

HEFER SYSTEMS & CONTROLS LTD.

- *Water & Waste Water treatment Tech.*
- *Process Analytical Equipment*



חפר מיכשור ומערכות בע"מ

- *טכנולוגיות לטיפול במים ושפכים*
- *מיכשור אנליטי למדידה ובקרת תהליכים*

Operator's manual

WHA-3000-C

Hardness Analyzer



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General

The WHA-3000-C is an On-line analyzer, designed to measure Hardness levels in the range of 0.1 up to 999 ppm CaCo₃

It is a simple, yet, sophisticated systems which provide many options related to the sample or control features.

The system is assembled of the following items:

- IC-3000 controller
- WHA-1503 – Hardness electrode
- R57-V12 – Reference electrode with integral temp. Compensation.
- Sample cell
- Flow and pressure adjusting system.
- IP-65 enclosure for splash proof protection.

System operation

The sampled water gets into the sample cell threw the flow and pressure adjusting system. The electrodes sample the CaCo₃ concentration and the signals are being sent to the controller. The controller provides the reading in ppm units and sends a 4-20 mA signal to an outside element like a computer or a recorder. 4 dry contacts provide the alarm and control signals. An optional RS-232 TX/RX is provided for computer connection.

Specifications

Functional specifications

Features

- * Input from a Hardness and a reference electrodes
- * Measuring range from 0,01 to 1000 ppm
- * Selectable scales 10,00 - 100,0 - 1000 ppm
- * Autoranging
- * Up to 5 points calibration (Factory calibrated).

- * Temperature input from Pt100
- * Temperature readout
- * Automatic and manual Temperature compensation

- * Alphanumeric back-lighted LCD
- * Software filter on the readout
- * Automatic and manual operation

- * 0/20 mA or 4/20 mA programmable isolated output
- * Dual set-points with hysteresis, delay and min/max programmable functions
- * Min/max and set-points timing alarm relay
- * Software:
 - 3 access levels
 - User friendly
 - Keyboard lock
 - Access code
 - watch-dog
- * EEPROM parameter storage
- * Automatic overloads protection and reset
- * Extractable terminal blocks
- * 96X96 (1/4" DIN) housing

Input

The instrument accepts input from a hardness Electrode and a separate reference. A second input is provided for 2 or 3 wires Pt100 RTD Temperature.

Software filter

The unit is provided with a programmable software filter, to be inserted when the readout is not stable.

The user may select different filter values for small and large signal fluctuations.

Calibration

First calibration carried out by standard solutions (from 2 to 5 concentration values) is necessary. This calibration is being preformed at the factory and should not be changed.

One point calibration may be performed in order to correct the Reference electrode drift during the regular operation.

Temperature compensation

The unit is supplied with manual or automatic Temperature compensation. The instrument detects of the absence or malfunctioning of the Temperature sensor and automatically switches to manual compensation.

Analog output

Either a 0/20 mA or 4/20 mA programmable and isolated output may be selected, for use as an interface with computers or data loggers.

The input range corresponding to the output is programmable.

Control relays

The monitor is equipped with two SPDT control relays.

Each control relay may be programmed for set-point, high/low, hysteresis or delay time actuation.

The full display indicates the current settings and current status of each relay.

Alarm relay

The unit contains a third SPDT relay designated as an alarm relay.

This relay may be used to warn of conditions that may indicate operational problems.

The relay will activate on either high/low value conditions, or on failure of the control relays to maintain proper control.

In addition this relay may be programmed for either normal or fail-safe operation.

Operating mode

The instrument is provided with 2 programmable modes of operation.

Automatic operation:

The Automatic mode is the normal operation mode of the unit.

Manual operation:

This mode of operation would normally be used for control system troubleshooting.

The unit will allow the relays to be manually actuated by pushing up/down keys.

The letter "M" flashing on the display, indicates the instrument is in manual operation mode.

Configuration

A number of programming functions are provided in the Configuration menu and are protected by a selectable access number, which must be entered to allow changes in this setting.

The keys on the front panel of the monitor can be used for both changing the display and for calibrations and set-point adjustments.



When the monitor is shipped, all functions are accessible.

However, the adjustment and calibration functions may be locked in order to prevent unauthorized adjustments to the instrument.

Options

- 4 - Dual isolated and programmable output.
Two outputs may be configured for Concentration or Temperature.
- R - RS232 isolated output.
The output sends the data (Concentration, mV, °C) to the serial port to the computer.
- 24 - 24 VAC power supply.



Technical specifications

The DEFAULT values are correspondent to the factory calibration values.
Parameters marked by " * " can be modified in the Configuration procedures.

