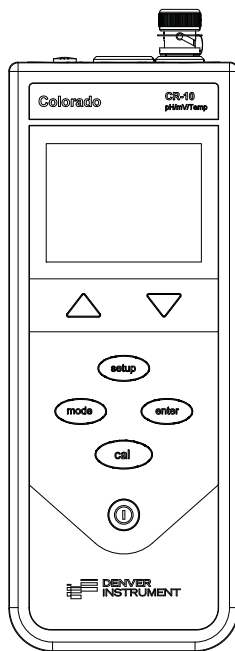


Colorado Series

CR-10 Portable pH / mV / Temperature Meter
Operation Manual



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General Introduction and Initial Inspection

The CR meter is a precise instrument for the measurement of pH, mV and temperature. A built-in microcomputer is used to store, calculate and compensate for all the relevant parameters relating to pH determinations. These include temperature characteristics of the pH sensor*, buffer solutions and sensor slope deviations.

The mechanical touch keys are highly reliable with tactile and audio feedback. This meter operates with four 1.5 VAA batteries. Re-calibration is not required when the power is turned on again.

The CR meter has a large LCD that displays the pH or mV and temperature simultaneously along with the user-prompting mode indication icons.

The instrument prompts the user through the calibration and measurement procedures.

The CR meter uses pH and ORP sensors with BNC connectors and interchangeable ATC (Automatic Temperature Compensation) / temperature sensors. The meter works with 10 K ohm temperature sensor only.

Other features include sensor offset recognition, sensor slope recognition, sensor efficiency display, buffer coefficients, automatic or manual temperature compensation, percentage of power supply display.

Carefully unpack the CR meter and accessories.

Inspect for damage caused during shipment. If any damage is found, notify your representative immediately. See instructions on page 15 for recycling of the packing materials.

* Sensor used throughout this manual refers to either a pH/mV electrode or an ATC temperature probe.

Safety Information

The CR portable meter complies with the European Council Directives as well as international regulations and standards for electrical equipment, electromagnetic compatibility, and the stipulated safety requirements. Improper use or handling, however, can result in damage and/or injury.

- To prevent damage to the equipment, read these operating instructions thoroughly before using your portable CR meter. Keep these instructions in a safe place. Please observe the following to ensure safe and reliable operation of your portable CR meter:



Do not use this equipment in hazardous areas/locations.



If you use electrical equipment in installations and under ambient conditions requiring higher safety standards, you must comply with the provisions as specified in the applicable regulations for installation in your country.

- Use Denver Instrument accessories, as these are optimally designed for use with your portable meter.
- The buffer solution used for standardization must match the stored values exactly.

- Note on installation:
The operator shall be responsible for any modifications to Denver Instrument equipment and must check and, if necessary, correct these modifications. On request, Denver Instrument will provide information on the minimum operating specifications (in accordance with the Standards listed on page 18 for defined immunity to interference).

Industrial protection ratings for the housing:

- Portable CR meter: IP65
- If you have any problems with your portable CR meter: contact your local Denver Instrument office, dealer or service center.

Replacing the Batteries

Follow the procedures to replace the internal batteries.

1. Replace batteries when the low battery icon appears on the LCD. The instrument can operate within specifications for approximately one hour after the low battery icon starts to appear.
2. The battery compartment is located at the bottom side of the CR meter (refer to Figure 1). Flip the CR meter over so that the bottom side is facing up. Slide the battery cover to expose the battery compartment.
3. Replace all four type AA batteries.
4. Replace battery cover.

