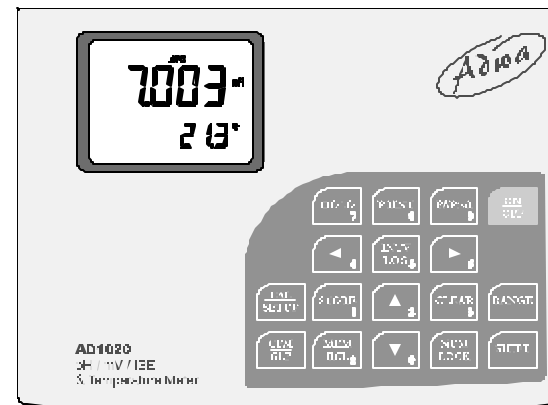




**USER MANUAL**

**AD1000 and AD1020  
pH/mV/ISE/Temperature  
Bench Meters**

**ADWA INSTRUMENTS Kft.**  
Alsókikötő sor 11, 6726 Szeged, Hungary  
Tel. +36 62 317 878  
Fax +36 62 550 610  
e-mail: [sales@adwainstruments.com](mailto:sales@adwainstruments.com)  
[www.adwainstruments.com](http://www.adwainstruments.com)



Dear Customer,

Thank you for choosing an Adwa product.

Please read carefully this manual before starting operations.

This instrument is in compliance with the EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC for electrical equipments.

For additional technical information, please e-mail us at **sales@adwainstruments.com**.

## ***WARRANTY***

---

Adwa warrants this product to be free of defects in material and workmanship as stated in the operating manual. If repair or adjustment is necessary and has not been the result of abuse, misuse or improper handling within the warranty period, please contact your dealer or the nearest Adwa Office for the RGA (Return Goods Authorization) number to put on the outside of your package. Warranted service will be made without charge. **The meter is warranted for a period of 2 years, while probes are warranted for 6 months.** The warranty period commences from the original date of sale. Warranty is only valid when the product is used under normal conditions and in accordance with the instruction manual. The warranty is void if the instrument is repaired or serviced by unauthorized personnel, not used in accordance to the instructions, or if non-Adwa accessories such as buffer solutions, probes, etc. are used in conjunction with the meter. Adwa will not be held responsible for any accident whether directly or indirectly, caused by the use of this instrument.

## ***ELECTRODES, PROBES AND SOLUTIONS***

<b>A1131B</b>	Refillable pH electrode with glass body, tip protection bottle, BNC connector and 1 m cable
<b>A1230B</b>	pH electrode with Epoxy body, tip protection bottle, BNC connector and 1 m cable
<b>A3230B</b>	ORP electrode with Epoxy body, tip protection bottle, BNC connector and 1 m cable
<b>A7662</b>	Stainless steel temperature probe with 1 m cable.
<b>A70004P</b>	pH 4.01 buffer, 20 ml sachet, 25 pcs
<b>A70007P</b>	pH 7.01 buffer, 20 ml sachet, 25 pcs
<b>A70010P</b>	pH 10.01 buffer, 20 ml sachet, 25 pcs
<b>A7071S</b>	3.5 M KCl + AgCl electrolyte solution for refillable electrodes, 30 ml bottle

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## ***INTRODUCTION***

**AD1000** and **AD1020** are professional bench meters with ranges for pH, ORP (Oxidation Reduction Potential), ISE (**AD1020** only) and temperature measurements. Relative mV readings are also provided.

Main features include:

- Up to 5-point calibration with 7 memorized buffers (pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01 & 12.45) and two custom buffers
- Calibration time-out alarm
- pH calibration using buffers with 0.001 resolution
- pH reading with manual or automatic temperature compensation
- Log-on-demand (up to 50 samples) and automatic logging (up to 1000 samples)
- Two selectable alarm limits
- User selectable logging interval mode
- Connection to an external serial printer with the following specifications:
  - at least 16 characters / line
  - baud rate 9600
  - 9-pin RS232 input

<b>SYMPTOMS</b>	<b>PROBLEM</b>	<b>SOLUTION</b>
The meter does not work with the temperature probe.	Out of order temperature probe.	Replace the probe.
The meter fails to calibrate or gives faulty readings.	Broken or out of order pH electrode.	Replace the electrode.
Explicit warnings are displayed during pH calibration.	Dirty/broken pH electrode, contaminated reference or buffers.	Follow displayed instructions.
At start-up the meter displays all LCD permanently.	One of the keys is blocked.	Check the keyboard or contact the vendor.
Long beep heard when pressing a key.	Key without function in current mode. End of range reached with the ARROW keys.	Don't press keys without function in current mode.
Digits can not be introduced with the numeric keys.	Max. value reached for corresponding range.	Delete digits.
"Err xx" error message displayed.	Internal error.	Turn off the meter and then turn on. If the error persist, contact the dealer.

## ***TROUBLESHOOTING GUIDE***

<b>SYMPTOMS</b>	<b>PROBLEM</b>	<b>SOLUTION</b>
Slow response/ excessive drift.	Dirty pH electrode.	Soak the electrode tip in deionized water solution for 30 minutes and then follow the cleaning procedure.
Reading fluctuate up and down (noise).	Clogged/dirty junction. Low electrolyte level (refillable electrodes only).	Clean the electrode. Refill with fresh electrolyte (refillable electrodes only).
The display shows blinking dashes during pH measurements.	Out of range in pH scale.	Make sure the pH sample is in the specified range. Calibrate. Check the electrolyte level and the general state of the pH electrode.
The display shows blinking reading during measurements.	Reading out of range or electrode not connected.	Check sample or connect electrode.
Out of range in the mV scale.	Dry membrane/dry junction.	Soak in A7071S electrolyte solution for at least one hour.

- Large easy-to-read LCD showing pH or ISE (**AD1020** only), mV and temperature readings simultaneously, together with graphic symbols
- HOLD feature to freeze the stable reading on the LCD
- GLP feature to view last calibration data for pH, ISE and relative mV
- PC interface

Both models are supplied complete with:

- **A1131B** refillable pH electrode with glass body, BNC connector and 1 m cable
- **A7662** stainless steel temperature probe 1 m cable
- pH 4.01 and pH 7.01 calibration buffers (20 ml sachet each)
- Electrode holder
- 12 Vdc power adapter
- User manual

### ***TECHNICAL DATA***

<b>Range</b>	-2.00 to 16.00 pH / -2.000 to 16.000 pH ±2000 mV 0.001 to 19999 ppm ( <b>AD1020</b> only) - 20.0 to 120.0°C (- 4.0 to 248.0°F)
<b>Resolution</b>	0.01 pH / 0.001 pH 0.1 mV (±999.9 mV) / 1 mV (outside) 0.001 ppm (0.001 to 9.999) 0.01 ppm (10.00 to 99.99) 0.1 ppm (100.0 to 999.9) 1 ppm (1000 to 19999) ( <b>AD1020</b> only) 0.1°C (0.1°F)
<b>Accuracy</b> (@20°C/68°F)	±0.01 pH / ±0.002 pH ±0.2 mV up to ±699.9 mV ±0.5 mV up to ±999.9 mV ± 2 mV outside ±0.5% f.s.
ISE ( <b>AD1020</b> only) ±0.4°C (±0.7°F) (excluding probe error)	
<b>Relative mV Offset</b>	± 2000 mV
<b>pH Calibration</b>	Up to 5 point calibration, with 2 custom and 7 standard buffers (pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45)

### **For refillable electrodes:**

Refill the electrode reference chamber with fresh **A7071S** electrolyte solution. Allow the electrode to stand upright for 1 hour. Follow the storage procedure above.