1) OPERATING MODE	DEFAULT
Automatic/Manual	Auto
2) CONCENTRATION	
Input: ISE electrodes	
* Ion type: -2/-1/+1/+2	X++
Measuring range: 5 decades from 0.01 to 1000 ppm	
* Scales: 10.00 - 100.0 - 1000 ppm Autoranging	1000ppm
Calibration: min. 2 points / max. 5 points	
1 point calibration: ± 100.0 mV	0.0 mV
Range: ± 1100.0 mV	
Software filter 90% Response Time:	
* Large signal changing (>10.0mV): 0.4"/20.0"	10.0"
* Small signal changing (<10.0mV): 0.4"/20.0"	10.0"
4) TEMPERATURE	
Input: RTD Pt100	
Connection: 2/3 wires	
Measuring and compensation range: -10.0/110.0 °C	
Resolution: +/- .1 °C	
Zero adjustment: +/- 2°C	0°C
Manual Temperature compensation: -10/110°C	20°C
5) THERMOCOMPENSATION:	
Thermo compensation: On/Off	Off
Isothermal point: -999.9mV/+999.9mV	0.0 mV
Thermo compensation coefficient: 0.0/1.000%/°C	0.198%/°C
Compensation range: -10/110°C	
Reference Temperature: 20 °C	
6) SET POINT A/B	
Action: ON-OFF	
Set point value: 0/1000	0.0ppm
Hysteresis: 0/100	0.0ppm
Relay delay: 0.0/99.9 sec	0.0 sec
* Function: HI/LO (Max/Min)	LO
Relay contacts: SPDT 220 V, 5 Amps Resistive load	

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7) ALARM (C-D)

Low value: 0/1000	0.0ppm
High value: 0/1000	100.0ppm
Delay: 0.0/99.9 sec	0.0 sec
* Contact type: ACT/DEA	ACT
* Alarm on max. SA: ON/OFF	OFF
* Max. time SA: 0/60 minutes	60 m
* Alarm on max. SB: ON/OFF	OFF
* Max. time SB: 0/60 minutes	60 m
Relay contacts: SPDT 220 V 5 Amps Resistive load	

8) ANALOG OUTPUT Nr. 1

* Scale: ppm/°C (option 091.3711)	ppm
* Range: 0-20/4-20 mA	0-20 mA
Scale ppm:	
* Point 1 (out mA min.): 0/1000	0.0ppm
* Point 2 (out mA max.): 0/1000	100.0ppm
Scale °C: (option 091.3711)	
* Point 1 (out mA min.): -10.0/110.0°C	-10.0°C
* Point 2 (out mA max.): -10.0/110.0°C	110.0°C
Response time: 2.5 sec. for 98%	
Isolation: 250 Vca	
R max: 600 Ohm	

9) ANALOG OUTPUT Nr. 2 (option 4)

* Scale: ppm/°C	ppm
* Range: 0-20/4-20 mA	0-20 mA
Scale ppm:	
* Point 1 (out mA min.): 0/1000	0.0ppm
* Point 2 (out mA max.): 0/1000	100.0ppm
Scale °C:	
* Point 1 (out mA min.): -10.0/110.0°C	-10.0°C
* Point 2 (out mA max.): -10.0/110.0°C	110.0°C
Response time: 2.5 sec. for 98%	
Isolation: 250 Vca	
R max: 600 Ohm	

10) SERIAL COMMUNICATION (option R) **WHA-3000-C**

Baud Rate: 4800 bit/s
 Bit length: 8 bit
 Nr. of Stop bit: 1
 Parity: None
 Isolated from measure circuits
 Data frequency: 0.4 sec.
 Example of data transmission:
 ' ±1000.0 mV 100.0 ppm ±100.0 °C '

11) CONFIGURATION (*)

Free calibration (Access code not required):	
Keyboard locked/unlocked	unlocked
LCD contrast (0/7)	4
Access code number required for:	
Ion type: (X-/X-/X+/X++)	X+
Set point output scale: (10.00/100.0/1000)	100.0ppm
Large signal RT filter SW: (0.4/20.0)	2.0 sec
Small signal RT filter SW: (0.4/20.0)	10.0 sec
Output Nr.1 scale: (ppm/°C) (option 091.3711)	ppm
Output Nr.1 range: (0/20 4/20)	0/20 mA
Point 1 (for 0 or 4 mA): (0/1000)	0.0ppm
Point 2 (for 20 mA): (0/1000)	100.0ppm
Output Nr.2 scale: (ppm/°C) (option 091.3711)	ppm
Output Nr.2 range: (0/20 4/20)	0/20 mA
Point 1 (for 0 or 4 mA): (0/1000)	0.0ppm
Point 2 (for 20 mA): (0/1000)	100.0ppm
Relay A function: (LO/HI)	LO
Relay B function: (LO/HI)	LO
Alarm on max. operating time of SA: (ON/OFF)	OFF
Max. operating time of SA: (0/60)	60 m
Alarm on max. operating time of SB: (ON/OFF)	OFF
Max. operating time of SB: (0/60)	60 m
Alarm relay status: (ACT/DEA)	ACT
Access number: 0/999	0

12) GENERAL SPECIFICATIONS (IC-3000) **WHA-3000-C**

Alphanumeric display: 1 line x 16 characters
Acquisition time: 0/50°C
Humidity: 95% without condensation
Power supply: 110/220 Volt ac +/- 10 % 50/60 Hz
Isolation: 4000 Volt between primary and secondary (IEC 348)
Power: 5 VA max.
Terminal block: extractable
Weight: 850 gr.
Dimensions: 96 x 96 x 155 mm. (DIN 43700)

PHYSICAL SPECIFICATIONS

IC-3000 controller:

The controller enclosure is designed for surface or panel mounting.