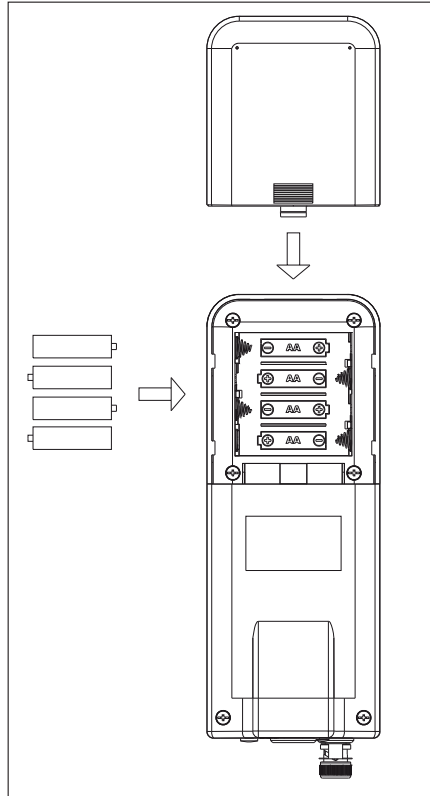


Figure 1

Turning the Instrument ON/OFF

When the instrument is not in use, press the ON/OFF key to turn off the instrument.

About the LCD

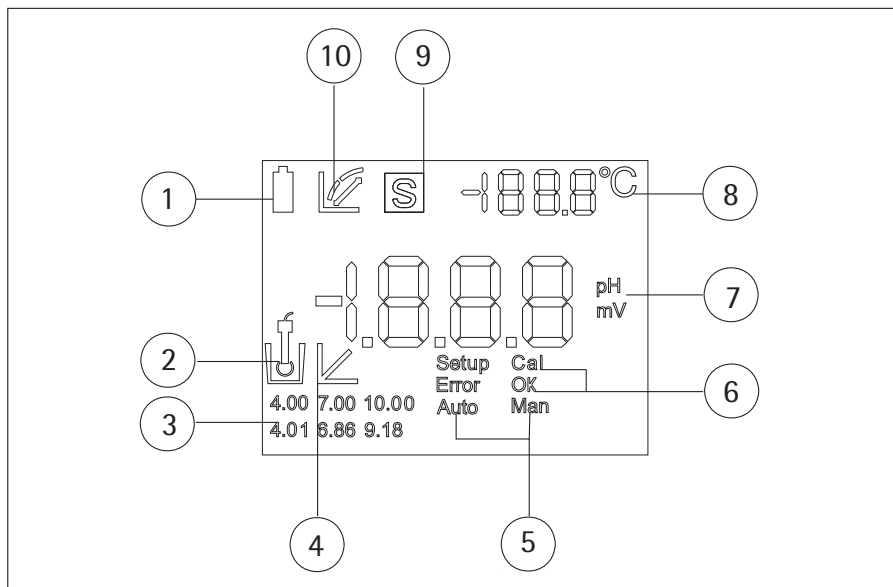


Figure 2

- 1 Low battery icon
- 2 Calibration in process icon
- 3 Buffer icons
- 4 Calibration result
- 5 Auto temperature and manual temperature icon
- 6 Calibration mode and OK icon (calibration accepted)
- 7 pH and mV mode icons
- 8 Temperature with units
- 9 Stability icon
- 10 Measuring and calibration icons

