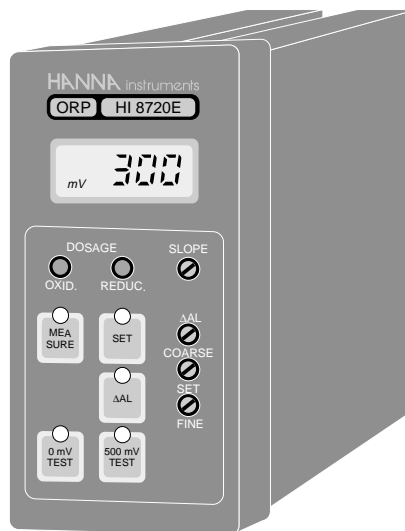


Instruction Manual

HI 8510 - HI 8512
HI 8710 - HI 8711
HI 8720 - HI 931500
HI 931501 - HI 932500

Panel - Mounted
ORP - pH Indicators
and Controllers



These Instruments are in Compliance with the CE Directives

 **HANNA**
instruments
<http://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 all the necessary information for the correct use of the instrument, as well as a precise idea of its versatility in a wide range of applications.
These instruments are in compliance with **CE** directives EN 50081-1 and 50082-1.

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PRELIMINARY EXAMINATION

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

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

GENERAL DESCRIPTION

HI 8510, HI 8512, HI 8710, HI 8711, HI 8720, HI 931500, HI 931501 and HI 932500 are pH-ORP panel-mounted indicators and controllers designed for simplicity of use in a wide range of industrial process applications.

The models are designed with DIN standard panel mount with membrane keypads on the front panel, a large LCD display and autodiagnostic functions (not **HI 931500, HI 931501 and HI 932500**).

Connections to the power supply, contacts and recorders are made through screw terminals on the rear panel.

Two models are available for **HI 8510, HI 8711, HI 8512, HI 8520**. The E-model accepts input direct from the pH or ORP electrode, while the T-model accepts a 2-wire current loop of 4 to 20 mA from a pH or ORP transmitter.

HI 931500, HI 931501 and HI 932500 are equipped with a BNC socket to connect a pH-ORP electrode.

Other features include: recorder output in 0 to 20mA or 4 to 20 mA; LED indicators which identify the controller mode.

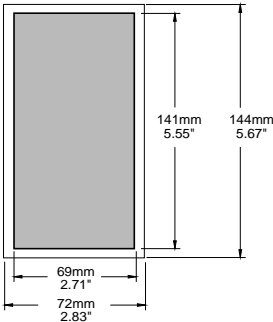
Using the pH indicators in conjunction with a 4-20mA output pH transmitter **HI 8614** or **HI 8614L** (with LCD display) and using the ORP indicators in conjunction with a 4-20 mA output ORP transmitter **HI 8615** or **HI 8615L** (with LCD display) will assure you of a strong, interference-free signal at distances up to 300 m (1000 ft).

All instruments are supplied with a plastic transparent front cover and mounting brackets (electrode and mains cable excluded).

MECHANICAL DIMENSIONS

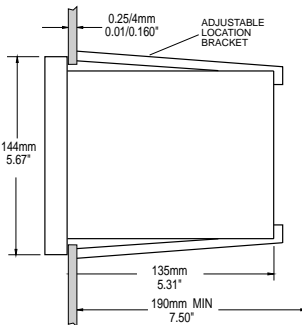
The meters have a DIN 43 700 casing in black anodized aluminum. Front and back of the instruments are supplied with shockproof ABS plastic and a transparent protective cover for the front panel.

Front view of the panel-mounted unit.



These dimensions show the cutout size for the installation.

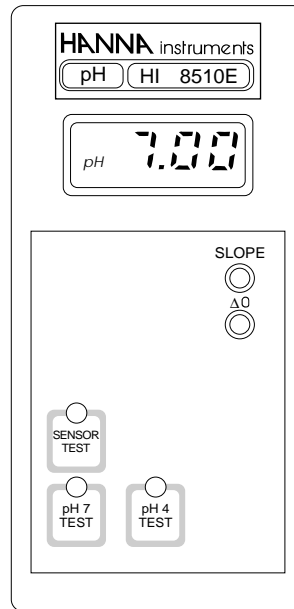
Side view of the panel-mounted unit.



Adjustable location brackets (supplied with the meter) allow the indicator to slide into the cutout and will hold the unit securely in place. 190 mm (7.50") is the minimum amount of room required to install the indicator with the cables connected.

**FUNCTIONAL DESCRIPTION HI 8510
pH INDICATOR**

FRONT PANEL



Keypad

SENSOR TEST

To display the mV response of the electrode in order to verify its working condition

pH 7 TEST

To verify the internal circuit of the meter in terms of Offset compensation

pH 4 TEST

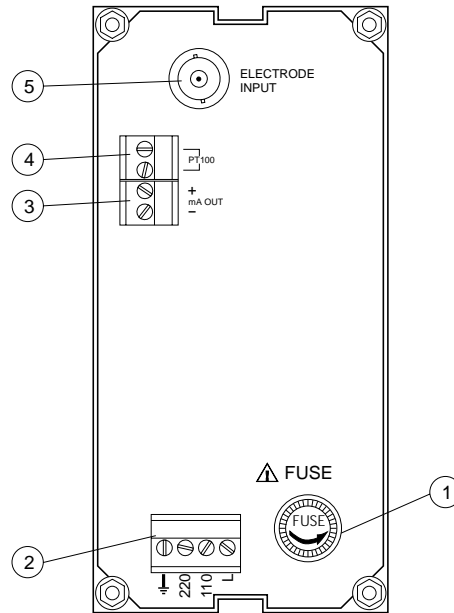
To verify the amplifier circuit of the meter

Trimmers

ΔO For Offset calibration

SLOPE For Slope calibration

REAR PANEL HI8510E

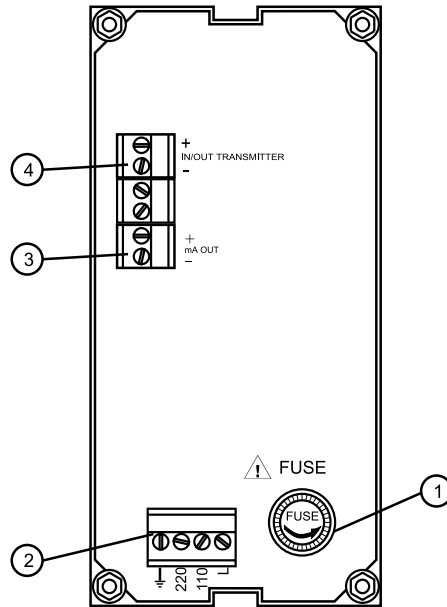


1. Fuse Holder
2. Power supply
3. Recorder output
4. Connections for PT100 temperature sensor
5. BNC socket for pH electrode.




Unplug the instrument from the power supply before replacing the fuse.

REAR PANEL HI8510T

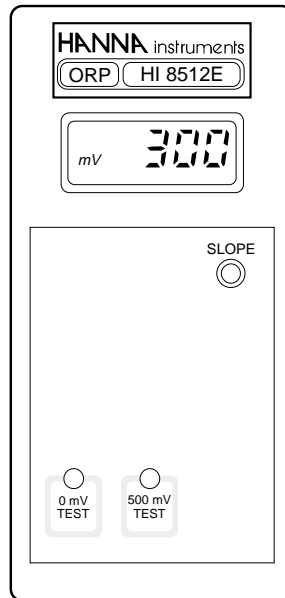


1. Fuse Holder
2. Power supply
3. Recorder output
4. Connections to the transmitter.

 Unplug the instrument from the power supply before replacing the fuse.

FUNCTIONAL DESCRIPTION HI 8512 ORP INDICATOR

FRONT PANEL



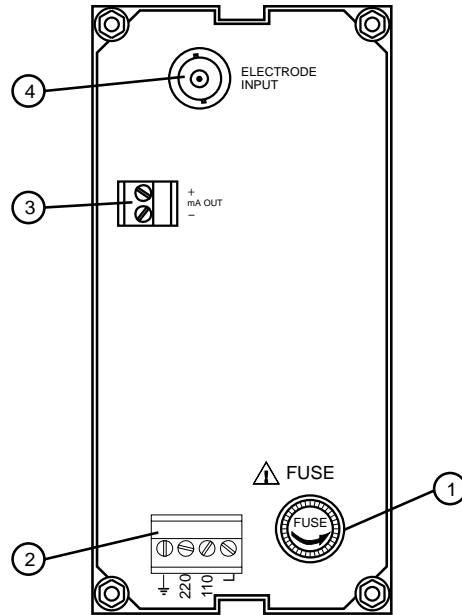
Keypad

- 0 mV TEST** To verify the instrument calibration at point 0
- 500 mV TEST** To verify the slope at point 500 mV

Trimmers

- SLOPE** For Slope calibration

REAR PANEL HI8512E

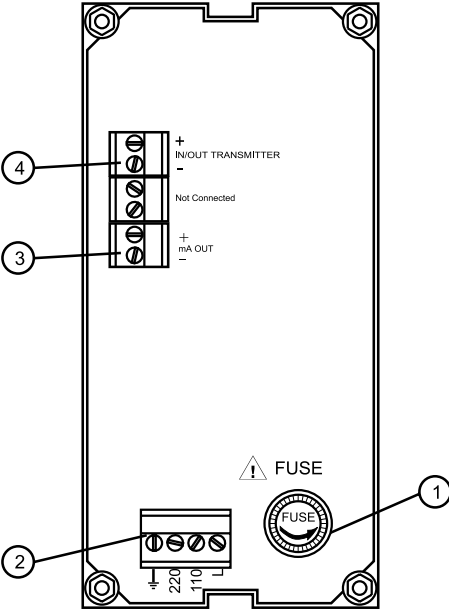


1. Fuse Holder
2. Power supply
3. Recorder output
4. BNC socket for ORP electrode.




Unplug the instrument from the power supply before replacing the fuse.