### **CLEANING PROCEDURE**

Soak in deionized water for approximately 30 minutes.

**IMPORTANT:** After performing any of the cleaning procedures, rinse the electrode thoroughly with deionized water, refill the reference chamber with fresh electrolyte and soak the electrode in **A7071S** electrolyte solution for at least 1 hour before taking measurements.

**For refillable electrodes:**

If the filling solution (electrolyte) is more than 2.5 cm below the fill hole, add **A7071S** electrolyte solution.

For faster response, unscrew the fill hole screw during measurements.

**STORAGE PROCEDURE**

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

Replace the solution in the protective cap with a few drops of **A7071S** electrolyte solution.

NEVER STORE THE ELECTRODE IN DISTILLED OR DEIONIZED WATER.

**PERIODIC MAINTENANCE**

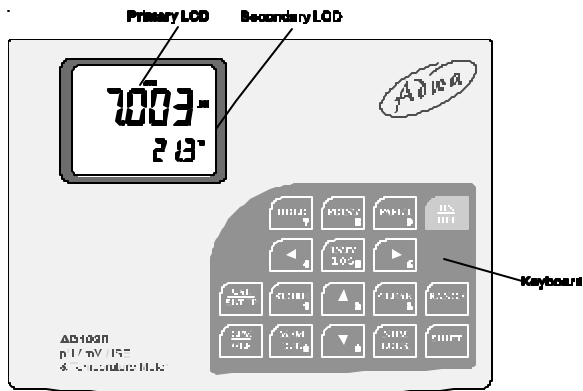
Inspect electrode and cable. The cable used for connection to the instrument must be intact and there must be no points of broken insulation on the cable or cracks on the electrode stem or bulb. Connectors must be perfectly clean and dry. If any scratches or cracks are present, replace the electrode. Rinse off any salt deposits with water.

<b>ISE Calibration</b> (AD1020 only)	Up to two-point calibration, 5 standard solutions available (0.1, 1, 10, 100, 1000 ppm)
<b>Temperature Compensation</b>	Manual or automatic, -20.0 to 120.0°C (-4.0 to 248.0°F)
<b>pH Electrode</b>	<b>A1131B</b>
<b>Temperature Probe</b>	<b>A7662</b>
<b>Logging Interval</b>	5 seconds to 180 minutes
<b>Printer</b>	External serial printer
<b>PC Interface</b>	USB port
<b>Analog Output</b>	± 2000 mV
<b>Input Impedance</b>	10 <sup>12</sup> Ohm
<b>Environment</b>	0 to 50°C (32 to 122°F) RH max. 95% non-condensing
<b>Power Supply</b>	12 Vdc adapter
<b>Dimensions</b>	230 x 180 x 50 mm
<b>Weight</b>	1.8 kg

## FRONT AND REAR PANELS

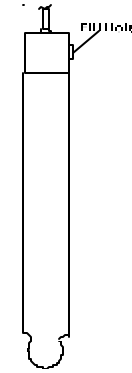
---

### Front Panel



## pH ELECTRODE CONDITIONING & MAINTENANCE

---



### PREPARATION PROCEDURE

Remove the pH electrode protective cap. **DO NOT BE ALARMED IF SALT DEPOSITS ARE PRESENT.** This is normal with electrodes and they will disappear when rinsed with water.

During transport, tiny bubbles of air may form inside the glass bulb affecting proper functioning of the electrode. 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 **A7071S** electrolyte solution for at least one hour.



- To return to normal measurement mode, press CAL at any moment during calibration.
- If the calibration procedure is ended after the 600.0 mV point is confirmed, the meter returns to normal measurement mode and stores a 2-point calibration data.

### ***ANALOG OUTPUT***

---

For the full range of each measurement, the analog output varies from - 2000 to 2000 mV.

### ***PC INTERFACE***

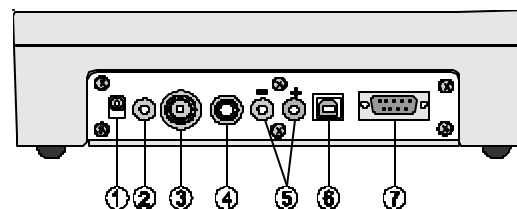
---

Data transmission from the instrument to the PC can be done with the **AD9316** Windows® compatible software (optional). **AD9316** also offers graphing and on-line help feature.

Data can be exported to the most popular spreadsheet programs for further analysis.

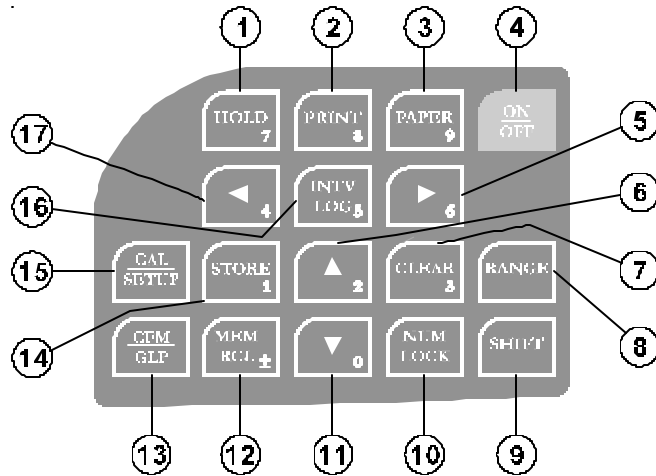
To connect your instrument to a PC, use a standard USB cable. Make sure that the instrument is switched off and plug the cable to the instrument USB port and to the PC USB port.

### **Rear Panel**



1. Power adapter socket
2. Reference input socket
3. BNC connector for pH, ORP or ISE electrodes
4. Temperature probe socket
5. Analog output sockets
6. USB port for PC connection
7. RS232 port for external serial printer connection

## Keyboard



1. **HOLD** key, to freeze reading on the LCD
2. **PRINT** key, to obtain a printout or cancel printing
3. **PAPER** key, to pull out the external printer paper
4. **ON/OFF** key, to turn the instrument ON and OFF
5. **Left arrow** key, to toggle between parameters while in MEM RCL or SETUP mode (backwards), to toggle between absolute mV and temperature while in relative mV mode and between pH buffer and temperature while in pH calibration mode

The CAL tag lights up and the secondary LCD shows 0.0 mV.

- Set the simulator to 0.0 mV. When the reading is stable and close to the selected calibration point, the CFM tag starts blinking.
- Press CFM to confirm and the secondary LCD will display the second expected value (600.0 mV).
- Set the simulator to 600.0 mV. When the reading is stable and close to the selected calibration point, the CFM tag starts blinking.
- Press CFM to confirm. The secondary LCD will display the third expected value (1800 mV).
- Set the simulator to 1800.0 mV. When the reading is stable and close to the selected calibration point, the CFM tag starts blinking.
- Press CFM to confirm. The instrument returns to measurement mode.