Key Functions

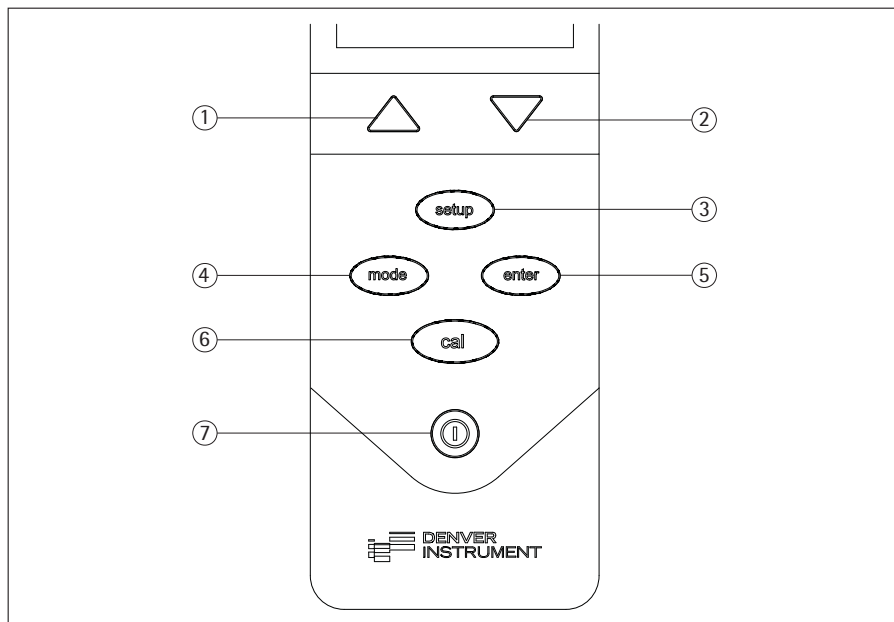


Figure 3

- 1 and 2 [\triangle] and [∇] keys. The [\triangle] and [∇] keys are used to manually enter the temperature values. They have no effect on the instrument when operating in ATC mode. Hold the UP [\triangle] and the DOWN [∇] keys for five seconds. The scrolling speed will increase. When in the Setup screen, the UP [\triangle] and DOWN [∇] keys will allow the user to select either buffer set 4.00, 7.00, 10.00 or 4.01, 6.86, 9.18.
- 3 [**SETUP**] key: The [**SETUP**] key selects buffer.
- 4 [**MODE**] key: The [**MODE**] key selects the parameters to be displayed. Pressing the [**MODE**] key changes the display sequentially to display pH and mV. The calibration values will not be affected by changing the display modes.
- 5 [**ENTER**] key: Press [**ENTER**]; the large LCD will display the efficiency of the sensor. Press and hold [**ENTER**] for 3 seconds and the CR meter will clear the calibration and reset all factory settings.
- 6 [**CAL**] key: Press to calibrate.
- 7 [**ON/OFF**] key: The [**ON/OFF**] key turns the CR meter on or off.

Connector

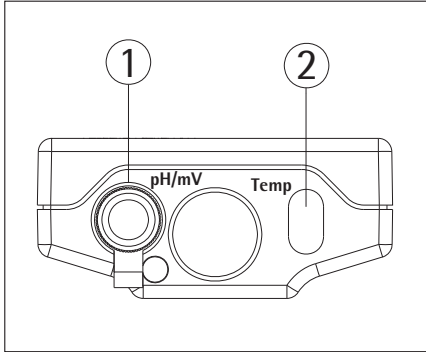


Figure 4

- 1 BNC sensor connector
- 2 Temperature compensation sensor connector

Operational Procedures

Buffer Table Selection

There are two sets of buffer available for this meter: 4.00, 7.00, 10.00 pH and 4.01, 6.86, 9.18 pH. Press the [**MODE**] key to toggle between pH and mV modes. In pH mode, press the [**SETUP**] key to go into **Buffer Selection Mode**.

Buffer Selection Mode

Use [Δ] and [∇] keys to select buffer set. Press the [**ENTER**] key to confirm buffer set and to exit Buffer Selection Mode.

pH Calibration

1. Calibration with ATC/Temp Sensor in the pH Mode
 - 1.1 Connect the pH sensor to the BNC connector and the ATC/Temp sensor to the ATC/Temp connector of the unit. **Auto** icon will be on. Press the **[MODE]** key until the unit displays pH mode.
 - 1.2 Rinse the pH sensor and ATC/Temp sensor in distilled water and immerse them in the first buffer solution. The temperature displayed is the buffer temperature.

NOTE: If no ATC/Temp sensor is connected, **Man** icon will be on, adjust the temperature reading (0.0 to 60.0°C) to that of the first buffer, using the [\triangle] and [∇] keys.