REAR PANEL HI8512T

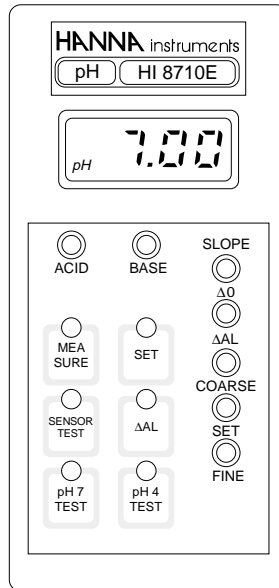


- 1. Fuse Holder
- 2. Power supply
- 3. Recorder output
- 4. Connections to the transmitter.

 Unplug the instrument from the power supply before replacing the fuse.

**FUNCTIONAL DESCRIPTION HI 8710
pH CONTROLLER WITH ALARM**

FRONT PANEL



Keypad

- SET** To set the working point of pH dosage
- MEASURE** To set HI 8710 on measurement mode and to enable the diagnostic tests
- SENSOR TEST** To display the mV response of the electrode in order to verify its working condition
- ΔAL** To display and set the tolerance of the alarm points
- pH 7 TEST** To verify the internal circuit of the meter in terms of Offset compensation
- pH 4 TEST** To verify the amplifier circuit of the meter

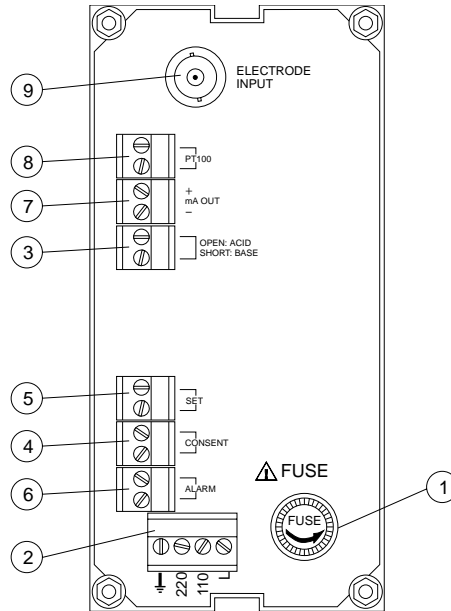
Trimmers

ΔO	For Offset calibration
SLOPE	For Slope calibration
ΔAL	To set the tolerance of the alarm
SET/COARSE	To coarsely adjust the set point
SET/FINE	To finely adjust the set point

Leds

ACID	To show the acid dosage is active
BASE	To show the basic dosage is active
ΔAL (blinking)	To show the alarm is active

REAR PANEL HI8710E

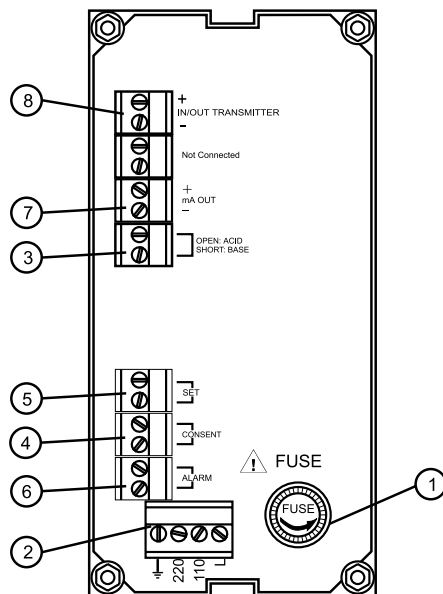


1. Fuse Holder
2. Power supply
3. Acid/Basic dosage selection
4. Reductant or oxidant dosage consent
5. Connections for dosing pump
6. Alarm contacts
7. Recorder output
8. Connections for PT100 temperature sensor
9. BNC socket for pH electrode.



Unplug the instrument from the power supply before replacing the fuse.

REAR PANEL HI8710T



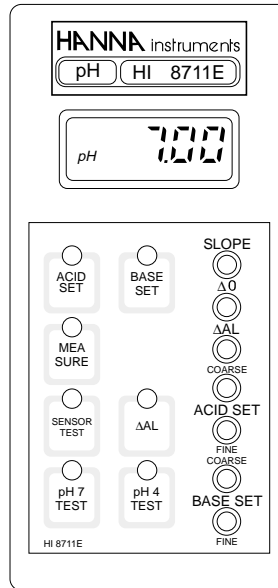
1. Fuse Holder
2. Power supply
3. Acid/Basic dosage selection
4. Reductant or oxidant dosage consent
5. Connections for dosing pump
6. Alarm contacts
7. Recorder output
8. Connections to the transmitter.



Unplug the instrument from the power supply before replacing the fuse.

**FUNCTIONAL DESCRIPTION HI 8711
DUAL OUTPUT pH CONTROLLER**

FRONT PANEL



Keypad

ACID SET	To set the working point of acid dosage
BASE SET	To set the working point of basic dosage
MEASURE	To set HI 8711 on measurement mode and to enable the diagnostic tests
SENSOR TEST	To display the mV response of the electrode to verify its working condition.
ΔAI	To display and to set the tolerance of the alarm points

pH 7 TEST	To verify the internal circuit of the meter in terms of Offset compensation
pH 4 TEST	To verify the amplifier circuit of the meter

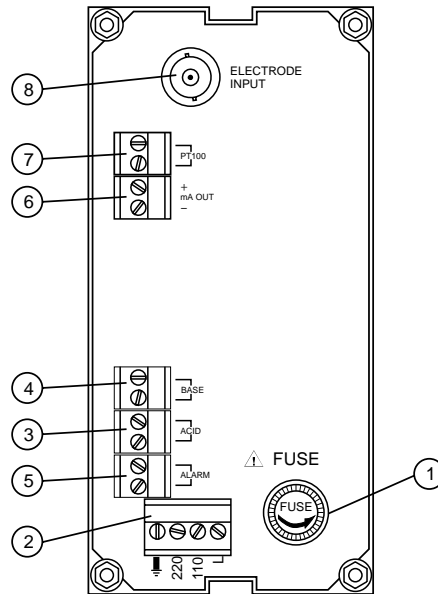
Trimmers

ΔO	For Offset calibration
SLOPE	For Slope calibration
ΔAL	To set the tolerance of the alarm
ACID SET/COARSE	To coarsely adjust the acid set point
ACID SET/FINE	To finely adjust the acid set point
BASE SET/COARSE	To coarsely adjust the basic set point
BASE SET/FINE	To finely adjust the basic set point

Leds

ACID SET (Blinking)	To show the acid dosage is active
BASE SET (Blinking)	To show the basic dosage is active
ΔAL (Blinking)	To show the alarm is active

REAR PANEL HI 8711E

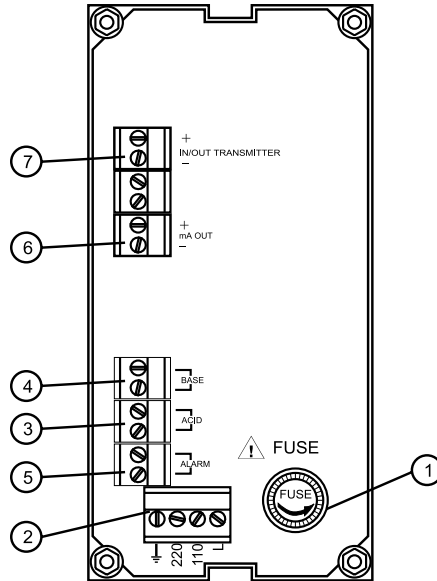


1. Fuse Holder
2. Power supply
3. Connections for dosing pump for acid
4. Connections for dosing pump for base
5. Alarm contacts
6. Recorder output
7. Connections for PT100 temperature sensor
8. BNC socket for pH electrode.



Unplug the instrument from the power supply before replacing the fuse.

REAR PANEL HI 8711T



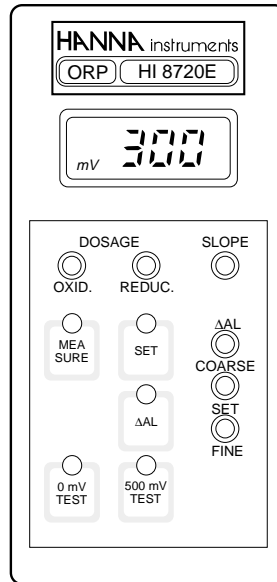
1. Fuse Holder
2. Power supply
3. Connections for dosing pump for acid
4. Connections for dosing pump for base
5. Alarm contacts
6. Recorder output
7. Connections to the transmitter.



Unplug the instrument from the power supply before replacing the fuse.