### Notes:

- If the reading is not close to the selected point, the WRONG tag will blink. Verify the calibration conditions or contact your dealer if calibration can not be performed.

- **Press CFM** to confirm. The instrument returns to normal measurement mode.



**Note:** If the reading is not close to the selected calibration point, the **WRONG** tag will blink. Change the temperature probe and restart calibration.

### *mV CALIBRATION* (for technical personnel only)

The instruments are factory calibrated for mV range.

Adwa's ORP electrodes are interchangeable and no mV calibration is needed when they are replaced.

If measurements are not accurate, a mV recalibration should be performed.

For an accurate recalibration, contact your dealer or the nearest Adwa Customer Service Center, or follow the instructions below.

A two or three-point procedure can be performed at 0.0, 600.0 and 1800.0 mV.

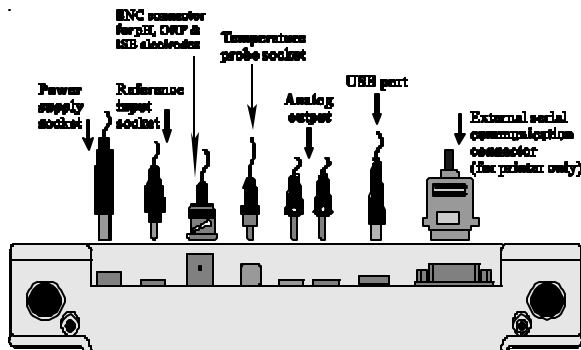
- Attach a mV simulator with an accuracy of  $\pm 0.1$  mV to the BNC connector on the rear panel.
- With the instrument off, press and hold the CFM & STORE keys, then power on the instrument.

6. **Up arrow** key, to manually increase the value of temperature or other parameters
7. **CLEAR** key, to clear calibration or logged data
8. **RANGE** key, to select measurement unit or switch focused data
9. **SHIFT** key, to activate the second function key
10. **NUM LOCK** key, to activate numerical keys (0 to 9,  $\pm$ )
11. **Down arrow** key, to manually decrease the value of temperature or other parameters
12. **MEM RCL** key, to view logged data
13. **CFM/GLP** key, to confirm values and to display GLP (Good Laboratory Practice) information
14. **STORE** key, to store measured data
15. **CAL/SETUP** key, to enter/exit calibration mode and to enter/exit SETUP mode
16. **INTVLOG** key, to start/stop logging
17. **Right arrow** key, to toggle between parameters while in MEM RCL or SETUP mode (forwards), to toggle between absolute mV and temperature while in relative mV mode and between pH buffer and temperature while in pH calibration mode

**Note:** To select second function, press first SHIFT and then the desired key. The SHIFT tag will appear on the LCD until the desired key is pressed. To leave second function mode, press SHIFT again.

## OPERATIONAL GUIDE

### CONNECTIONS



- Plug the 12 Vdc adapter into the power supply socket.

**Note:** These instruments feature a non-volatile memory to keep calibration data and all meter settings even when unplugged.

- Immerse the temperature probe into the vessel with ice and water as close as possible to the reference thermometer. Allow a few seconds for probe thermal stabilization.
- Use the arrow keys to set the reading on the secondary LCD to that measured by the reference thermometer.



- When the reading is stable and close to the selected calibration point, the CFM tag starts blinking.
- Press CFM to confirm. The secondary LCD will display 50.0°C (or 122.0°F).



- Immerse the temperature probe into the second vessel as close as possible to the reference thermometer. Allow a few seconds for probe thermal stabilization.
- Use the arrow keys to set the reading on the secondary LCD to that of the hot water measured by the reference thermometer.
- When the reading is stable and close to the selected calibration point, the CFM tag starts blinking.

## TEMPERATURE CALIBRATION

(for technical personnel only)

The instruments are factory calibrated for temperature. Adwa's temperature probes are interchangeable and no temperature calibration is needed when they are replaced. If temperature measurements are not accurate, temperature new calibration should be performed.

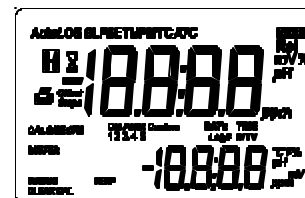
For an accurate recalibration, contact your dealer or the nearest Adwa Customer Service Center, or follow the instructions below.

- Prepare a vessel containing ice and water, and another one containing hot water at approximately 50°C (122°F). Place insulation material around the vessels to minimize temperature drift.
- Use a calibrated thermometer with a resolution of 0.1°C (or 0.1°F) as reference thermometer. Connect the supplied **A7662** temperature probe to the appropriate socket on the rear panel.
- With the instrument off, press and hold the CAL & up arrow keys, then power on the instrument. The "CAL" tag lights up and the secondary LCD shows 0.0°C (or 32.0°F). The primary LCD will display the measured temperature or "----", if the reading is out of range.

- Attach the pH, ORP or ISE (**AD1020** only) electrode and the temperature probe to the appropriate sockets on the rear panel. For electrodes with separate reference, connect the reference to the proper input socket.
- Attach the analog output and serial cables to the connectors on the back of the instrument.

## INSTRUMENT START-UP

Turn the instrument on by pressing the ON/OFF button. All LCD tags are displayed and a beep is heard (if beep is ON) while the instrument performs a self test.

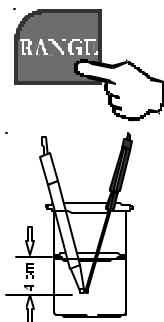


The instrument will display the date on the primary LCD and the time on the secondary LCD, and then it will enter the same measurement range as it was at power off.

## pH MEASUREMENTS

Make sure the instrument has been calibrated before taking pH measurements.

- Press RANGE to enter pH range. Press RANGE again to change the pH measurement resolution.
- Immerse pH electrode tip and temperature probe approximately 4 cm into the solution to be tested. Allow for the electrode to stabilize and put the temperature probe tip as close as possible to the pH electrode.
- The pH reading is displayed on the primary LCD and the temperature value on the secondary LCD.



- **If measurements are taken successively in different samples, it is recommended to rinse the electrode thoroughly with deionized or tap water and then with some**

From setup mode, if CAL and then PRINT is pressed for a chosen parameter, a help printout will provide the following information (e.g. Alarm Time-Out):

```

SET
ALARM TIME-OUT
(OFF or 1-7)
Active Keys:
^ -increment
v -decrement
CAL-exit, no save
CFM-save & exit
CLR-set to
default
    
```

During logging, an automatic printout will provide the following information for pH, mV and ISE (AD1020 only), log-on-demand and automatic logging modes:

```

LOG ON DEMAND
Instr ID    0003
Date       2004/01/01
Time       01:13:53
Sample No   1
pH         7.01
mV        -23.3
°C         26.2
Offset     -22.9mV
slope      100.0%
    
```

```

START AUTOLOG
Instr ID    0002
Lot         L03
Date       2004/10/15
Time       18:05:01
Interval    00:30
Slope      99.7%
Sample No   1
pH         7.02
mV        -0.5
°C         25.0
Sample No   2
pH         7.01
mV        -0.2
°C         25.0
Sample No   3
pH         6.97
mV         1.9
°C         24.9
STOP AUTOLOG
Date       2004/10/15
Time       18:06:51
    
```

- When exiting the setup mode, the instrument asks if the setup report has to be printed. The “Prn” message will be displayed, together with the printer symbol (🖨️) and the CFM tag blinking.