Single Point Calibration

- 1.3 Press the **[CAL]** key to initiate calibration. The selected buffer icon will flash. Press the **[ENTER]** key. The buffer icon will remain on, and the **calibration icons** will flash until the unit detects a stable reading. When a stable reading is reached, the **calibration icons** will stop flashing, and sensor efficiency will be displayed momentarily. The pH value of the first buffer will then be displayed. The first point has been calibrated.

NOTE:

- a. If the first buffer is pH 4.00/10.00 or (4.01/9.18) the unit will automatically exit the calibration mode after the first point has been calibrated. **Single point** calibration is complete. The unit cannot be further calibrated.
- b. If the first buffer is pH 7.00 (6.86), press the **[MODE]** key to save a single point 7 buffer calibration.

Multi-Point Calibration

- 1.4 Press the **Cal** key to initiate calibration. Immerse pH sensor and ATC/Temp sensor in a pH7.00(6.86) buffer solution. The selected buffer icon will flash. Press the **enter** key. The buffer icon will be remain on, and the **calibration icons** will flash until the unit detects a stable reading. When a stable reading is reached, the **calibration icons** will stop flashing and momentarily display the sensor efficiency. The first point has been calibrated and the unit is ready to be sloped at for the second buffer.

Note: For multi-point calibrations, the pH 7.00 (6.86) buffer solution must be used first.

- 1.5 Remove the pH sensor and ATC/Temp sensor from the first buffer. Rinse them in distilled water and immerse them in the second buffer solution. The unit will display the temperature of the second buffer.
- 1.6 The remaining two buffer icons will flash, indicating that calibration should be continued. Press the **enter** key, the second buffer icon will remain on. The **calibration icons** will flash until the unit detects a stable reading. When a stable reading is reached, the **calibration icons** will stop flashing and display the sensor efficiency. The second point has been calibrated and the unit is ready for the third buffer.

[**NOTE:** For two-point calibration, press the **mode** key to save both calibration points and to exit the calibration mode. The **two point** calibration is complete.]

- 1.7 Remove the pH sensor and ATC/Temp sensor from the second buffer. Rinse them in distilled water and immerse them in the third buffer solution. The unit will display the temperature of the third buffer.
- 1.8 The last buffer icon will flash. Press the **enter** key. The third buffer icon will be on, and the **calibration icons** will flash until the unit detects a stable reading. When a stable reading is reached, the **calibration icons** will stop flashing and display sensor efficiency. The third point has been calibrated. The unit will automatically exit the calibration mode. **Three point** calibration is complete.

pH Measurements

When buffer icons are on the measurement screen, this means that the instrument has a single or multi-point calibration and is ready for measurements.

1. Measurement with ATC/Temp sensor in the pH mode:
 - 1.1 Connect the pH sensor and the ATC/Temp sensor to the connectors of the instrument. The **Auto** icon will be on.
 - 1.2 Press the **[MODE]** key for the LCD to indicate **pH**.
 - 1.3 Rinse the sensor in distilled water. Then rinse with a little of the sample (if enough is available) and immerse in the sample.
 - 1.4 Allow sufficient time for the display to stabilize. The instrument will display the pH value of the sample at the and sample temperature.
 - 1.5 If "----" is displayed, the pH value measured is out of the -2.00 to 16.00 pH range. The instrument will display the correct value once the input pH is brought within range.
2. Measurement with manual temperature compensation in the pH mode:
 - 2.1 Connect the pH sensor to the connector of the instrument.
 - 2.2 Press the **[MODE]** key until the LCD display the pH icon.
 - 2.3 Rinse the sensor in distilled water. Then rinse with a little of the sample (if enough is available) and immerse in the sample.
 - 2.4 Set the instrument to the temperature of the sample by pressing the UP [\triangle] and DOWN [∇] keys.
 - 2.5 Allow sufficient time for the display to stabilize. The instrument will display the pH value of the sample at the set sample temperature.
 - 2.6 If "----" is displayed, the mV value measured is out of the -2.00 to 16.00 pH range. The instrument will display the correct value once the input pH is brought within range.