FUNCTIONAL DESCRIPTION HI 8720 ORP CONTROLLER

FRONT PANEL



Keypad

- SET** To set the working point of ORP dosage
- MEASURE** To set HI 8720 on measurement mode and to enable the diagnostic tests
- ΔAI** To display and to set the tolerance of the alarm points
- 0 mV TEST** To verify the instrument calibration at point 0
- 500 mV TEST** To verify the slope at point 500 mV

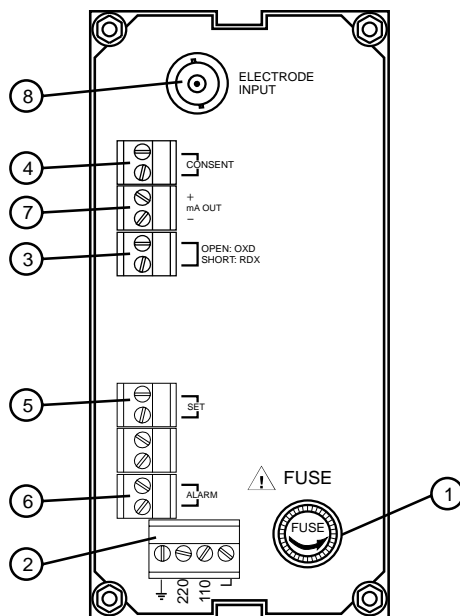
Trimmers

- SLOPE** For Slope calibration
- ΔAL** To display and set the tolerance of the alarm points
- SET/COARSE** To coarsely adjust the set point
- SET/FINE** To finely adjust the set point

Leds

- OXID** To show the oxidant dosage is active
- REDUC** To show the reductant dosage is active
- ΔAL (blinking)** To show the alarm is active

REAR PANEL HI8720E

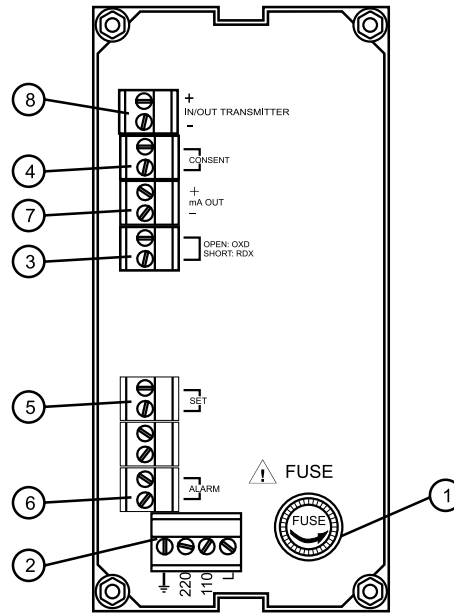


1. Fuse Holder
2. Power supply
3. Oxidant/Reductant dosage selection
4. Oxidant or reductant dosage consent
5. Connections for dosing pump
6. Alarm contacts
7. Recorder output
8. BNC socket for ORP electrode.



Unplug the instrument from the power supply before replacing the fuse.

REAR PANEL HI8720T



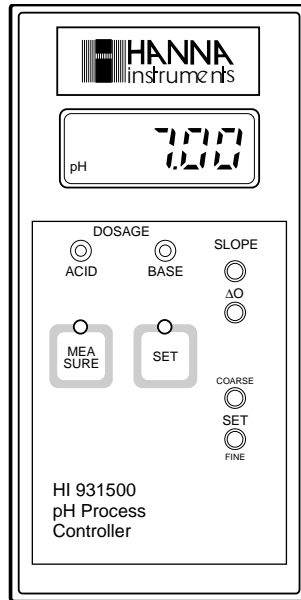
1. Fuse Holder
2. Power supply
3. Oxidant/Reductant dosage selection
4. Oxidant or Reductant dosage consent
5. Connections for dosing pump
6. Alarm contacts
7. Recorder output
8. Connections to the transmitter.



Unplug the instrument from the power supply before replacing the fuse.

**FUNCTIONAL DESCRIPTION HI 931500
SINGLE OUTPUT pH CONTROLLER**

FRONT PANEL



Keypad

- SET** To set the working point of pH dosage
- MEASURE** To set HI 931500 on measurement mode

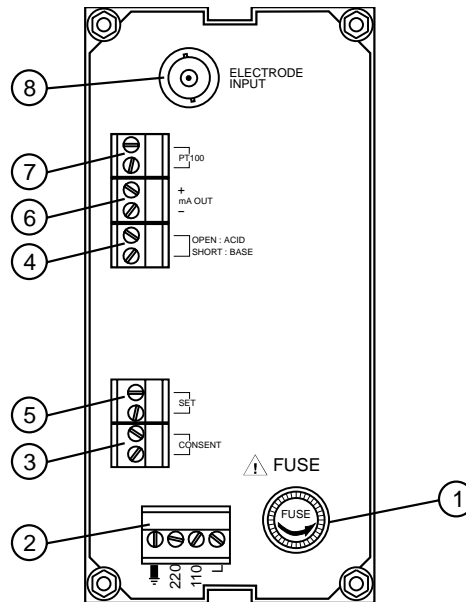
Trimmers

- ΔO** For Offset calibration
- SLOPE** For Slope calibration
- SET/COARSE** To coarsely adjust the set point
- SET/FINE** To finely adjust the set point

Leds

- ACID** To show the acid dosage is active
- BASE** To show the basic dosage is active

REAR PANEL HI 931500



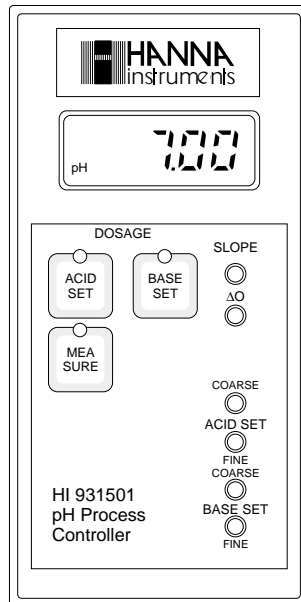
1. Fuse Holder
2. Power supply
3. Reductant or oxidant dosage consent
4. Acid/Basic dosage selection
5. Connections for Dosing Pumps
6. Recorder output
7. Connections for PT100 temperature sensor
8. BNC socket for pH electrode.



Unplug the instrument from the power supply before replacing the fuse.

**FUNCTIONAL DESCRIPTION HI 931501
DUAL OUTPUT pH CONTROLLER**

FRONT PANEL



Keypad

- ACID SET** To set the working point of acid dosage
- BASE SET** To set the working point of basic dosage
- MEASURE** To set HI 931501 on measurement mode

Trimmers

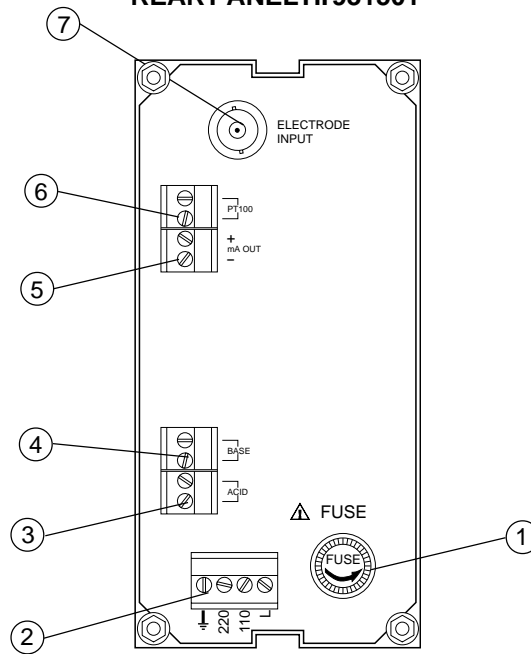
- ΔO** For Offset calibration
- SLOPE** For Slope calibration
- ACID SET/COARSE** To coarsely adjust the acid set point

ACID SET/FINE To finely adjust the acid set point
BASE SET/COARSE To coarsely adjust the basic set point
BASE SET/FINE To finely adjust the basic set point

Leds

ACID SET (Blinking) To show the acid dosage is active
BASE SET (Blinking) To show the basic dosage is active
MEASURE To show the meter is on measurement mode

REAR PANEL HI931501



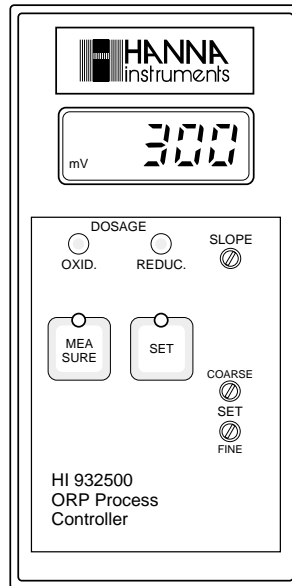
1. Fuse Holder
2. Power supply
3. Connections for dosing pump for acid
4. Connections for dosing pump for base
5. Recorder output
6. Connections for PT100 temperature sensor
7. BNC socket for pH electrode.



Unplug the instrument from the power supply before replacing the fuse.

**FUNCTIONAL DESCRIPTION HI 932500
ORP CONTROLLER**

FRONT PANEL



Keypad

- SET** To set the working point of ORP dosage
- MEASURE** To set HI 932500 on measurement mode

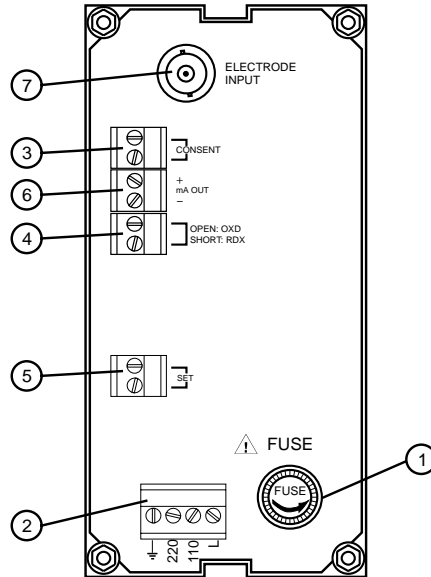
Trimmers

- SLOPE** For Slope calibration
- SET/COARSE** To coarsely adjust the ORP set point
- SET/FINE** To finely adjust the ORP set point

Leds

- OXID** To show the oxidant dosage is active
- REDUC** To show the reductant dosage is active

REAR PANEL HI 932500



1. Fuse Holder
2. Power supply
3. Oxidant or reductant dosage consent
4. Oxidant/Reductant dosage selection
5. Connections for dosing pump
6. Recorder output
7. BNC socket for ORP electrode.