It consists of an anodized aluminum case built according to the standard DIN 43700, with an aluminum panel coated with scratch-proof and non-corrosive polycarbonate membrane.

Signal and power cable connections are made by using two special extractable terminal blocks placed in the back of the instrument.

This makes wiring, installation and general maintenance of the probes and other devices easier. The package is supplied complete with fixing clamps for panel-mounting.

IP-65 Enclosure:

The wall mount enclosure is IP-65 protected, 30X40 cm with a clear door at the front, having a U.V protection. The enclosure comes with 4 clamps for wall mount fixing and 2 lockers for the door.



SOFTWARE DESCRIPTION

KEY	SYMBOL	FUNCTION
<pre> ----- MODE DISP ----- </pre>	[MODE]	<ul style="list-style-type: none"> - allows the operator to go to the next Display - allows to revert to the main Display. <p>The eventual new parameter values will not be memorized</p>
<pre> ----- CAL ----- </pre>	[CAL]	<ul style="list-style-type: none"> - allows the access to calibration sequences
<pre> ----- ^ ----- </pre>	[^]	<ul style="list-style-type: none"> - allows to increment the displayed parameters - allows to choose between different functions
<pre> ----- v ----- </pre>	[v]	<ul style="list-style-type: none"> - allows to decrement the displayed parameters - allows to choose between different functions
<pre> ----- ENT <-- ----- </pre>	[ENT]	<ul style="list-style-type: none"> - allows to enter the selected data and to return to the main Display (D0)



Readout sequences

Applying the power to the instrument the display will show the Ion selected for approximately 3 seconds, then will show the main display (DO).

|ISE meter X+ |

X+ positive monovalent ion
 (X++) positive bivalent ion
 (X-) negative monovalent ion
 (X--) negative bivalent ion

Press [MODE] to visualize the following Display:

(D0)	xxx.xppm AL BH	Concentration value, set-point status/functions
(D1)	ppm x point cal	ISE calibration
(D2)	xxx.x mV X++	mV supplied by ISE
(D3)	TEMP.: xx.x°C	Temperature value
(D4)	Termoc.: OFF	thermocompensation parameters
(D5)	SA xxx.xppm* LO	set-point A parameters
(D6)	SB xxx.xppm* HI	set-point B parameters
(D7)	AL x.x/xxx.xpp	alarm parameters
(D8)	01 xx.xmA/xxx pp	analog output Nr.1/input values
(D8BIS)	02 xx.xmA/xxx pp	analog output Nr.2/input values
(D9)	Configuration	configuration display
(D10)	IC7685 R2.0x	instrument P/N and software release

-

[MODE] to go to

(D1) | ppm x point cal | ISE calibration
x Number of memorized calibration points

[CAL] to activate the calibration sequence

[MODE] to go to

(D2) | xxx.x mV X++ | mV supplied by ISE
xxx.x mV mV given by the electrode
X++ ion valence

[MODE] to go to

(D3) |TEMP.: xx.x°C| Temperature value
xx.x Temperature value
M manual value

[CAL] to activate the Temperature calibration or the procedure of the manual Temperature value selection

[MODE] to go to

(D4) |Termoc.: OFF | Thermo-compensation parameters
OFF thermo-compensation deactivated
(ON) thermo-compensation activated

[CAL] to activate the thermo-compensation parameters calibration

[MODE] to go to



(D5) |SA xxx.xppm* LO| Set-point A parameters

SA set-point A parameters
 xxx.xppm set-point value
 set-point A status (relay activated)
 LO selected function (minimum)
 * alarm function on set-point A is activated

[CAL] to activate the set-point value, hysteresis and delay time programming sequences

[MODE] to go to

(D6) |SB xxx.xppm* HI| Set-point B parameters

SB set-point B parameters
 xxx.xppm set-point value
 set-point B status (relay activated)
 HI selected function (maximum)
 * alarm function on set-point B is activated

[CAL] to activate the set-point value, hysteresis and delay time programming sequences

[MODE] to go to

(D7) |AL x.x/xxx.xpp| Alarm parameters

AL Concentration values alarm (ppm)
 x.x low alarm value
 xxx.x actual high alarm value

[CAL] to activate the alarm values programming sequences

[MODE] to go to

(D8) |01 xx.xmA/xxx pp| analog output Nr.1/input values

01 selected analog output Nr.1
 xx.xmA analog output value (mA)
 xxx pp input measuring value (ppm)



(xxx°C) Temperature value (option 091.3711) WHA-3000-G

[MODE] to go to

(D8BIS) |02 xx.xmA/xxx pp| analog output Nr.2/input values

02 selected analog output N°2 (option 091.3711)
xx.xmA analog output value (mA)
xxx pp input measuring value (ppm)
(xxx°C) Temperature value

[MODE] to go to

(D9) |Configuration | Configuration display

[CAL] to activate the programming sequences of keyboard lock/unlock,
display contrast, visualization and modification of the instrument
configuration parameters

[MODE] to go to

(D10) |IC7685 R2.0x| Instrument P/N and software release

[MODE] to go back to the main display (D0)



CALIBRATION SEQUENCES

The following procedures will be active whenever the instrument is not in the keyboard lock condition.

