886.2.2739.2983

Thailand:
Tel. 66.2619.0708 • Fax 66.2619.0061

United Kingdom:
Tel. (01525) 850.855 • Fax (01525) 853.668

USA:
Tel. (401) 765.7500 • Fax (401) 765.7575

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