Temperature Measurements

The CR meter can be used to measure temperature independently with the ATC/Temp sensor, without using the pH sensor.

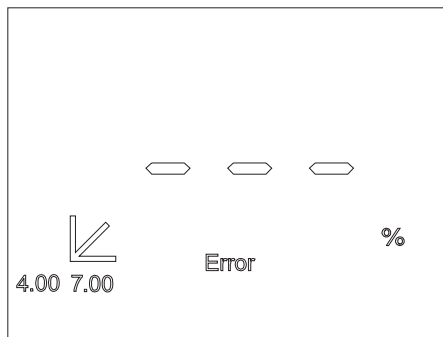
1. Place the ATC/Temp sensor in the media to be measured. The measured temperature is displayed.
2. If "----" is displayed, the temperature is out of the temperature range -10 to 120°C . Once the temperature is within range, then "----" will disappear and the correct temperature reading will be displayed.

mV Measurements

1. Measurement in the mV mode:
 - 1.1 Connect an ORP sensor to the BNC connector of instrument.
 - 1.2 Press the [MODE] key until the LCD displays the mV icon.
 - 1.3 Rinse the sensor in distilled water. Then rinse with a little of the sample (if enough is available) and immerse in the sample.
 - 1.4 Allow sufficient time for the display to stabilize. The instrument will display the mV value of the sample.
 - 1.5 If "----" is displayed, the mV value measured is out of the " $-1999/+1999$ mV" range. The instrument will display the correct value once the input mV is brought within range.

Measurement Error Indications

Indications



Reasons

- Buffer temperature is out of the 0 to 60°C range;
- The pH sensor slope is off by more than $\pm 30\%$ of the ideal slope; the buffer is incorrect.

Solutions:

- Check expiration of buffers.
- Refill fillable sensor (see sensor instruction).
- Clean sensor (see sensor instructions).
- Make sure correct buffer set is selected in the CR meter.

In pH measurement,
the CR meter displays "----"

The pH value is out of the
-2.00 pH to 16.00 pH range

In mV measurement,
the CR meter displays "----"

The mV value is out of the
-1999 mV to 1999 mV range

In Temperature measurement,
the CR meter displays "----"

The temperature is out of the
-10.0°C to 120.0°C range

If "----" is displayed, the mV value measured is out of the "-1999/+1999 mV" range. The instrument will display the correct value once the input mV is brought within range.

pH Buffers

The temperature coefficient of pH calibration buffers 4.00, 7.00, 10.00 and 4.01, 6.86, 10.00 are stored inside the instrument.

The buffers used to calibrate the instrument must exhibit the same temperature characteristics as the stored values.

Temperature coefficient of the pH buffers

°C	4.00	6.86	9.18	4.01	7.00	10.00
0	4.01	6.98	9.46	4.01	7.11	10.32
5	4.00	6.95	9.39	4.01	7.08	10.25
10	4.00	6.92	9.33	4.00	7.06	10.18
15	4.00	6.90	9.28	4.00	7.03	10.12
20	4.00	6.88	9.23	4.00	7.01	10.06
25	4.00	6.86	9.18	4.01	7.00	10.01
30	4.01	6.85	9.14	4.01	6.98	9.97
35	4.02	6.84	9.10	4.02	6.98	9.93
40	4.03	6.84	9.07	4.03	6.97	9.89
45	4.04	6.83	9.04	4.04	6.97	9.86
50	4.06	6.83	9.02	4.06	6.97	9.83
55	4.07	6.83	8.99	4.08	6.97	9.80
60	4.09	6.84	8.97	4.10	6.98	9.78

Note: The actual reading of the instrument can differ by ± 0.02 pH from the values shown.

Instructions for Recycling

Information and Instructions on Disposal and Repairs

Packaging that is no longer required must be disposed of at the local waste disposal facility. The packaging is made of environmentally friendly materials that can be used as secondary raw materials.