Unplug the instrument from the power supply before replacing the fuse.

SPECIFICATIONS HI 8510

	HI 8510E	HI 8510T
Range	0.00 to 14.00 pH	
Resolution	0.01 pH	
Accuracy	±0.02 pH	±0.5%
Typical EMC Deviation	±0.1 pH ±0.2 mA	±0.1 pH ±0.2 mA
Installation Cat.	II	
Input	10 ¹² Ohm	4 to 20 mA
Calibration	Offset: ±2 pH ΔO trimmer Slope: 80 to 110% Slope trimmer	
Temperature Compensation	Fixed or automatic with PT100 from 0 to 100°C	
Readout	4-digit LCD plus graphic symbols	
Recorder Output	0 to 20 mA or 4 to 20 mA (isolated)	
Power Supply	110/115 V or 220/240 V; 50/60 Hz	
Environment	-10 to 50°C (14 to 122°F)	
Weight	1 kg (2.2 lb.)	

SPECIFICATIONS HI 8512

	HI 8512E	HI 8512T
Range	-1000 to +1000 mV	
Resolution	1 mV	
Accuracy	±5 mV	±0.5%
Typical EMC Deviation	±6 mV ±0.2 mA	±6 mV ±0.2 mA
Installation Cat.	II	
Input	10 ¹² Ohm	4 to 20 mA
Calibration	Slope: 90 to 110% slope trimmer	
Readout	4-digit LCD plus graphic symbols	
Recorder Output	0 to 20 mA or 4 to 20 mA (isolated)	
Power Supply	110/115 V or 220/240 V; 50/60 Hz	
Environment	-10 to 50°C (14 to 122°F)	
Weight	1 kg (2.2 lb.)	

SPECIFICATIONS HI 8710

	HI 8710E	HI 8710T
Range	0.00 to 14.00 pH	
Resolution	0.01 pH	
Accuracy	±0.02 pH	±0.5%
Typical EMC Deviation	±0.1 pH ±0.2 mA	±0.1 pH ±0.2 mA
Installation Cat.	II	
Input	10 ¹² Ohm	4 to 20 mA
Calibration	Offset: ±2 pH ΔO trimmer Slope: 80 to 110% Slope trimmer	
Temperature Compensation	Fixed or automatic with PT100 from 0 to 100°C	
Set Point Relay	One, Isolated, 2 A, max 240 V, resistive load, 1.000.000 strokes	
Alarm Relay	One, Isolated, 2 A, max 240 V, resistive load, 1.000.000 strokes	
Readout	4-digit LCD plus graphic symbols	
Recorder Output	0 to 20 mA or 4 to 20 mA (isolated)	
Power Supply	110/115 V or 220/240 V; 50/60 Hz	
Environment	-10 to 50°C (14 to 122°F)	
Weight	1 kg (2.2 lb.)	

SPECIFICATIONS HI 8711

	HI 8711E	HI 8711T
Range	0.00 to 14.00 pH	
Resolution	0.01 pH	
Accuracy	±0.02 pH	±0.5%
Typical EMC Deviation	±0.1 pH ±0.2 mA	±0.1 pH ±0.2 mA
Installation Cat.	II	
Input	10 ¹² Ohm	4 to 20 mA
Calibration	Offset: ±2 pH ΔO trimmer Slope: 80 to 110% Slope trimmer	
Temperature Compensation	Fixed or automatic with PT100 from 0 to 100°C	
Set Point Relay	Two, Isolated, 2 A, max 240 V, resistive load, 1.000.000 strokes	
Alarm Relay	One, Isolated, 2 A, max 240 V, resistive load, 1.000.000 strokes	
Readout	4-digit LCD plus graphic symbols	
Recorder Output	0 to 20 mA or 4 to 20 mA (isolated)	
Power Supply	110/115 V or 220/240 V; 50/60 Hz	
Environment	-10 to 50°C (14 to 122°F)	
Weight	1 kg (2.2 lb.)	

SPECIFICATIONS HI 8720

	HI 8720E	HI 8720T
Range	-1000 to +1000 mV	
Resolution	1 mV	
Accuracy	±5 mV	±0.5%
Typical EMC Deviation	±6 mV ±0.2 mA	±6 mV ±0.2 mA
Installation Cat.	II	
Input	10 ¹² Ohm	4 to 20 mA
Calibration	Slope: 90 to 110% Slope trimmer	
Set Point Relay	One, Isolated, 2 A, max 240 V, resistive load, 1.000.000 strokes	
Alarm Relay	One, Isolated, 2 A, max 240 V, resistive load, 1.000.000 strokes	
Readout	4-digit LCD plus graphic symbols	
Recorder Output	0 to 20 mA or 4 to 20 mA (isolated)	
Power Supply	110/115 V or 220/240 V; 50/60 Hz	
Environment	-10 to 50°C (14 to 122°F)	
Weight	1 kg (2.2 lb.)	

SPECIFICATIONS HI 931500

	HI 931500
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy	±0.02 pH
Typical EMC Deviation	±0.1 pH ±0.2 mA
Installation Cat.	II
Input	10 ¹² Ohm
Calibration	Offset: ±2 pH ΔO trimmer Slope: 80 to 110% Slope trimmer
Temperature Compensation	Fixed or automatic with PT100 from 0 to 100°C
Readout	4-digit LCD plus graphic symbols
Recorder Output	0 to 20 mA or 4 to 20 mA
Set Point Relay	One, Isolated, 2 A, max 240 V, resistive load, 1.000.000 strokes
Power Supply	110/115 V or 220/240 V; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F)
Weight	1 kg (2.2 lb.)

SPECIFICATIONS HI 931501

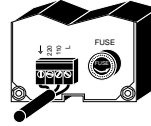
	HI 931501
Range	0.00 to 14.00 pH
Resolution	0.01 pH
Accuracy	±0.02 pH
Typical EMC Deviation	±0.1 pH ±0.2 mA
Installation Cat.	II
Input	10 ¹² Ohm
Calibration	Offset: ±2 pH ΔO trimmer Slope: 80 to 110% Slope trimmer
Temperature Compensation	Fixed or automatic with PT100 from 0 to 100°C
Readout	4-digit LCD plus graphic symbols
Recorder Output	0 to 20 mA or 4 to 20 mA
Set Point Relay	Two, Isolated, 2 A, max 240 V, resistive load, 1.000.000 strokes
Power Supply	110/115 V or 220/240 V; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F)
Weight	1 kg (2.2 lb.)

SPECIFICATIONS HI 932500

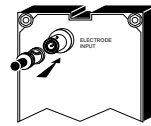
	HI 932500
Range	-1000 to +1000 mV
Resolution	1 mV
Accuracy	±5 mV
Typical EMC Deviation	±6 mV ±0.2 mA
Installation Cat.	II
Input	10 ¹² Ohm
Calibration	Slope: 90 to 110% Slope trimmer
Readout	4-digit LCD plus graphic symbols
Recorder Output	0 to 20 mA or 4 to 20 mA
Set Point Relay	One, Isolated, 2 A, max 240 V, resistive load, 1.000.000 strokes
Power Supply	110/115 V or 220/240 V; 50/60 Hz
Environment	-10 to 50°C (14 to 122°F)
Weight	1 kg (2.2 lb.)

INITIAL PREPARATION

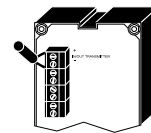
- Connect a 3-wire power cable to the 4-screw terminal strip; according to the voltage level as indicated and pay particular attention to the correct live, earth and neutral terminal connections.



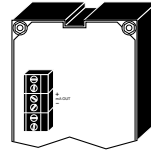
- For **Model E, HI 931500, HI931501** and **HI 931500** connect the pH or ORP electrode to the BNC marked "ELECTRODE INPUT".



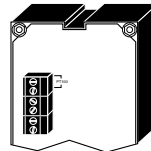
- For **Model T**, connect the 2 signal wires of the pH or ORP transmitter to the terminal marked "IN/OUT TRANSMITTER" paying particular attention to the indicated polarity.



- Recorder Terminals: these contacts are the output terminals for connection to a recorder. The output is from 0 to 20 mA / 4 to 20 mA as indicated and is proportional to the measured pH or ORP value.

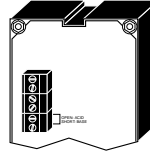


- PT 100 Terminals: these contacts connect the PT 100 temperature sensor for automatic temperature compensation of pH measurement. If temperature compensation is not required, connect a 110 Ohm, 0.25W resistor across the terminals (equivalent to a fixed temperature of 25°C/77°F).

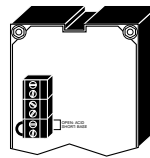


- **HI 8710** and **HI 931500** are single dosage controllers for dosing either acid or alkaline liquid.

If you plan to dose acid (e.g. in Hexavalent Chromium reduction), make an open circuit between ACID/BASE selection terminals (see rear panel descriptions #3 at page 12-13 and #4 at page 23).