- Press CFM to print the setup report or CAL to exit without printing.

```

~~~~~
                SETUP REPORT
Instr ID      0003
Cal Time Out OFF
One Cal Point
                pnt
Custom Buffer
pH           3.000
Cb2         Not defined
Ion Charge   undf
Date        2004/01/01
Time        02:28:34
Printer      ON
Beep         OFF
Baud Rate    2400
Comm prefix  16
ALARM HIGH LIMIT
pH           no
mV           no
Rel mV       no
ppm          no
ALARM LOW LIMIT
pH           no
mV           no
ppm          no
Temperature  - °C
AUTO-LOG:
Interval     000:05
START Condition:
            btn-button
STOP Condition:
Duration     03:00
~~~~~

```

of the next sample. This will prevent cross contaminations and condition the electrode before immersing it into the solution to be tested.

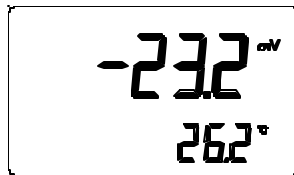
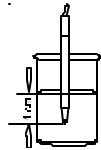
- The pH reading is affected by temperature. In order to measure the pH accurately, the temperature effect must be compensated for. To use the ATC (Automatic Temperature Compensation) capability of the instrument, connect the **A7662** temperature probe, immerse it into the sample as close as possible to the pH electrode and wait for a few seconds.
- If the sample solution temperature is known, MTC (Manual Temperature Compensation) can be performed by disconnecting the temperature probe. The display will show the default temperature of 25°C (or 77°F) or the last temperature reading with the °C (or °F) tag blinking.
- The temperature can be adjusted using the arrow keys (from -20.0°C to 120.0°C or from -4.0°F to 248.0°F).

## ORP (mV) MEASUREMENTS

Oxidation-reduction potential (REDOX) measurements provide the quantification of the oxidizing or reducing power of the tested sample.

To correctly perform a redox measurement, the surface of the ORP electrode must be clean and smooth.

- Press RANGE to enter the mV range.
- Immerse the ORP electrode tip 4 cm into the solution to be tested and wait a few seconds for the reading to stabilize.
- The instrument displays the mV reading on the primary LCD and the temperature on the secondary LCD.



- If reading is out of range, the closest full-scale value will blink on the primary LCD.

When in SETUP mode, the following information can be printed:

- If PRINT is the first key pressed after entering the setup mode, a setup table of contents will be printed.

```
INSTRUMENT SETUP
Calibration
Alarm Time Out
One point cal
behavior
pH Custom Buf. 1
pH Custom Buf. 2
Ion Charge
Beep Alarms:
Alarm high
Alarm low
AutoLOG:
Start condition
End condition
Interval
Temperature unit
Current Date
Current Time
Printer ON/OFF
Beep ON/OFF
Baud rate
Command prefix
Instrument ID
Active Keys:
^ -next item
v -prev. item
CAL-enter in
modifying mode
SET-exit SETUP
RANGE-select
parameter
See also items
Help printings
```



**Note:** For ISE (AD1020 only) and relative mV measurement modes, the ppm and Rel.mV values will be printed.

When in GLP mode, the printout provide the following information:

- For pH range:

```

      GLP pH
Instr ID   0003
Date      2004/01/01
Time      01:04:32
Cal Time Out OFF
Offset    -22.9mV
Slope     100.0%
Cal Buffers:
pH        7.01
  
```

- For relative mV range:

```

      GLP Rel mV
Instr ID   0003
Date      2004/01/01
Time      02:27:35
Channel    pH
Off.RelmV -23.3
  
```

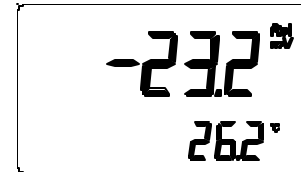
- For ISE range (AD1020 only):

```

      GLP Ion
Instr ID   0003
Date      2004/01/03
Time      02:30:04
Slope     -59.3
Ion Charge 1
Cal Buffers
ppm       0.1
mV        -320.6
ppm       100
mV        -158.4
  
```

## RELATIVE mV MEASUREMENTS

To enter relative mV mode, press RANGE. The relative mV reading will be displayed on the primary LCD and the current temperature value on the secondary LCD.

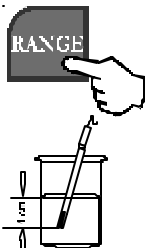


**Note:** Press the right or left arrow key to toggle between temperature and absolute mV reading on the secondary LCD.

The relative mV reading is equal to the difference between the absolute mV input value and relative mV offset established in the relative mV calibration.

### ION MEASUREMENTS (AD1020 only)

- Press RANGE to enter the ISE measurement mode.



- Immerse the ISE electrode tip 4 cm into the solution to be tested and wait a few seconds for stable reading.
- The instrument displays the ppm reading on the primary LCD and the temperature on the secondary LCD.



### PRINTING

When connected to an external serial printer, a complete set of information can be printed.

#### **Printer specifications :**

- at least 16 characters / line
- baud rate 9600
- 9-pin RS232 input

Data can be printed on demand (from measurement, GLP and SETUP modes) by pressing PRINT key or automatically (from automatic logging and log-on-demand modes).

Automatic data printing from automatic logging mode can be done only if the automatic logging interval is greater than 30 seconds and the printer status is set to ON.

**Note:** To cancel printing, press PRINT again.

While in pH measurement mode, the printout provides the following information:

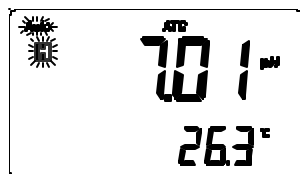
Date	2004/01/01
Time	02:25:17
pH	7.01
mV	-23.2
°C	26.3

## ***HOLD***

---

To freeze a stable reading on the LCD, press HOLD key from normal measurement mode.

The “Auto” and “H” tags will blink on the LCD until the reading stabilizes.



When the reading is stable, the “Auto” and “H” tags stop blinking and the reading is frozen.

Press HOLD key again to return the normal measurement mode.

**Note:** Pressing RANGE the instrument will skip to the displayed range, without leaving the HOLD mode. The STORE key also holds HOLD mode. Pressing MEM RCL key, SHIFT and then SETUP or GLP, the instrument leaves the HOLD mode and performs the selected function.

## **TEMPERATURE MEASUREMENTS**

Connect the **A7662** temperature probe to the appropriate socket on the rear panel.

Immerse the temperature probe into the solution and allow the reading to stabilize.



### **Notes:**

- The temperature can be displayed in Celsius (°C) or in Fahrenheit degree (°F). See “Setup” section for details.
- The temperature probe must be measured in the same sample together with the pH or ISE electrode.

## ***pH CALIBRATION***

---

The instrument should be recalibrated:

- Whenever the pH electrode is replaced
- At least once a week
- After testing aggressive chemicals
- If the CAL DUE message is blinking during measurement

### **PREPARATION**

Pour small quantities of the buffer solutions into clean beakers. If possible, use plastic beakers to minimize any EMC interferences.