To unlock the keyboard follow the procedures mentioned in the "Configuration" chapter.

The following procedures allow the sensor calibration, the set-point and alarm parameters programming.

The sequence (1, 2,) helps the operator to following the regular calibration sequence.

IMPORTANT NOTE: during the calibration procedure the microprocessor turn the unit to the main display if no keys have been pressed within 5 minutes (30 minutes for ISE calibration sequences)

Manual/automatic mode

Normally the instrument works in automatic mode.

Follow this procedure to change operating mode Automatic/Manual.

1. [MODE] to go to
 (DO) |xxx.xppm $\bar{\text{AL}}$ BH|

2. [CAL] to access the operating mode selection
 |CAL MODE: $\bar{\text{AUTO}}$ |
 AUTO automatic mode
 (MANUAL) manual mode
 [MODE] to go back to (DO)

3. [^] [V] to select the operating mode

4. [ENT] to confirm the selected operating mode and to go back to (DO)

MESSAGE FUNCTION

| " UPDATE " | the selection has been memorized
 The unit go back to (DO)

New electrode Calibration

This calibration is necessary when installing the new ISE electrode.

It is necessary to provide from 2 to 5 standard solutions.

The Concentration of the next solution must be no more of 100 times (2 decades).
The electrode's output of the next solution must be $\Delta \text{mV} > 10 \text{ mV}$.

1. [MODE] to go to
(D1) |ppm x point cal |

Calibration point insertion:

2. [CAL] to access the calibration sequences

|CAL POINT Nr. x |

Nr.x Nr. of the calibration point (1/5)

[MODE] to delete the calibration procedure
(see "Calibration procedure deletion")

[ENT] to end the calibration procedure
(see "Calibration procedure ending")

3. [CAL] to insert the Nr.x point

Immerse the electrode into the standard solution

|CAL Px:± xxx.xmV|

xxx.xmV signal supplied by the electrode

[MODE] to exit from the procedure



4. [ENT] to confirm and to go to the decade selection

|Px DECADE:100.0 |

100.0 decade

[MODE] to exit from the procedure

5. [^] [V] to select the decade

6. [ENT] to access the calibration point value insertion

|Px VALUE: xxx.x |

Px calibration point number

xxx.x actual value of the calibration point Px

[MODE] to exit from the procedure

7. [^] [V] to insert the new calibration value

8. [ENT] - to confirm the calibration value
 - to go to the next point Px (from 2 to 5)
 - if Px=5 the unit will check the validity of the calibration

Calibration procedure deletion

1. [MODE] press this key during the visualization of the calibration point number (CAL POINT Nr. x)

|ABORT POINT CAL?|

[MODE] to abort the calibration procedure and to go back to the visualization of the calibration point number

2. [ENT] to delete the calibration and to go back to (D1)

Calibration procedure ending

The calibration may be ended from the following display:

|CAL POINT $\bar{\quad}$ Nr. x |

1. [ENT] to start the ending of the procedure

|END POINT $\bar{\quad}$ CAL? |

[MODE] to annul the ending procedure and to go back to the visualization of the calibration points number

2. [ENT] to end the calibration and to go to the inserted point check



Calibration validity check

During the validity check, the instrument will show the following message:

|CHECK CAL POINT |

1. If the inserted points are proper, the following message will be displayed:

|VALUE UPDATED |

[ENT] to stop the message and to go to the display D1

2. If the inserted points have any error, the following message will be displayed:

|POINT n ERROR |

n (2/5) wrong point number

[ENT] to visualize the type of error

Messages and type of errors during the calibration:

|WRONG ION |

The response curve is inverse (check the ion type selection).

|SLOPE TOO LOW |

Slope is < 50% of the nominal value.

(Nominal value for monovalent ions (X+ X-): 56 mV/decade)

(Nominal value for bivalent ions (X++ X--): 28 mV/decade)

Check if X++ (X--) has been selected instead of X+ (X-)



|SLOPE TOO HIGH |

Slope is > 200% of the nominal value
Check if X+ (X-) has been selected instead of X++ (X--)

|POINT TOO FAR |

The calibration point is 2 decades far from the previous one.
Choose a second standard solution with lower concentration. (<100 times)

|POINT TOO NEAR |

The calibration point is < 10 mV far from the previous one.
Choose a second standard solution with higher concentration. (>10 times)

[ENT] to go back to the wrong point calibration

One point calibration

This is the regular calibration during the electrode's life.
Be sure the 2/5 solutions calibration has been done at least one time before start this kind of calibration.