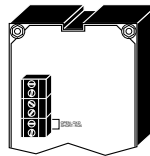


If you plan to dose alkaline (e.g. in Cyanide oxidation product), make a short circuit across the above mentioned terminals.

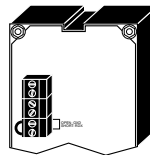


- **HI 8720** and **HI 932500** are single dosage controllers for dosing either oxidant or reductant liquid.

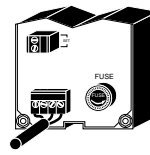
If you plan to dose oxidants (e.g. in cyanide oxidation), make an open circuit between oxidation/reduction selection terminals (see rear panel descriptions #3 at page 20-21 and #4 at page 28).



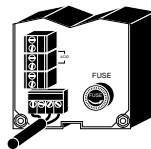
If you plan to dose reductants (e.g. in hexavalent chromium reduction), make a short circuit across the above mentioned terminals.



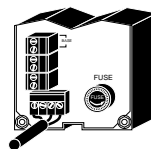
- Set Contacts (**HI 8710**, **HI 8720**, **HI 931500** and **HI 932500** only): these contacts (maximum 2A, 220 V) are for connection to the dosing pump to dose either acidic or alkaline liquids (**HI 8710** and **HI 931500** only) or to dose either oxidizing or reducing chemicals (**HI 8720** and **HI 932500** only). These contacts act only as a switch for the power to the drive.



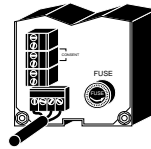
- Acid Contacts (**HI 8711** and **HI 931501** only): these two contacts are for the connection to the dosing pump for the acid. They act as a switch for the power to the drive.



- Base contact (**HI 8711** and **HI 931501** only): these two contacts are for the connection to the dosing pump for the base. They act as a switch for the power to the drive.



- Consent Contacts (**HI 8710**, **HI 8720**, **HI 931500** and **HI 932500** only): these contacts (maximum 2A, 220 V)

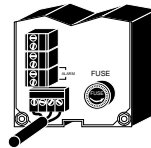


are used for reduction and oxidation reactions when the pH controller is used in conjunction with an ORP Controller and viceversa. In these applications, the consent contacts of both meters are connected together to link the ORP and pH controllers so that ORP dosage will occur only if the actual pH value is correct. This is to avoid overdosage of oxidants or reductants which may lead to undesirable pollution.

The "Consent" contacts can be left open if **HI 8710** or **HI 931500** are used independently as pH controllers only.

The "Consent" should be shorted if **HI 8720** or **HI 932500** are used independently as ORP controllers only.

- Alarm Contacts (**HI 8710**, **HI 8711** and **HI 8720** only): if the measured pH or ORP is not within the tolerance of the set value, the alarm contact is closed. This can occur if there is insufficient dosage or if there is overdosage.



Note: all external cables to be connected to the rear panel should be ended with cable lugs.

OPERATIONAL GUIDE

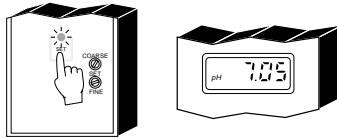
The setting of the various keys are made via the front panel keys and trimmers. When each key is pressed the LED is lighted indicating to the user that the function is in operation.

Make sure that the pH or the ORP meter with the electrode is calibrated before operating the instruments (see page 40-42).

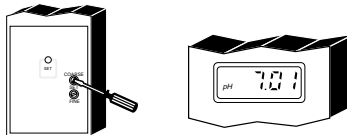
SET POINTS

HI 8710, HI 8720, HI 931500 and HI 932500 only

To set the working point of pH or ORP dosage, press the "SET" key. The display will show the set value.

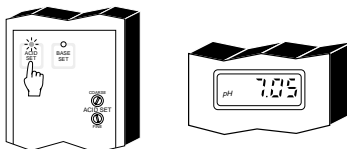


Use a small screwdriver to adjust the trimmers "COARSE" and "FINE" until the desired set value is displayed.

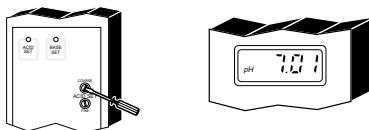


HI 8711 and HI 931501 only

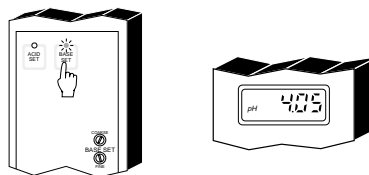
To set the working point of acid dosage, press the "ACID SET" key. The display will show the set value for acid dosage.



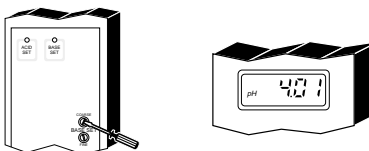
Use a small screwdriver to adjust the trimmers "ACID SET"/"COARSE" and "FINE" until the desired base set value is displayed.



To set the working point of base dosage, press the "BASE SET" key. The display will show the set value for base dosage.



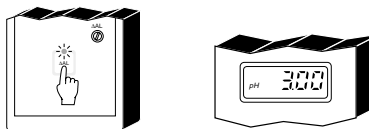
Use a small screwdriver to adjust the trimmers "BASE SET"/"COARSE" and "FINE" until the desired base set value is displayed.



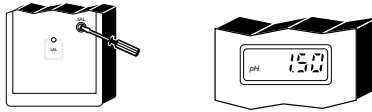
ALARMS

HI 8710, HI 8711 and HI 8720 only:

To set the alarm, press the "ΔAL" key and the display will show the set tolerance for the alarm.



Use a small screwdriver to adjust the trimmers "ΔAL" until the desired tolerance is displayed.



For example:

in **HI 8710** if the set value is pH 3 and a Δ Alarm of 1.5 pH is chosen, the instrument gives an alarm every time the measured pH value is higher than 4.5 pH or lower than 1.5 pH.

In **HI 8711** if the set values are pH 7 and pH 8 and a Δ Alarm of 1.5 pH is chosen, the instrument gives an alarm every time the measured pH value is higher than 9.5 pH or lower than 5.5 pH.

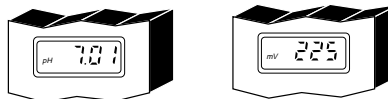
In **HI 8720** if the set value is 300 mV and the Δ Alarm of 100 mV is chosen, the instrument gives an alarm every time the measured ORP value is higher than 400 mV or lower than 200 mV.

MEASUREMENTS

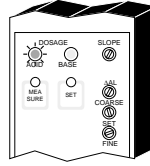
After setting the pH or ORP value and the eventual alarm immerse the electrode in the test solution and press the "MEASURE" key.



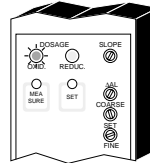
The actual pH or ORP value of the test solution is displayed.



When acid is dosed, the ACID LED will be lighted, and when base is being dosed, the BASE LED will be lighted (**HI 8710**, **HI 931500** and **HI 931501** only).

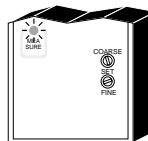


When oxidants are dosed, the OXID LED will be lighted, and when reductants are being dosed, the REDUC LED will be lighted (**HI 8720**, **HI 932500** only).



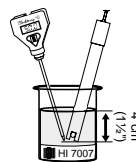
pH CALIBRATION

Make sure you are in the measurement mode (MEASURE LED light is on) and not in the set mode before proceeding the calibration (not for **HI 8510**).



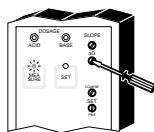
Note the temperature of the buffer with a ChecktempC or a glass thermometer.

Remove the protective cap from the electrode, rinse it with some pH 7.01 solution (HI 7007), then dip in pH 7.01 buffer.



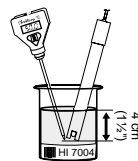
Note: the electrode should be submerged approximately 4 cm (1½") into the solution. The thermometer should be located as close to the pH electrode as possible.

Shake briefly and wait one minute before adjusting the ΔO trimmer to display pH 7.01 on the LCD if the temperature of the buffer solution is at 25°C (77°F).



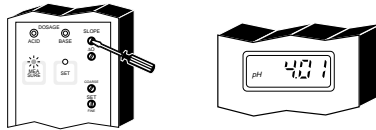
If the temperature of the buffer solution is not 25°C (77°F), refer to the chart on page 43 for the appropriate buffer value to adjust to the noted temperature.

Rinse the electrode and temperature sensor thoroughly in water and immerse them in pH 4.01 (HI 7004) or pH 10.01 (HI 7010) buffer solution.



Note: to get accurate readings, use pH 4.01 if you are going to measure acid samples or pH 10.01 for alkaline measurements.

Shake briefly and wait one minute before adjusting the slope trimmer to display pH4.01 (or 10.01) on the LCD if the temperature of the buffer solution is at 25°C, if not refer to the chart on page 43 for appropriate buffer value for the corresponding temperature.

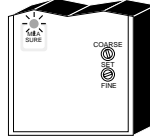


The calibration is now complete and the instrument is ready for use.

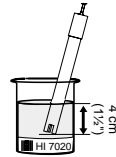
Note: If the meter is used in conjunction with a PT 100 temperature sensor, immerse it into the buffers during the calibration procedure.

ORP CALIBRATION

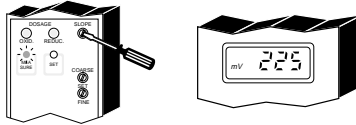
Make sure you are in the measurement mode (MEASURE LED light is on) and not in the set mode before proceeding with the calibration (not for **HI 8512**).



Immerse the electrode in HI 7020 ORP solution.