For accurate calibration and to minimize cross-contamination, use two beakers for each buffer solution: the first one for rinsing the electrode and the second for calibration.

If you are measuring in the acidic range, use pH 4.01 or 1.68 as second buffer. If you are measuring in the alkaline range, use 10.01/9.18 or 12.45 as second buffer.

For extended range measurements (acidic and alkaline), perform a five-point calibration by selecting five of the available buffers.

#### **PROCEDURE**

If 0.001 pH resolution is selected, each selected standard buffer value can be updated accordingly with the value of the production lot certificate at 25°C (77°F). From calibration mode, when a standard pH buffer with 0.001 resolution is selected, press SHIFT and then SETUP. The buffer value will start blinking and it can be changed within a  $\pm 0.020$  pH window using the arrow keys.

The instrument allows to choose among 7 memorized pH buffers (pH 1.68, 4.01, 6.86, 7.01, 9.18, 10.01, 12.45) and 2 custom buffers.

Custom buffers allow the user to calibrate using a solu-

- Press CLEAR to delete the selected lot/record or all lots.

**Note:** Positions remain free in the log-on-demand lot by deleting the last logged sample or all lots.

- If the “dEL All” option was selected, all logged data are deleted and the instrument returns to normal measurement mode.
- Press MEM RCL at any time to return to measurement mode.

**Notes:**

- To view the previous logged parameter, press the left arrow key.
- In Rel mV MEM RCL mode the offset value is not available and the display shows '----'.
- The record number is an identification number inside a lot.

After scrolling all logged parameters, the meter displays the “dEL” message together with the lot number.



**Notes:**

- Pressing SHIFT and then SETUP key, the instrument toggles between lot and record number (log-on-demand only) or all lots.
- The “LdM” message on the secondary LCD indicates that data has been stored in log-on-demand mode.

tion with a pH value different from a standard one. Up to two custom buffers can be set through the setup menu. The custom buffer value can also be changed within a  $\pm 1.0$  pH window around the set value.

For accurate measurements it is recommended to perform a five-point calibration. However, at least a two-point calibration is suggested.

The instrument will automatically skip the buffers already used and require a minimum difference of 0.2 pH unit between two buffers used for calibration.

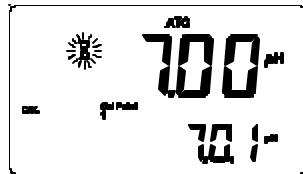
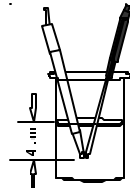
A new calibration will override existing stored calibration data. The slopes adjacent to the calibration points will be reevaluated.

If the new calibration point has no correspondence in the existing stored calibration data, it is simply added or the instrument will ask which buffer will be replaced by the current one.

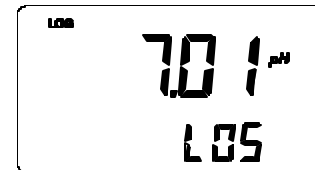
If at least a two-point calibration has been performed and an offset correction of the electrode is desired, keeping unchanged the existing slopes, perform a one-point calibration selecting the “OFFS” option in the setup menu. If the “Pnt” option is selected, the slopes adjacent to the calibration points will be reevaluated.

## FIVE-POINT CALIBRATION

- Immerse the pH electrode and the temperature probe approximately 4 cm into a buffer solution of your choice (pH 1.68, 4.01, 6.86, 7.01, 10.01, 12.45, custom buffer 1 or 2, if set) and stir gently. The temperature probe should be close to the pH electrode.
- Press CAL and the instrument will display the measured pH on the primary LCD and the “7.01 pH” buffer on the secondary LCD, together with CAL and “Cal Point 1” tags.



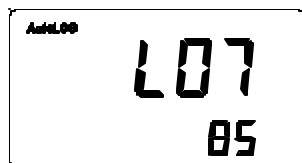
- If necessary, press the up and down arrow keys to select a different buffer value.



Pressing SHIFT and then SETUP key while in MEM RCL mode, the secondary LCD will toggle between the lot and the record number. Use the arrow keys to select a different lot or record.

Press RANGE or the right arrow key to scroll all logged parameters, displayed as shown in the table below:

Parameter	Primary LCD	Secondary LCD
mV	mV reading	Temperature
TIME	Hour and minutes	Seconds
DATE	Year	Month and day
OFFSET	Offset value	Lot or record number
SLOPE	Slope value	Lot number or ion charge (ISE range)

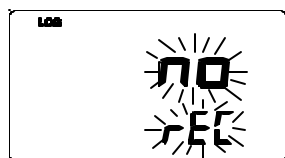


**Notes:**

- If printer is ON and the logging interval is at least 30 seconds, each logged sample is printed.
- If the pages for automatic logging are full, the “FULL LOC” message is displayed, as in log-on-demand mode.

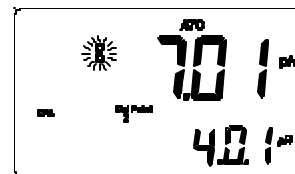
**VIEWING LOGGED DATA**

To retrieve stored information, press MEM RCL from normal measurement mode. If no data were logged, the display will show the “no rEC” message.



Otherwise, the instrument displays the memorized pH, Rel mV or ppm reading, and the lot number.

- The hourglass tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer, the CFM tag appears. Press the CFM key to confirm.
- The calibrated value is then displayed on the primary LCD and the secondary LCD will display the second expected buffer value, together with CAL and “Cal Point 2” tags.



- After the first calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 4 cm into the second buffer solution and stir gently. The temperature probe should be close to the pH electrode.
- If necessary, use the arrow keys to select a different buffer value.
- The hourglass tag will blink on the LCD until the reading is stable.

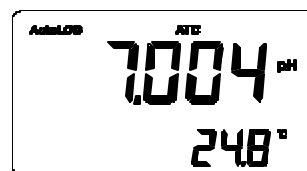
- When the reading is stable and close to the selected buffer, “CFM” tag appears.
- Press CFM key to confirm. The calibrated value is then displayed on the primary LCD and the secondary LCD will display the third expected buffer value.
- After the second calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 4 cm into the third buffer solution and stir gently. The temperature probe should be close to the pH electrode.
- If necessary, use the arrow keys to select a different buffer value.
- The hourglass tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer value, the CFM tag appears. Press the CFM key to confirm.
- The calibrated value is then displayed on the primary LCD, while the secondary display will show the fourth expected buffer value.
- After the third calibration point is confirmed, immerse the pH electrode and the temperature probe approximately 4 cm into the fourth buffer solution and stir



### Notes:

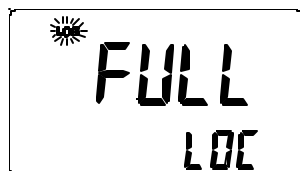
- For different automatic logging modes, the logging starts/stops automatically after the set start/stop condition is reached.
- The “AutoLOG” tag will blink if one of these modes is selected and the start condition is not reached.

After the data logging is started, the current value is displayed on the primary LCD and the temperature on the secondary LCD, together with the “AutoLOG” tag.



To stop the automatic logging, press the INTVLOG key at any time. The instrument will display for a few seconds the lot number, the sample number and the “AutoLOG” tag, and then it will return to normal measurement mode.