Take a sample from the process (at least 500 mL) and read the concentration on the display while taking the sample.
Measure the value of the sample with a laboratory instrument.
Adjust the reading of the controller following the steps of the 2-5 point calibration but, end the calibration after the first point .

NOTE: [^]+[V]+[ENT] pressing the 3 keys the unit will turn to the factory calibration (drift adjustment 0.0 mV)



Messages during the zero calibration:

If the zero calibration is correct, the instrument will show the following message:

|ZERO PNT UPDATED|

After 2 seconds the message will disappear and the unit will go back to (D1).

If the deviation value is > 100 mV, the following message will appear:

|Z > 100 mV |

After 5 minutes the message will disappear and the unit will go back to (D1). The new Zero value is not memorized.

It is necessary to calibrate the unit with 2 standard solutions at least.

[ENT] to acknowledge the error message.
The message 'NO UPDATE' will appear for 2 seconds, then the unit goes back to (D1).



Temperature calibration

1. [MODE] to go to
(D3) |TEMP.: xx.x °C |

2. [CAL] to access the calibration procedure
|CAL T xx.x°C |

xx.x measured Temperature value
>>>>> Temperature value overrange

[MODE] to exit from the procedure and to go back to (D3)
[^]+[V]+[ENT] press the 3 keys to turn to factory calibration

3. [^] [V] to modify the actual value
4. [ENT] to confirm and to go to the manual Temperature insertion
|CAL T.M: xx.x°C|

xx.x manual Temperature value

[MODE] to exit from the procedure and to go back to (D3)

5. [^] [V] to modify the actual value
6. [ENT] to confirm and to go back to (D3)

MESSAGE

FUNCTION

| " UPDATE " | The calibration is accepted

ERROR MESSAGES

| Z > 2.0°C | Zero > 2.0°C The above message will last for 5 minutes.

[ENT] to acknowledge the error messages

| " NO UPDATE " | the calibration is not accepted.
The unit go back to (D3)



Thermo compensation parameters

The Automatic Temperature Compensation may be affected only when the isothermal value is known.

Select OFF in the following step 3 if the value is unknown.

1. [MODE] to go to
(D4) |Term comp.: OFF |

2. [CAL] to access the calibration sequences
|CAL TC: OFF |

OFF thermo compensation deactivated
(ON) (thermo compensation activated)

[MODE] to exit from the procedure and to go back to (D4)

3. [^] [V] to select ON or OFF

4. [ENT] to confirm and to go to the thermo compensation coefficient selection

|CAL TC: x.xxx%/°C|

x.xxx Thermo compensation coefficient value

[MODE] to exit from the procedure and to go back to (D4)

5. [^] [V] to modify the value

6. [ENT] to confirm and to go to the isothermal point insertion

|CAL Ipp: xxx.xmV|

xxx.x electrode's isothermal value

[MODE] to exit from the procedure and to go back to (D4)

7. [^] [V] to modify the inserted value

8. [ENT] to confirm and to go back to (D4)

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Set-point A/B calibration

For each set-point it is possible:

- to insert the set-point
- to insert the hysteresis
- to insert the delay time

1. [MODE] to go to

(D5) |SA xxx.xppm LO|

(D6) |SB xxx.xppm HI|

The following procedure is suitable for both set-point A and B.

Set-point value

2. [CAL] to access the calibration sequences

|CAL SA S:xxx.xpp|

SA set-point A calibration
xxx.xpp set-point value

[MODE] to exit from the procedure and to go back to
(D5)/(D6)

3. [∧] [V] to insert the set-point value

4. [ENT] to confirm and to go to the next step

|CAL SA I: x.xpp|

x.xpp actual hysteresis value

[MODE] to exit from the procedure and to go to (D5)/(D6)

- 5. [Λ] [V] to insert the hysteresis value
- 6. [ENT] to confirm and to go to the delay time insertion

|CAL SA D: x.xs |

x.xs actual delay time value

[MODE] to exit from the procedure and to go to (D5)/(D6)

- 7. [Λ] [V] to insert the delay time value
- 8. [ENT] to confirm and to go back to (D5)/(D6)

| " UPDATE " | The calibration is accepted

Alarm calibration

The following operations are possible:

- to select the min/max alarm value
- to select the delay time value

- 1. [MODE] to go to
(D7) |AL x.x/xxx.xpp|
- 2. [CAL] to access the calibration sequences

|CAL AL L: x.xpp|

AL L low alarm calibration
x.xpp actual low alarm value

[MODE] to exit from the procedure and to go to (D7)

- 3. [Λ] [V] to insert the alarm value
- 4. [ENT] to confirm and to go to the high alarm insertion

|CAL AL H:xxx.xpp|

AL H high alarm calibration
xxx.xpp high alarm value

[MODE] to exit from the procedure and to go to (D7)

5. [Λ] [V] to insert the alarm value
6. [ENT] to confirm and to go to the delay time selection

|CAL AL D: x.xs |

AL D delay alarm calibration
x.xs delay time value

[MODE] to exit from the procedure and to go to (D7)

7. [Λ] [V] to insert the delay value
8. [ENT] to confirm and to go back to pD7p

| " UPDATE " | The new data have been memorized



CONFIGURATION

The following operations are possible:

- keyboard locked/unlocked selection
- display contrast selection
- access number insertion

1. [MODE] to go to
(D9) | Configuration |
 2. [CAL] to access the configuration sequences
Keyboard locked/unlocked
| KB UNLOCKED |
UNLOCKED (LOCKED) Keyboard unlocked (locked)
[MODE] to go back to (D9)
 3. [^] [V] to select one of the two options (locked/unlocked)
 4. [ENT] to confirm and to go to the next step
- LCD display contrast
- |LCD contrast: x |
x contrast level
[MODE] to go back to (D9)
1. [^] [V] to select the contrast from 0 to 7
 2. [ENT] to confirm and to go to the access number insertion

Access number

|Access Nr.: 0 |

0 access number request

[MODE] to go back to (D9)

1. [Λ] [V] to insert the access number (when keeping the key pressed the number will scroll with 3 speed level)
2. [ENT] to confirm and to proceed with the configuration

IMPORTANT NOTE: any number different from the right access code, will allow the visualization of the parameters and not the modification.

The following message will appear:

MESSAGE	FUNCTION
'Cal Inhibition'	Configuration changes are inhibited

Ion valence

|TYPE OF ION: X+ |

X+(X--)(X-)(X+) type of selected ion

[MODE] to go back to (D9)

- [Λ] [V] to select the type of ion
- [ENT] to confirm and to go to the next step

Before modifying the type of ion, the unit need the confirmation.

The type of ion modification cancels the calibration points previously memorized and turn the unit to the factory calibration.

|Reset ppm cal? |

[MODE] to go back to (D9)

- [ENT] to confirm the type of ion and to reset the calibration point



Set-point scale, alarm and analog output

|Scale: 100.0 ppm| (10.00 - 1000)

100.0 (10.00) (1000) selected scale

[MODE] to go back to (D9)

[^] [V] to select the scale
[ENT] to confirm and to go to the next step

Note: set-point, alarm and analog output values will be shown in the scale as selected.

Software filter

|Large s RT: x.xs|

Large s RT response time for large fluctuations
x.xs software filter value (sec.)

[MODE] to go back to (D9)

[^] [V] to select the time
[ENT] to confirm and to go to the next step

|Small s RT:xx.xs|

Small s RT response time for small fluctuations
xx.xs response time value (in sec.)

[MODE] to go back to (D9)

[^] [V] to select the time
[ENT] to confirm and to go to the next step



Scale of the analog output n°1 (option 091.3711)

|CAL OUT1: ppm |

ppm (°C) input/analog output Nr.1

[MODE] to go back to (D9)

[^] [V] to select values in ppm (°C)
[ENT] to confirm and to go to the next step

Analog output n°1 range

|CAL OUT1: 0/20mA|

0/20mA (4/20mA) range selected

[MODE] to go back to (D9)

[^] [V] to select the output range
[ENT] to confirm and to go to the next step

|CAL P1: x.xppm|

P1 begin of the output range
x.xppm measuring value related to 0/4 mA

[MODE] to go back to (D9)

[^] [V] to choose the value x.x in ppm
[ENT] to confirm and to go to the next step

|CAL P2: xxx.xppm|

P2 end of the output range
xxx.xppm measuring value related to 20 mA

[MODE] to go back to (D9)

[^] [V] to choose the value xxx.x in ppm
[ENT] to confirm and to go to the next step

IMPORTANT NOTE: if the value related to P1 is higher than the value related to P2, the analog output will be the "reverse", otherwise will be the "direct" type.

Scale of the analog output n°2 (option 4)

|CAL OUT2: ppm |
ppm (°C) input/analog output n°2

[MODE] to go back to (D9)

[^] [V] to choose the values in ppm
[ENT] to confirm and to go to the next step

Analog output n°2 range

|CAL OUT2: 0/20mA|
0/20mA (4/20mA) range selected

[MODE] to go back to (D9)

[^] [V] to select the output range
[ENT] to confirm and to go to the next step

|CAL P1: x.xppm|
P1 begin of the output range
x.xppm measuring value related to 0/4 mA

[MODE] to go back to (D9)

[^] [V] to choose the value x.x in ppm
[ENT] to confirm and to go to the next step

|CAL P2: xxx.xppm|

P2 end of the output range
xxx.xppm measuring value related to 20 mA

[MODE] to go back to (D9)

[^] [V] to choose the value xxx.x in ppm
[ENT] to confirm and to go to the next step

IMPORTANT NOTE: if the value related to P1 is higher than the value related to P2, the analog output will be the "reverse", otherwise will be the "direct" type.