Adjust the slope trimmer until an ORP value of between 200 mV and 250 mV is displayed.



The calibration is now complete and the instrument is ready for use.

pH VALUES AT VARIOUS TEMPERATURE

Temperature has an effect on pH. The calibration buffer solutions are effected by temperature changes to a lesser degree than normal solutions.

Please refer to the following chart to perform the pH calibration:

TEMP		pH VALUES				
°C	°F	4.01	6.86	7.01	9.18	10.01
0	32	4.01	6.98	7.13	9.46	10.32
5	41	4.00	6.95	7.10	9.39	10.24
10	50	4.00	6.92	7.07	9.33	10.18
15	59	4.00	6.90	7.04	9.27	10.12
20	68	4.00	6.88	7.03	9.22	10.06
25	77	4.01	6.86	7.01	9.18	10.01
30	86	4.02	6.85	7.00	9.14	9.96
35	95	4.03	6.84	6.99	9.10	9.92
40	104	4.04	6.84	6.98	9.07	9.88
45	113	4.05	6.83	6.98	9.04	9.85
50	122	4.06	6.83	6.98	9.01	9.82
55	131	4.07	6.84	6.98	8.99	9.79
60	140	4.09	6.84	6.98	8.97	9.77
65	149	4.11	6.85	6.99	8.95	9.76
70	158	4.12	6.85	6.99	8.93	9.75

For instance, if the buffer's temperature is 25°C (77°F), calibrate to read 4.01 or 7.01 or 10.01 on the display.

If the buffer's temperature is 20°C, calibrate to read 4.00/7.03/10.06 on the display.

If the buffer's temperature is 50°C, calibrate to read 4.06/6.98/9.82 on the display.

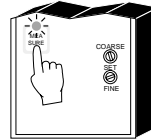
pH DIAGNOSTIC TESTS

The **HI 8510**, **HI 8710** and **HI 8711** are the only pH controllers with built-in autodiagnostic functions to enable the user to check and troubleshoot any malfunctions.

The functions are made via front panel keys to isolate the cause of malfunction whether it is due to pH electrode contamination, internal offset circuit or the amplifier circuit.

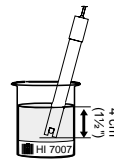
Follow the procedure describe below if you detect any malfunctioning of the instrument or electrode.

Press the "MEASURE" button before pressing any of the following keys.



A) *Sensor Test*

Immerse the electrode in pH 7.01 buffer solution (HI 7007), press the "SENSOR TEST" key and the display shows the mV response of the electrode.

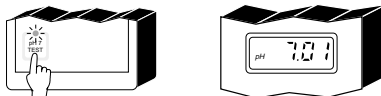


If the electrode is in good working condition, the value should be within ± 30 mV. A value between 30 mV and 60 mV or between -60 and -30 mV indicates some contamination of the electrode.

If the value is higher than 60 mV or lower than -60 mV the contamination is too high and the electrode should be replaced.

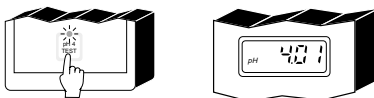
B) *Internal Offset Circuit Test*

Press the "pH7 TEST" key and the display should show a value between 7 pH \pm 1 pH. This will verify the internal circuit of the meter in terms of the offset compensation.



C) *Amplifier Circuit Test*

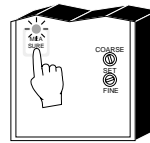
Press the "pH4 TEST" key and the display should show a value between 3.30 pH and 4.30 pH. This will verify the amplifier circuit of the meter.



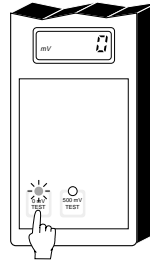
ORP DIAGNOSTIC TESTS

The **HI 8512** and **HI 8720** are the only ORP controllers with built-in autodiagnostic functions to enable the user to check and troubleshoot any malfunctions. The functions are made via front panel keys to isolate the cause of malfunction.

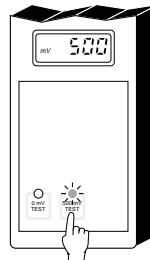
Press the "MEASURE" key before proceeding with the following tests (HI 8720 only).



- A) *0 mV Test*
Press the "0 mV TEST" key and the display should show a value of 0 mV ± 10 mV. This will verify instrument calibration at point 0.



- B) *500 mV Test*
Press the "500 mV TEST" key and the display should show a value of 500 mV ± 20 mV. This will verify the slope at point 500 mV.



LED INDICATION

The LEDs above all keys are designed to indicate the state of each function, whether it is active or the display is indicating the mode.

For HI 8711 and HI 931501 only

Each LED can be in one of the following states:

- A) Light stays on The mode is displayed on the LCD but is not active. E.g. alarm set point is displayed but the alarm contact is open.
- B) Light Blinking 25% On, 75% Off
The mode is not displayed on the LCD but the mode is active. E.g. alarm contact is closed but the alarm set point is not displayed.
- C) Light Blinking 75% On, 25% Off
The mode is active and being displayed.
- D) Light Off The function is neither active nor displayed.

TAKING REDOX MEASUREMENTS

Redox measurements allow the quantification of the oxidizing or reducing power of a solution, and are commonly expressed in mV.

Oxidation may be defined as the process during which a molecule (or an ion) loses electrons and reduction as the process by which electrons are gained.

Oxidation is always coupled together with reduction so that as one element gets oxidized, the other is automatically reduced, therefore the term oxidation-reduction is frequently used.

Redox potentials are measured by an electrode capable of absorbing or releasing electrons without causing a chemical reaction with the elements with which it comes into contact.

The electrodes most usually available for this purpose have gold or platinum surfaces; gold possesses a higher resistance than platinum in conditions of strong oxidation, while platinum is preferred for the measurements of oxidizing solutions containing halides and for more general uses.

When a platinum electrode is immersed in an oxidizing solution a monomolecular layer of oxygen is developed on its surface. This layer does not prevent the electrode from functioning, but it increases the response time. The opposite effect is obtained when the platinum surface absorbs hydrogen in the presence of reducing mediums. This phenomenon is rough on the electrode.

To make correct redox measurements the following conditions must prevail:

- The surface of the electrode must be cleaned and smooth.
- The surface of the electrode must undergo a preventive treatment depending on the solution to be measured has oxidizing or reductive characteristics.

Because the Pt/PtO system depends on the pH, the pretreatment of the electrode may be determined by the pH and the redox potential of the solution to be measured.

As a general rule, if the ORP mV reading corresponding to the pH solution value is higher than the value in the Table below, an oxidizing pre-treatment is necessary; otherwise a reducing pre-treatment is necessary:

pH	mV	pH	mV	pH	mV	pH	mV	pH	mV
0	990	1	920	2	860	3	800	4	740
5	680	6	640	7	580	8	520	9	460
10	400	11	340	12	280	13	220	14	160

Reducing pre-treatment: immerse the electrode for some minutes in **HI 7091**.

Oxidizing pre-treatment: immerse the electrode for some minutes in **HI 7092**.

If the pre-treatment is not performed, the electrode will take significantly longer to respond.

When working with electrodes of the refilling type, the electrolyte used for filling must be constantly kept at an adequate level (no less than 2½ centimeters from the filling hole) and topped up if necessary with **HI 7071** refilling solution.

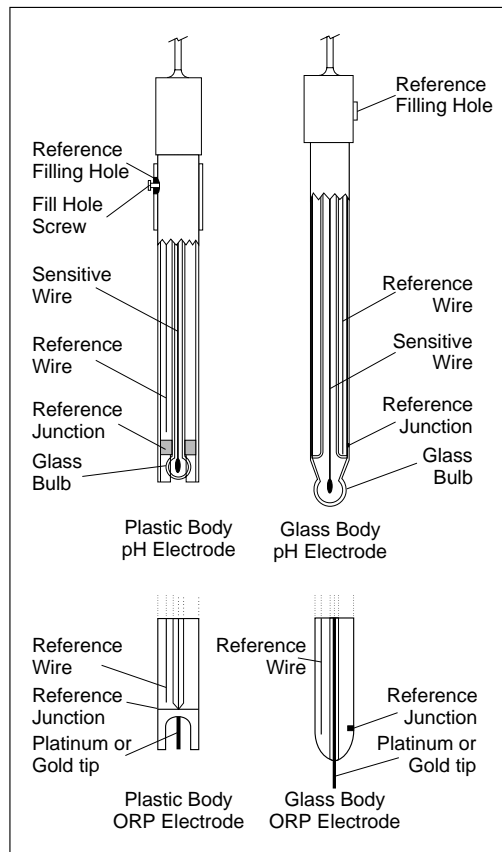
In the event that measurements are performed with solutions containing sulfides or proteins, the cleaning of the diaphragm of the reference electrode must be performed (see page 20, "Cleaning Procedure").

In order to have a correct functioning of the ORP electrode, immerse it into **HI 7020** and measure the response; the obtained value should be within 200 and 275 mV.

After this functional test, it is suggested to wash the electrode thoroughly with water and proceed to the oxidizing or reducing pre-treatment before taking measurements.

When not in use, the electrode tip should be kept moist and far from any type of mechanical stress which might cause damage. For this reason, the use of the protective cap supplied with the electrode and filled with **HI 70300** storage solution is advised.

ELECTRODE CONDITIONING AND MAINTENANCE



PREPARATION

Remove the protective cap.

DO NOT BE ALARMED IF ANY SALT DEPOSITS ARE PRESENT.

This is normal with electrodes and they will disappear when rinsed with water.