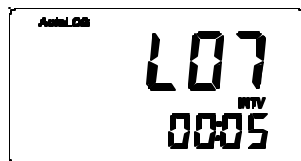
The instrument returns to normal measurement mode.

### AUTOMATIC LOGGING

The user-selectable automatic logging options make these instruments very useful in a wide range of applications.

- Start pressing the INTVLOG key or set starting time/date. Stop after a set duration.
- Start pressing the INTVLOG key or set starting time/date. Stop when a set value is reached.
- Start pressing the INTVLOG key or set starting time/date. Stop when a set sample number is reached.

When the automatic logging starts, the instrument will display for a few seconds the lot number and the auto-log interval, together with the “AutoLOG” tag.



gently. The temperature probe should be close to the pH electrode.

- If necessary, use the arrow keys to select a different buffer value.
- The hourglass tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer value, the CFM tag appears. Press the CFM key to confirm.
- The calibrated value is then displayed on the primary LCD, while the secondary display will show the fifth expected buffer value.
- After the fourth calibration point is confirmed, immerse pH electrode and temperature probe approximately 4 cm into the fifth buffer solution and stir gently. The temperature probe should be close to the pH electrode.
- If necessary, use the arrow keys to select a different buffer value.
- The hourglass tag will blink on the LCD until the reading is stable.
- When the reading is stable and close to the selected buffer value, the CFM tag appears. Press the CFM key to confirm.

- The instruments store the calibration values and return to normal measurement mode.

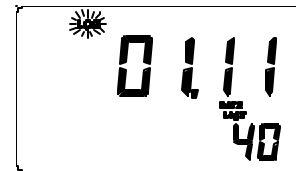
#### **FOUR, THREE, or TWO-POINT PROCEDURE**

Proceed as described in the “Five-point calibration” section and press CAL after the appropriate accepted calibration point. The instrument will memorize the calibration data and return to normal measurement mode.

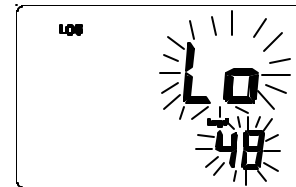
#### **ONE-POINT CALIBRATION**

- Two setup options are available: “Pnt” and “OFFS”.
- If the “Pnt” option is selected, the adjacent slopes will be reevaluated.
- If the “OFFS” option is selected, an electrode offset correction is performed keeping unchanged the existing slopes.
- Proceed as described in the “Five-point calibration” section and press CAL after the first accepted calibration point. The instrument will memorize the single point calibration data and return to normal measurement mode.

The instrument will display the current date on the primary LCD and the record number on the secondary LCD, together with the ‘LOG’ tag blinking for a few seconds. Then the number of free locations is shown.



If there are less than 6 memory locations left, the record number and the “Lo” message will blink for a few seconds to alert the user, and then the number of free locations is displayed.



If the logging space is full, the “FULL LOC” message will be displayed for a few seconds together with the “LOG” tag blinking, followed by the “FrEE 0” message.

## ***LOGGING / STORING***

---

This feature allows the user to log automatically pH & Rel mV or ISE & Rel mV measurements, together with the temperature reading. All logged data can be transferred to a PC through the USB port.

The maximum logging space is 1000 record locations (samples). This can be divided from 1 up to 50 lots (one lot can use all the free space). The lot ID can be from 1 to 99 (after 99 it restarts from 1). A maximum of 50 lots can be stored, even if there is free space available.

**Note:** When the logged lots are more than one, the total number of samples can be less than 1000, because the logging memory is divided in pages of 20 samples each.

The logging interval can be set from 5 seconds to 180 minutes (see “Setup” section for details). Up to 50 record locations are also provided for the log-on-demand.

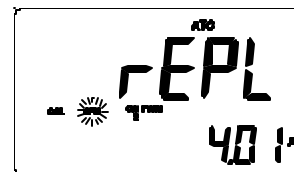
### **LOG-ON-DEMAND (LOGGING/STORING THE CURRENT DATA)**

To store the current reading into the instrument memory, press STORE from normal measurement mode.



### **Notes:**

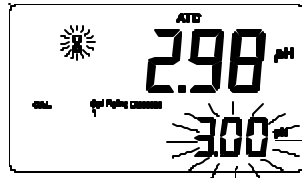
- During calibration press RANGE or the right or left arrow keys to toggle between pH buffer and temperature reading on the secondary LCD.
- Each time a buffer is confirmed, the new calibration parameters replace the old data of the corresponding buffer.
- If current confirmed buffer has no correspondence in the stored calibration, it will be added to the existing calibration data. If the stored calibration is a five-point procedure, the instrument will ask which buffer should be replaced.



Use the arrow keys to select the buffer to be replaced, then press CFM to confirm or CAL to exit calibration without replacing.

## CUSTOM BUFFERS

If at least one custom buffer was set in SETUP menu, it can be selected for calibration using the arrow keys. Press SHIFT and then SETUP key if you want to adjust the buffer value. The buffer value, displayed on the secondary LCD, will start blinking.



Use the ARROW keys to change the buffer value.

After about 5 seconds the last change has been performed, the buffer value is updated and the meter exit from the changing mode. Press SHIFT and then SETUP key if you want to change again the value.

**Note:** Custom buffer value can be adjusted in a  $\pm 1.00$  pH window, around the set value.

- Pressing RANGE while in setup viewing mode, the instrument will display one of the following options: “dur”, “SAMP”, “rdG” & “pH”, “rdG” & “mV”, “rdG” & “Rel mV” and “rdG” & “ppm”.
- Press the CAL key and the instrument will enter the setup changing mode and display one of the following messages:
  - “dur” on the secondary LCD and the duration value (hh:mm) on the primary LCD, together with the “TIME” tag. The duration can be set from 1 minute to 199 hours and 59 minutes.
  - “SAMP” on the secondary LCD and the sample number on the primary LCD.
  - “rdG” on the secondary LCD and the last set limit value on the primary LCD, with the corresponding range tag blinking.  
To set a different resolution, press RANGE while in setup changing mode.

The automatic logging will start accordingly with the selected option for the “Strt” item: by pressing INTVLOG if the selected option is “btn” (button), or when the set starting time is reached.

The automatic logging will stop accordingly with the selected option for the “End” item or when INTVLOG key is pressed.

- If both alarm items are set, the instrument will beep when the reading is above alarm high limit or below alarm low threshold.

**Note:** If the “AL.HI” value is minor than or equal to the “AL.LO” value, the WRONG tag will blink.

### **AutoLOG SETUP**

#### AutoLOG Start Condition

- Select the ‘Strt’ item. The previously set automatic logging start condition will be displayed. The default value is ‘btn’ (button), i.e. start with key pressed.
- To view the set date, press and hold the RANGE key while in setup viewing mode, when time is displayed.
- If the CAL key is pressed while in setup viewing mode, the start time is displayed.

**Note:** Pressing CLEAR while in setup changing mode, the start condition will be reset to the default value (“btn”).

#### AutoLOG End Condition

- Select the “End” item. The previously set automatic logging end condition will be displayed. The following options will be available: “dur” (duration), “SAMP” (sample number), “rdG” (reading limit).

### **CLEAR CALIBRATION**

If the CLEAR key is pressed at any time during calibration, the “CLEAR CAL” tag lights up and the “donE” message is displayed on the secondary LCD.