Set-point A function

|SET A F. : LO |

F function
LO (HI) minimum (maximum)

[MODE] to go back to (D9)

[^] [V] to select the function LO or HI
[ENT] to confirm and to go to the next step



Set-point B function

|SET B F. : LO |

F function
LO (HI) minimum (maximum)

[MODE] to go back to (D9)

[^] [V] to select the function LO or HI
[ENT] to confirm and to go to the next step

Set-point A alarm

|AL SET A: ON |

ON (OFF) alarm inserted (not inserted)

[MODE] to go back to (D9)

[^] [V] to select ON or OFF
[ENT] to confirm and to go to the next step
- by selecting OFF the alarm function is not activated.
The unit goes to the next parameter calibration. - by selecting ON the alarm function is activated.
(when the relay B will be active longer than the time selected in the following procedure).

|TIME SET A: xx m|

xx m activation time

[MODE] to go back to (D9)

[^] [V] to choose the time value
[ENT] to confirm and to go to the next step



Set-point B alarm

|AL SET B: ON |

ON (OFF) alarm inserted (not inserted)

[MODE] to go back to (D9)

[^] [V] to select ON or OFF
[ENT] to confirm and to go to the next step
- by selecting OFF the alarm function is not activated.
The unit goes to the next parameter calibration. - by selecting ON the alarm function is activated.
(when the relay B will be active longer than the time selected in the following procedure).

|TIME SET B: xx m|

xx m activation time

[MODE] to go back to (D9)

[^] [V] to choose the time value
[ENT] to confirm and to go to the next step

Alarm relay contact

|AL RELAY: ACT |

ACT (DEA) relay activated (deactivated) when the alarm is active

[MODE] to go back to (D9)

[^] [V] to select ACT or DEA
[ENT] to confirm and to go to the next step

New access number

|Change A Nr.:NO |

NO (YES) access number changing not required (required)

[MODE] to go back to (D9)

[^] [V] to select NO or YES
[ENT] to confirm and to go to the next step
- by selecting NO the unit will go to the Configuration display
- by selecting YES the unit will go to the following display:

|New Nr.: xxx |

xxx actual access number

[MODE] to go back to (D9)

[^] [V] to insert the new access number
[ENT] to confirm and to go to the next step

The instrument asks the operator to insert again the new access number.

|Confirm Nr.: xxx |

xxx actual access number

[MODE] to go back to (D9)

[^] [V] to insert the new access number
[ENT] to confirm and to go back to the beginning of the Configuration

The double insertion of the new access number assures the memorization of the right code.

As soon as the new number is memorized the message "UPDATE" will appear.

Should the operator insert two different numbers, the instrument will not modify the access number and the message "NO UPDATE" will be shown.

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- [ENT] press several time the key to verify the selected parameters before leaving the Configuration routine.
- [MODE] press to exit from the Configuration menu.

INSTALLATION

Controller installation

The controller may be installed close to the points being monitored, or it may be located some distance away in a control area.

The enclosure is designed for wall mounting. It should be mounted on a rigid surface, in a position protected from the possibility of damage or excessive moisture or corrosive fumes.

Electrical installation

Connections within the controller are made on detachable terminal strips located on the rear side. (fig. 2)

Power and output-recorder connections are made at the 13 pin terminal strip, while input signal connections are made at the 12 pin terminal strip.

Connecting the power

- terminal 4 connect to the ground
- terminals 1-2 connect to the ac power (if power is 110 V)
- terminals 1-3 connect to the ac power (if power is 220 V)

(If option 24 is installed, connect 24 VAC to 1-3 terminals)

WARNINGS:

- power the device by means of an isolation transformer
- avoid mains-voltage from an auto-transformer
- avoid mains voltage from a branch point with heavy inductive loads
- Separate power supply wires from signal ones
- control the mains voltage value
- an internal device protects the unit against power overloads.
Disconnect the power and wait few minutes before powering again.

Connecting alarms, pumps, valves

The output connections referred to set-point SA and set-point SB are made at terminal strip and they consist of two independent SPDT relays corresponding to Regulator A and Regulator B.

The output connection referred to alarm consists of SPDT relay corresponding to Alarm C/D.

RELAY "A" SET-POINT "SA"

terminal 6	marked C	common contact
terminal 5	marked NO	normal open contact
terminal 7	marked NC	normal closed contact

RELAY "B" SET-POINT "SB"

terminal 9	marked C	common contact
terminal 8	marked NO	normal open contact
terminal 10	marked NC	normal closed contact

RELAY "C/D" ALARM

terminal 12	marked C	common contact
terminal 11	marked NO	normal open contact
terminal 13	marked NC	normal closed contact

Arc suppressor

Install a suitable snubber between relay terminals if the relay activation causes interferences on the display.

Operating the system

Checking

Before connecting the system to the power supply:

- check that all cables are properly fastened to prevent strain on the connections
- check that all terminal-strip connections are mechanically and electrically sound
- check that power voltage is correct
- Check that all water connections are fastened and that there are no leakages from any of the connectors or pipes.

Pre-operation check

The system's controls and indicators are all located on the front panel (see fig.1).

The meter has a LCD display 1 indicating that the unit is on.

The cards of the controllers are adjusted at the factory.

If sensors have been connected correctly, as described in the above sections, the system should function correctly needing only the start up and the parameters calibrations as described in the following section.