During transport tiny bubbles of air may have formed inside the glass bulb. The electrode

cannot function properly under these conditions. These bubbles can be removed by "shaking down" the electrode as you would do with a glass thermometer.

If the bulb and/or junction are dry, soak the electrode in **HI70300** Storage Solution for at least one hour.

For refillable electrodes:

If the fill solution (electrolyte) is more than 1 cm ($\frac{1}{2}$ ") below the fill hole, add **HI7082 3,5M KCl Electrolyte Solution** for double junction or **HI7071 3,5M KCl+AgCl Electrolyte Solution** for single junction electrodes. For a faster response unscrew the fill hole screw during measurements.

For AmpHel® electrodes:

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

MEASUREMENT

Rinse the electrode tip with distilled water.

Immerse the tip (4 cm / $1\frac{1}{2}$ ") in the sample and stir gently for approx. 30 seconds.

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

STORAGE

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

Replace the solution in the protective cap with a few drops of **HI70300 Storage Solution** or, in its absence, **Filling Solution (HI7071** for single junction or **HI7082** for double junction electrodes).

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Follow the Preparation Procedure above before taking measurements.

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

PERIODIC MAINTENANCE

Inspect the electrode and the cable. The cable used for the connection to the meter must be intact and there must be no points of broken insulation on the cable or cracks on the electrode stem or bulb.

Connectors must be perfectly clean and dry. If any scratches or cracks are present, replace the electrode. Rinse off any salt deposits with water.

For refillable electrodes:

Refill the electrode with fresh electrolyte (**HI7071** for single junction or **HI7082** for double junction electrodes). Allow the electrode to stand upright for 1 hour.

Follow the Storage Procedure above.

CLEANING PROCEDURE

General Soak in Hanna **HI7061 General Cleaning Solution** for approximately 1 hour.

Removal of films, dirt or deposits on the membrane/junction:

Protein Soak in Hanna **HI7073 Protein Cleaning Solution** for 15 minutes.

Inorganic Soak in Hanna **HI7074 Inorganic Cleaning Solution** for 15 minutes.

Oil/grease Rinse with Hanna **HI7077 Oil and Fat Cleaning Solution**.

IMPORTANT: After performing any of the cleaning procedures rinse the electrode thoroughly with distilled water, drain and refill the reference chamber with fresh electrolyte, (not necessary for GEL filled electrodes) and soak the electrode in **HI70300 or HI 80300 Storage Solution** for at least 1 hour before taking measurements.

TROUBLESHOOTING

Evaluate your electrode performance based on the following.

- **Noise** (Readings fluctuate up and down) could be due to:
 - **Clogged/Dirty Junction:** Refer to the Cleaning Procedure above.
 - **Loss of shielding** due to low electrolyte level (in refillable electrodes only): refill with **HI7071** for single junction or **HI7082** for double junction electrodes.
- **Dry Membrane/Junction:** Soak in **Storage Solution HI 70300** for at least 1 hour.
- **Drifting:** Soak the electrode tip in warm Hanna Solution **HI7082** for one hour and rinse tip with distilled water. Refill with fresh **HI7071** for single junction electrodes and **HI7082** for double junction electrodes.
- **Low Slope:** Refer to the cleaning procedure above.
- **No Slope:** Check the electrode for cracks in glass stem or bulb (replace the electrode if cracks are found).
- **Slow Response/Excessive Drift:** Soak the tip in Hanna Solution **HI7061** for 30 minutes, rinse thoroughly in distilled water

and then follow the Cleaning Procedure above.

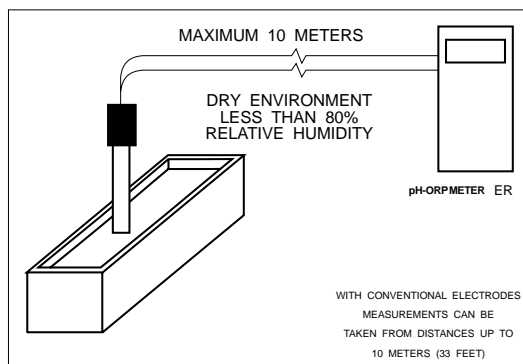
- **For ORP Electrodes:** polish the metal tip with a light abrasive paper (paying attention not to scratch the surface) and wash thoroughly with water.

SUGGESTED INSTALLATIONS

SHORT DISTANCE, INDOOR INSTALLATION

Due to the low current involved, a very high grade of insulation is required.

A dry environment is needed in order to obtain a level of insulation not lower than $10^{12} \Omega$.



This type of connection is very delicate and requires constant attention to maintain proper operating conditions.

The conventional electrodes should be used in indoor applications only, and should not use a cable longer than 10 m (33').

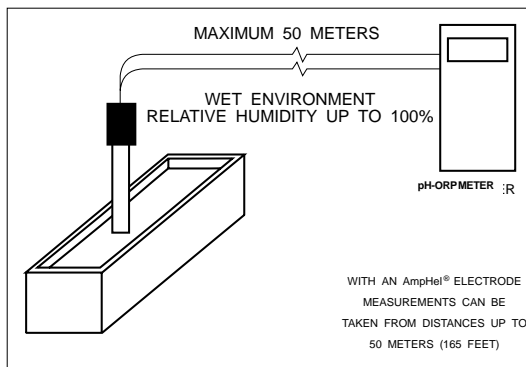
MEDIUM DISTANCE, INDOOR/OUTDOOR INSTALLATION

When an outdoor installation is required, it is necessary to install a transmitter to obtain accurate readings at distances from 10 to 50 m (33-165').

Since the introduction of AmpHel[®] these distances are no longer a problem. You are now able to connect your meter directly to an AmpHel[®] electrode, saving the cost of a transmitter or costly coaxial cable.

The standard cable length of the AmpHel[®] electrode is 5 m (16.5'). Additional lengths of regular cable up to 50 m (165'), can be

installed without special connectors.

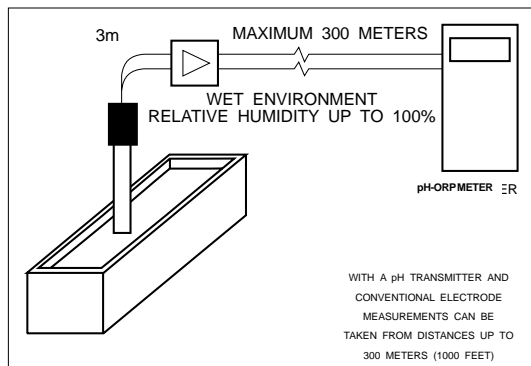


AmpHel® electrodes have a micro-amplifier in the electrode cap to boost the signal, drastically reducing susceptibility to noise and drift. With all of the components sealed in the electrode body, moisture up to 100% RH will not effect the signal.

LONG DISTANCE, INDOOR/OUTDOOR INSTALLATIONS, ISOLATED OUTPUT FOR COMPUTER INTERFACE

If your application has a distance greater than 50 m (165'), it is necessary to install a transmitter between the electrode and the meter.

Hanna offers a full line of pH/ORP transmitters with or without LCD displays.



AmpHel® is a registered Trademark of "Hanna Instruments"

ACCESSORIES

pH CALIBRATION SOLUTIONS

HI7004M	pH 4.01 Buffer Solution, 230 mL
HI7004L	pH 4.01 Buffer Solution, 460 mL
HI7006M	pH 6.86 Buffer Solution, 230 mL
HI7006L	pH 6.86 Buffer Solution, 460 mL
HI7007M	pH 7.01 Buffer Solution, 230 mL
HI7007L	pH 7.01 Buffer Solution, 460 mL
HI7009M	pH 9.18 Buffer Solution, 230 mL
HI7009L	pH 9.18 Buffer Solution, 460 mL
HI7010M	pH 10.01 Buffer Solution, 230 mL
HI7010L	pH 10.01 Buffer Solution, 460 mL

ORP SOLUTIONS

HI 7020M	200-275mV Buffer Solution, 230 mL
HI 7020L	200-275mV Buffer Solution, 460 mL
HI 7091M	Pre-Treatment Reducing Solution, 230 mL
HI 7091L	Pre-Treatment Reducing Solution, 460 mL
HI 7092M	Pre-treatment Oxidizing Solution, 230 mL
HI 7092L	Pre-Treatment Oxidizing Solution, 460 mL

ELECTRODE STORAGE SOLUTIONS

HI70300M	Storage Solution, 230 mL
HI70300L	Storage Solution, 460 mL

ELECTRODE CLEANING SOLUTIONS

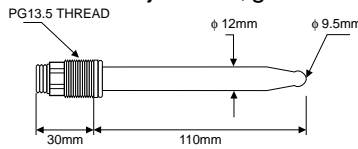
HI7061M	General Cleaning Sol., 230 mL
HI7061L	General Cleaning Sol., 460 mL
HI7073M	Protein Cleaning Sol., 230 mL
HI7073L	Protein Cleaning Sol., 460 mL
HI7074M	Inorganic Cleaning Sol., 230 mL
HI7074L	Inorganic Cleaning Sol., 460 mL
HI7077M	Oil & Fat Cleaning Sol., 230 mL
HI7077L	Oil & Fat Cleaning Sol., 460 mL

REFILLING ELECTROLYTE SOLUTIONS

HI7071	3.5M KCl + AgCl Electrolyte, 4x50 mL, for single junction electrodes
HI7072	1M KNO ₃ Electrolyte, 4x50 mL
HI7082	3.5M KCl Electrolyte, 4x50 mL, for double junction electrodes