All previous calibrations are cleared and the instrument continues the procedure. The points already confirmed for the current calibration are not deleted.

**Note:** If CLEAR is pressed during the first calibration point, the instrument returns to measurement mode.

### **RELATIVE mV CALIBRATION**

- Press CAL from relative mV measurement mode. The relative mV value is displayed on the primary LCD and the absolute mV value on the secondary LCD.
- If desired, change the displayed relative mV value using the arrow or the numerical keys (press NUM LOCK to activate them).

#### **Notes:**

- Press RANGE to change the resolution of the displayed value, if possible (e.g. 199.9 will change to 1999, while 19.9 will not change).
- If CLEAR is pressed outside NUM LOCK mode, the displayed value is set to 0.0 mV.

- Press NUM LOCK again to leave the numerical keys.
- When the reading is stable and the relative mV offset is within the offset window ( $\pm 2000$  mV), the CFM tag will be displayed.
- Press CFM to confirm relative mV calibration. The instrument will return to measurement mode.
- If the absolute mV reading is out of range or the relative mV offset is outside the offset window, the WRONG tag will blink. To complete the calibration procedure the input value or the relative mV offset has to be changed.

### ***ISE CALIBRATION (AD 1020 only)***

---

For greatest accuracy, it is recommended to calibrate the instrument frequently.

Due to electrode conditioning time, keep the electrode immersed for a few seconds in the solution to be tested. To make the calibration a simple and error-free procedure, the user will be guided step by step during calibration with easy messages on the display.

### **ALARM SETUP**

- Select one of the alarm items. The displayed value will be the one previously set.
- Press RANGE to select the range for the alarm and the corresponding range tag will blink.
- Press the CAL key to enter setup changing mode. Set the new value using the arrow or the numerical keys.

#### **Notes:**

- While in setup changing mode, press RANGE to select a different resolution, if possible (e.g. if 199.9 is displayed, by pressing RANGE the value will change to 1999; if 19.9 is displayed, nothing will happen if pressing RANGE).
- Pressing CLEAR key, the displayed item will be reset to the default value (“no”).
- Press NUM LOCK key to activate the numerical keys. The SHIFT tag will blink.
- Press CFM to confirm the set value.

While in normal measurement mode:

- If only the “AL.LO” item is set, the instrument will beep when the reading is below alarm low limit.
- If only the “AL.HI” item is set, the instrument will beep when the reading is above alarm high limit.

**Notes:**

- The custom buffers can be set only with 0.001 resolution. If 0.01 pH resolution is selected during calibration, the displayed custom buffer value will be a rounded one.
- While in setup changing mode for items calibration alarm time-out, custom buffer, alarm limits, start and stop condition, press CLEAR to set the selected item to the default value.
- Refer to the table below to select the correct ion charge for each ion type (AD 1020 only):

ION CHARGE	ION TYPE
-2 (divalent anion)	S, CO <sub>3</sub>
-1 (monovalent anion)	F, Cl, Br, I, CN, SCN, ClO <sub>4</sub> , NO <sub>3</sub>
+1 (monovalent cation)	H, Na, K, Ag, NH <sub>4</sub>
+2 (divalent cation)	Mg, Ca, Ba, Cd, Cu, Pb
undf	undefined ion

**PREPARATION**

- Set the proper ion charge through the setup item “IonCG”.

**Note:** If the “undF” option is selected in setup menu, the calibration must be a two-point procedure. If the user try to exit the calibration mode after confirming the first point, the “----” message appears on the LCD.

- Pour small quantities of the standard solutions into clean beakers. If possible, use plastic beakers to minimize any EMC interferences.
- For accurate calibration and to minimize cross-contamination, use two beakers for each standard solution, the first one for rinsing the electrode and the second for calibration.

**PROCEDURE**

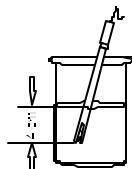
One and two-point procedures are available, with five memorized standard solutions: 0.1, 1.0, 10, 100, 1000 ppm.

- Press RANGE to enter the ISE mode.

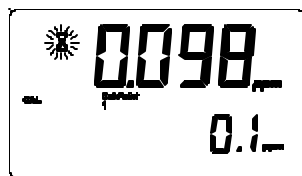


## TWO-POINT CALIBRATION

- Immerse the ISE electrode approximately 4 cm into the first standard solution and stir gently.



- Press CAL key. The primary LCD will display the ppm value using current offset and slope.
- The “CAL” and “Cal Point 1” tags light up, and the 0.1 ppm standard value is shown on the secondary LCD.
- If necessary, use the arrow keys to select a different standard solution.
- The hourglass symbol will blink on the LCD until the reading becomes stable.



- When the reading is stable and close to the selected standard, the CFM tag starts blinking.

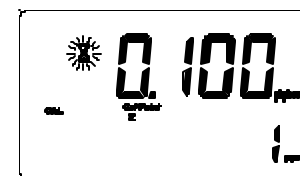
Item	Description	Valid values	Default
CAL DUE	Alarm time-out	OFF or 1 to 7 days	OFF
1 Pnt	1-point cal. behavior	Pnt, OFFS	Pnt
Custom C1	Custom buffer 1	-2.00 to 16.00 pH	no
Custom C2	Custom buffer 2	-2.00 to 16.00 pH	no
IonCG	Ion charge	undF, -2, -1, 1, 2	undF
AL.HI	Alarm high limit	pH, mV, Rel mV ranges	no
AL.LO	Alarm low limit	pH, mV, Rel mV ranges	no
Strt	AutoLOG start condition	See time/date or btn	btn
End	AutoLOG end condition	dur, SAMP, rdG	dur
Interval	AutoLOG interval	5 sec to 180 min	5 sec
tEMP	Temperature unit	°C, °F	°C
Date	Date (yyyy.mm.dd)	2000.01.01 to 2099.12.31	
Time	Time (hh:mm)	00:00 to 23:59	
	Printer status	ON, OFF	OFF
bEEP	Beep status	ON, OFF	OFF
bAUd	Baud rate	600, 1200, 2400, 4800, 9600	2400
PrEF	Command prefix	0 to 47	16
In Id	Instrument ID	0000 to 9999	0000



- Press SHIFT and then SETUP to exit the setup menu at any time.
- When the printer status is “ON”, the instrument asks for printing a setup report. Press CFM to print the report or CAL to return the normal measurement mode.

The table on next page lists all available setup parameters, their valid values and the factory settings (default).

- Press CFM to confirm calibration.
- The calibrated value will be displayed on the primary LCD and the second expected standard solution on the secondary LCD.



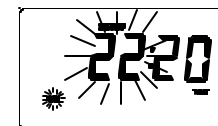
**Note:** The instrument will automatically skip the standard value used for the first point.

- After the first calibration point is confirmed, immerse the ISE electrode approximately 4 cm into the second standard solution.
- If necessary, use the arrow keys to select a different standard solution.
- The hourglass symbol will blink on the LCD until the reading becomes stable.
- When the reading is stable and close to the selected standard, the CFM tag starts blinking.
- Press CFM key to confirm calibration. The instrument stores the calibration data and returns to normal measurement mode.