Quick start guide

The unit may be installed for the following purposes:

- measuring
- measuring and regulation
- measuring, regulation and recording

The instrument is shipped with factory calibration and configuration suitable for measuring Hardness. For this reason the operation may require just the following steps:

Measuring

1. Switching-on the meter will assume the factory calibration.
The display will go to (D0) Display.
2. The meter is configured for Bivalent ions (ion type X++) and 1000 ppm scale.
3. Carry out the first one point calibration .

Measuring and regulation

Add the following to the preceding operations:

1. Press [CAL] [^] [ENT] to go to the manual operation.
If the automatic mode is selected, go to the step 2
2. A and B relay are configured as LOW (Minimum).
Select HIGH (Maximum) if necessary.

3. Select the Set-point, the Hysteresis and the Delay of A and B relay. From (D0) press 5 times [MODE] to start the Set-point A selection sequence.
From (D0) press 6 times [MODE] to start the Set-point B selection sequence.
4. The alarm on the activation time of A and B relay is deactivated.
Activate this kind of alarm if necessary.
5. Select alarm values of min/max and delay if necessary.
From (D0) press 7 times [MODE] to start the alarm selection sequence.

Measuring, regulation and recording

Add the following to the preceding operations:

1. Analog output is configured as ppm at 0/20 mA corresponding to the input scale.
Select 4/20 mA and a suitable input span if necessary.
2. If option 091.3711 is installed, follow the step 1. For the second output.
This option allows selecting the analog output as °C scale.

Manual operation

When the instrument is programmed for the manual operation (see Calibration sequences) the flashing "M" will appear on the display.

Analog outputs and alarm relay will remain activated.

[Λ] while pressing the key, A relay will be activated.

[V] while pressing the key, B relay will be activated.

Temperature compensation

Do not activate the Temperature compensation if the isothermal value and the thermo compensation Coefficient of the electrode are not known.

Following the Nernst's law the thermo compensation Coefficient is:

- 0.198 %/°C (monovalent ions)
- 0.099 %/°C (bivalent ions)

The above values should be confirmed by electrode's manufacturer.

The isopotential point change depending on the type of the measured ion.

The manual compensation is in alternative to the automatic compensation.

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NOTES:



Calibration

One point calibration

It is recommended to make a one point calibration when:

- The electrode is replaced or the ion type is changed (X--, X-, X+, X++);
- Periodically, in order to maintain a good accuracy.

There are 2 ways to make the one point calibration:

1. Sample preparation calibration (Not recommended):

Prepare from 2 up to 5 standard solutions.

We suggest standard solutions corresponding to the decades (0.10/1.00/10.00/100.0/1000).

From (D0) press MODE to start the calibration procedures (see 4.2.2.)

During the calibration the unit measures the mV signal from the electrode, while the operator insert the corresponding concentration value in ppm.

The instrument affects the validity check of the calibration points.

If a calibration point is not valid, an error message will appear together with the number of the point. The operator may repeat the calibration of this point.

The unit considers not valid the following calibration points:

- if between 2 points there are less than 10 mV
- if between 2 points there are more than 2 decades
- if slope is less than 50% or more than 200% of the regular slope
- if the slope is negative instead of positive (or vice versa).

The point corresponding to zero concentration is deleted.

During the calibration, control relays and alarm relay are deactivated.

Electrode's drift adjustment

This is the regular calibration to be effected during the electrode's life, by using a standard solution having a concentration value close to the process value.

By inserting just one calibration point, the unit will effect the electrode's drift adjustment. (see 4.2.3)



Temperature calibration

From (D0) press [MODE] to start the Temperature calibration sequence.

Immerse the Temperature sensor in a liquid at known Temperature and check the correspondent value on the display.

Follow the first 4 steps of the procedure in the Chapt. 4.2.4. to adjust the Temperature value

PREVENTIVE MAINTENANCE

Controller

Quality components are used to give the controller a high reliability.

The frequency of such maintenance depends on the nature of each particular application.

As in any electronic equipment, the mechanical components, such as switches, relays and connectors, are the most subject to damage.

Sensor

The state of the electrode's surface is critical for the normal operation of the system.

Protect the sensor from humidity, excessive moisture or corrosive fumes.

The electrode should be cleaned from time to time by simply washing with dionized water, in case it does not help, the electrode should be taped in a 1% HCl solution for no longer than 1 minute and then washed with water again.

NOTE: The electrode surface should not be cleaned with any kind of paper or fabric.

IC-3000 REAR PANEL CONNECTIONS

1. 2.	110 V. Power supply
1. 3.	220 V. Power supply
4.	Ground (power)
5. 6.	A Relay N.O. contacts
6. 7.	A Relay N.C. contacts
8. 9.	B Relay N.O. contacts
9.10.	B Relay N.C. contacts
11.12.	C Relay N.O. contacts (alarm)
12.13.	C Relay N.C. contacts (alarm)
14.	Recorder output 1 (+)
15.	Recorder output 2 (+) (option)
16.	Recorder output 1 and 2 (-)
21.	Reference Electrode input
22.	Ion Selective Electrode input
23.24.25.	Temperature sensor input

FIG. 2