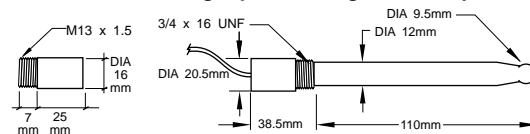
pH ELECTRODES

HI 1090T Screwcap PG13.5 connector, double junction, glass-body



HI 1110S Screw connector, single junction, glass-body

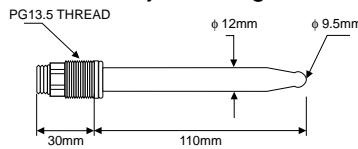
HI 1130B/3 BNC connector, 3 m (9.9') cable, single junction, glass-body



HI 1110S

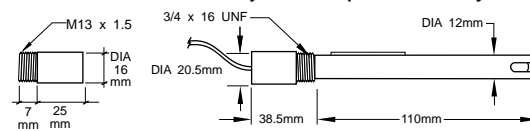
HI 1130B/3

HI 1110T Screwcap PG13.5 connector, double junction, glass-body



HI 1114S Screw connector, double junction plastic-body

HI 1134B/3 BNC connector, 3 m (9.9') cable, double junction plastic-body

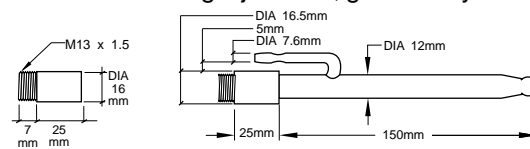


HI 1114S

HI 1134B/3

HI 1115S Screw connector, single junction, glass-body

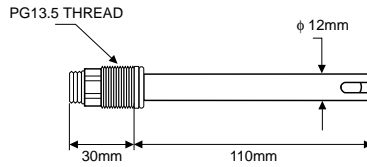
HI 1135B/3 BNC connector, 3 m (9.9') cable, single junction, glass-body



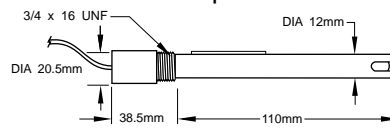
HI 1115S

HI 1135B/3

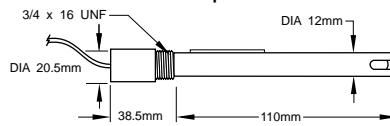
HI 1210T Screwcap PG13.5 connector, double junction, plastic-body



HI 1910B BNC connector, 1 m (3.3') cable, double junction, plastic-body, built-in amplifier

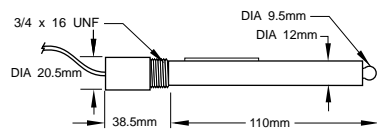


HI 1911B BNC connector, 1 m (3.3') cable, double junction, plastic-body, built-in amplifier

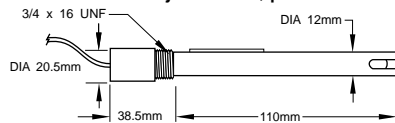


HI 1912B BNC connector, 1 m (3.3') cable, double junction, plastic-body, built-in amplifier

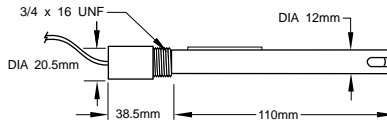
HI 1912B/5 BNC connector, 5 m (16.5') cable, double junction, plastic-body, built-in amplifier



HI 2114B/5 BNC connector, 5 m (16.5') cable, double junction, plastic-body

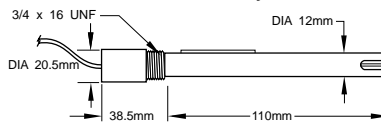


HI 2910B/5 BNC connector, 5 m (16.5') cable, double junction, plastic-body, built-in amplifier



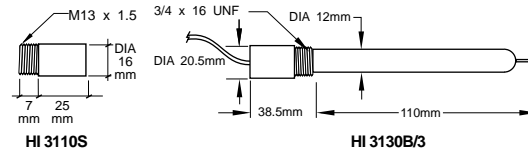
ORPELECTRODES

HI 2930B/5 BNC connector, 5 m (16.5') cable, Pt, Ultem®-body, built-in amplifier

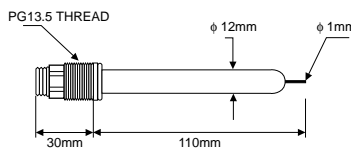


HI 3110S Screw-type connector, Pt, glass-body

HI 3130B/3 BNC connector, 3 m (9.9') cable, Pt, glass-body

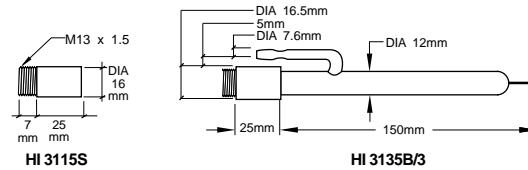


HI 3110T Screwcap PG13.5 connector, Pt, glass-body



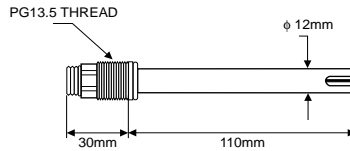
HI 3115S Screw-type connector, side-arm, Pt, glass-body

HI 3135B/3 BNC connector, 3 m (9.9') cable, side-arm, Pt, glass-body

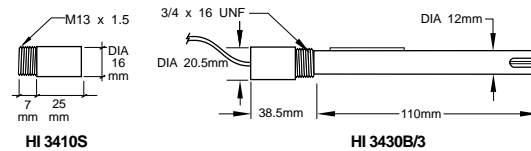


Ultem® is a registered Trademark of "General Electric Company"

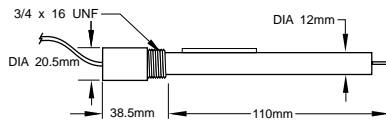
HI 3210T Screwcap PG13.5 connector, Pt, plastic-body



HI 3410S Screw connector, Pt, plastic-body
HI 3430B/3 BNC connector, 3 m (9.9') cable, Pt, plastic-body

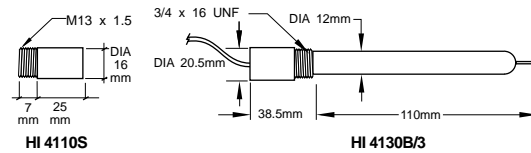


HI 3932B/5 BNC connector, 5 m (16.5') cable, Pt, Ultem®-body, built-in amplifier

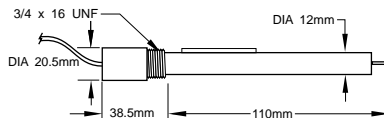


HI 4110S Screw-type connector, Au, glass-body

HI 4130B/3 BNC connector, 3 m (9.9') cable, Au, glass-body



HI 4932B/5 BNC connector, 5 m (16.5') cable, Au, Ultem®-body, built-in amplifier



OTHER ACCESSORIES

ChecktempC	Pocket-size thermometer with penetration probe and 0.1°C resolution (range -50.0 to 150.0°C)
HI76501/P	Calibration Screwdriver (20 pcs)
HI8614	pH Transmitter
HI8614L	pH Transmitter with LCD Display
HI8615	ORP Transmitter
HI8615L	ORP Transmitter with LCD Display
BL PUMPS	Dosing Pumps with Flow Rate from 1.5 to 20 LPH
HI 7871 & HI 7873	Level Controllers
HI6050 & HI 6051	Submersible Electrode Holders
HI 6054 & HI 6057	Electrode Holders for In-Line Applications
HI778P	Screened Coaxial Cable and Connectors for Screw-type pH/ ORP Electrodes
HI8427	pH and ORP Electrode Simulator with 1 m (3.3') Coaxial Cable ending in Female BNC Connectors (HI 7858/1)
HI931001	pH and ORP Electrode Simulator with LCD Display and 1 m (3.3') Coaxial Cable ending in Female BNC Connectors (HI 7858/1)
MANPROCR1	Instruction Manual

WARRANTY

All Hanna Instruments **meters are warranted for two years** against defects in workmanship and materials when used for their intended purpose and maintained according to instructions.

The probes and the electrodes are warranted for a period of six months.

Damages due to accident, misuse, tampering or lack of prescribed maintenance are not covered. This warranty is limited to repair or replacement free of charge.


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 failure. Obtain a Returned Goods Authorization from the Customer Service department first and then return the instrument with the Authorization # included along with shipment costs prepaid. If the repair is not covered by the warranty, you will be notified of the charge for repair or replacement. 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.

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

CE DECLARATION OF CONFORMITY



CE
DECLARATION OF CONFORMITY

We
Hanna Instruments Srl
V.le delle industrie 12
35010 Ronchi di Villafranca (PD)
ITALY


herewith certify that the process controllers

HI 8510E HI 8510T HI 8512E HI 8512T
HI 8710E HI 8710T HI 8720E HI 8720T
HI 8711E HI 8711T HI 931500 HI 931501
HI 932500

have been tested and found to be in compliance with the following regulations:

IEC 801-2	Electrostatic Discharge
IEC 801-3	RF Radiated
IEC 801-4	Fast Transient
EN 55022	Radiated, Class B

Date of Issue: 29-03-1996


D. Volpato - Engineering Manager
On behalf of
Hanna Instruments S.r.l.

Recommendations for Users

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

Operation of these instruments in residential area could cause unacceptable interferences to radio and TV equipments, requiring the operator to take all necessary steps to correct interferences.

The trimmers are sensitive to electrostatic discharges. It is recommended to use antistatic screwdrivers.

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

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

To avoid damages or burns, do not perform any measurement in microwave ovens.

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07/96



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