**Notes:**

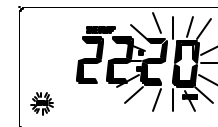
- If the mV value is out of the  $\pm 2000$  mV range, the “WRONG” and “BUFFER” tags are displayed. Check if the correct standard has been used, or refresh the electrode by following the maintenance procedure described on page 69. If necessary, change the standard solution or the electrode.
- If the ion charge is not specified (“undF” selected in setup menu), the slope window is between  $\pm 20$  mV and  $\pm 105$  mV. If a ion charge value is set, the slope value is between 50% and 120% of the default slope for the corresponding ion charge.  
Default slope value (mV/decade):  
-59.16 (monovalent anion) - ion charge is -1  
59.16 (monovalent cation) - ion charge is 1  
-29.58 (divalent anion) - ion charge is -2  
29.58 (divalent cation) - ion charge is 2  
100 - ion charge is “undF”
- To reset to the default values and clear calibration data, press the CLEAR key during calibration. The instrument will display the “CLR” message and return to measurement mode.

- To enter SETUP mode, from measurement mode press SHIFT and then SETUP.
- Press CAL to change the item value. The selected item (e.g. hour, while setting the time) and “CFM” tag will blink.



- Use the arrow keys to scroll the available values or insert the desired value with the numerical keys.
- Note:** To activate the numerical keys, press NUM LOCK. The SHIFT tag will blink. The new introduced digit is always the last one and all previous digits will shift to left.

- To delete the digits press CLEAR key before entering the NUM LOCK mode.
- If another item has to be set (e.g. minutes), press RANGE or left/right arrow key, and the item will start blinking.



- Use the arrow keys to scroll the available values or insert the desired value with the numerical keys.
- Press CFM to confirm or CAL to escape.
- Use the arrow keys to select the next/previous parameter.

## ***SETUP***

---

Setup mode allows viewing and modifying the following parameters:

- Calibration time-out alarm
- One-point calibration behavior
- Custom buffer 1
- Custom buffer 2
- Ion charge (AD1020 only)
- Alarm high limit
- Alarm low limit
- Start condition of automatic logging
- End condition of automatic logging
- Logging interval
- Temperature measure unit
- Current date (yyyy.mm.dd)
- Current time (hh:mm)
- Printer status
- Keyboard beep status
- Baud rate for serial communication
- Command prefix for serial communication
- Instrument ID

## **ONE-POINT CALIBRATION**

- To perform a single point calibration, press CAL after the first calibration point has been confirmed.



The instrument will store the one-point calibration data and return to normal measurement mode.

## ***GLP (GOOD LABORATORY PRACTICE)***

---

GLP is a set of functions that allows data storage (and retrieval) about the electrode status and maintenance.

All data regarding pH, relative mV and ISE calibrations are stored in the instrument memory.

## **CALIBRATION TIME-OUT ALARM**

The instrument allows to set the number of days (from 1 to 7) before the next required pH calibration. The default setting is “OFF” (disabled).

At start-up the instrument checks if the calibration time-out has expired. If yes, the “CAL DUE” message blinks to advise the user that a new calibration is required.

**Note:** If the instrument was not calibrated or all calibration data were cleared, the “CAL DUE” message is displayed even if the feature is disabled in the setup menu.

### LAST pH CALIBRATION DATA

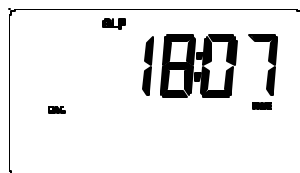
The last pH calibration data are stored automatically after a successful calibration.

To view the pH calibration data, from pH measurement mode press SHIFT and then GLP key. The instrument will display the date (yyyy.mm.dd) of the last calibration.



Use the up arrow key to view all calibration parameters in the following sequence:

- Time (hh:mm) of the last calibration.

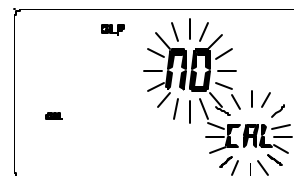


Use the up arrow key to view all logged calibration parameters in the following sequence:

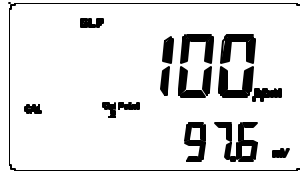
- Relative mV calibration offset and time (hh:mm) as in pH GLP mode.
- Instrument ID as in pH GLP mode.

#### Notes:

- Press SHIFT and then GLP key at any moment to return to normal measurement mode.
- If calibration has not been performed, the “no CAL” message will blink on the LCD.



- Second ISE calibration buffer on the primary LCD and corresponding mV value on the secondary LCD.



**Notes:**

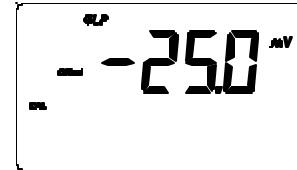
- If a single point calibration is performed after a two-point calibration, the instrument will keep the old slope.
- The “no bUF” message means that calibration was performed at one point.
- The instrument ID as in pH GLP mode.

**LAST RELATIVE mV CALIBRATION DATA**

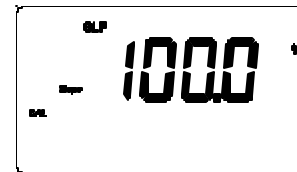
Last relative mV calibration data are stored automatically after a successful calibration.

To view the relative mV calibration data, from relative mV measurement mode press SHIFT and then GLP key. The instrument will display the date (yyyy.mm.dd) of the last calibration.

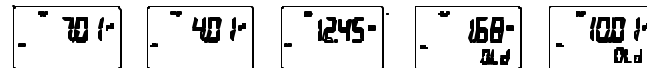
- pH calibration offset value.



- pH calibration slope (the GLP slope is the average of the calibration slopes; the percentage is referred to the ideal value of 59.16 mV/pH).

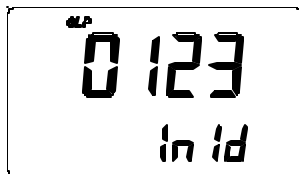


- Calibration buffers in the order used for calibration, together with the corresponding warnings.



**Notes:**

- The “Old” message displayed beside a buffer value means that this buffer was not used during last calibration. Press SHIFT and then SETUP key to see the old calibration date (or time, if old calibration date is the same as the last procedure).
- Each buffer is displayed with the resolution used during calibration.
- The “no bUF” message means that calibration was performed at less than five points.
- Calibration time-out alarm status. The display shows “OFF” if the feature is disabled, or the days remaining before the calibration alarm will be activated (e.g. 5 days), or after the calibration is expired (e.g. -3 days).
- The instrument ID.

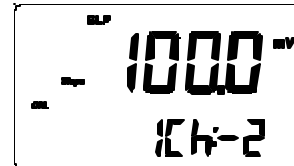


**LAST ISE CALIBRATION DATA (AD 1020 only)**

Last ISE calibration data are stored automatically after a successful calibration.

To view the ISE calibration data, from ISE measurement mode press SHIFT and then GLP key. The instrument will display the date (yyyy.mm.dd) of last calibration. Use the up arrow key to view all logged calibration parameters in the following sequence:

- ISE calibration time as in pH GLP mode.
- ISE calibration slope (mV/decade) on the primary LCD and ion charge on the secondary LCD.



- First ISE calibration buffer on the primary LCD and corresponding mV value on the secondary LCD.