The equipment, including accessories and batteries, does not belong in your regular household waste.

The EU legislation requires its Member States to collect electrical and electronic equipment and disposed of it separately from other unsorted municipal waste with the aim of recycling it.

In Germany and many other countries, Denver Instrument takes care of the return and legally compliant disposal of its electrical and electronic equipment on its own. These products may not be placed with the household waste or brought to collection centers run by local public disposal operations – not even by small commercial operators.

For disposal in Germany and in the other Member States of the European Economic Area (EEA), please contact our service technicians on location or our Service Center:

Denver Instrument GmbH
Robert-Bosch-Breite 10
37079 Goettingen, Germany
Tel: +49-551-20977-30
Fax: +49-551-20977-39

In countries that are not members of the European Economic Area (EEA) or where no Denver Instrument affiliates, subsidiaries, dealers or distributors are located, please contact your local authorities or a commercial disposal operator.

Prior to disposal and/or scrapping of the equipment, any batteries should be removed and disposed of in local collection boxes.

Denver Instrument, its affiliates, subsidiaries, dealers and distributors will not take back equipment contaminated with hazardous materials (ABC contamination) – either for repair or disposal. Please refer to the accompanying leaflet/manual or visit our Internet website for comprehensive information that includes our service addresses to contact if you plan to send your equipment in for repairs or proper disposal.

Specifications

Display	Range	Accuracy	Resolution
mV	-1999 to 1999 mV	± 0.2<1000 mV ± 1 mV>1000 mV	1 mV
pH	-2.00 to 16.00 pH	± 0.01 pH	0.01 pH
Automatic Temperature°C	-10.0 to 120.0°C	± 0.5°C	0.1°C
Manual Temperature°C	-5.0 to 90.0°C	± 0.5°C	0.1°C
pH Temp Compensation	AUTO/MAN -5.0 to 90.0°C		
pH measuring range	(4.00, 7.00 & 10.00) or (4.01, 6.86, 9.18)		
pH buffer temp. range	0 to 60°C		
pH calibration	3-point		
pH sensor offset recognition	± 90 mV at pH 7.00 or 6.86		
pH electrode slope recognition	70 – 130% of the theoretical slope pH 4.01, 9.18 or 10.01		
Input impedance	>10 ¹² Ω		
Power supply: batteries	4 AAx 1.5 V batteries		
Calibration backup	FLASH		
Audio feedback	All touch keys		
Ambient temp. range	0 to 50°C		
Relative humidity	Up to 95%		
ATC sensor	Thermistor (10 kΩ AT 25°C)		
Dimensions (L × W × B)	(9" × 3" × 1") 228 × 76 × 25 mm		
Net weight	1 lb (0.5 kg)		

CE Marking

The CR meter complies with the following EC Directives and European Standards:

Directive 2004/108/EC:
“**Electromagnetic compatibility (EMC)**”

EN 61326-1 Electrical equipment for measurement, control and laboratory use

EMC Requirements

Part 1: General requirements
Defined immunity to interference:
Industrial areas, continuous, unmonitored operation
Limitation of emissions:
Residential areas, Class B

Important Note:

The operator shall be responsible for any modifications to Denver Instrument equipment or connections of cables not supplied by Denver Instrument and must check and, if necessary, correct these modifications. On request, Denver Instrument will provide information on the minimum operating specifications (in accordance with the Standards listed above for defined immunity to interference).

Directive 2006/95/EC:
“**Electrical equipment designed for use within certain voltage limits**”

Applicable European Standards:

EN 61010 Safety requirements for electrical measurement, control, and laboratory equipment
Part 1: General requirements

If you use electrical equipment in installations and under ambient conditions subject to stricter safety standards than those described in the manual, you must comply with the provisions as specified in the applicable regulations for installation in your country.

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Denver Instrument GmbH,
Goettingen, Germany.

The status of the information, specifications and illustrations in this manual is indicated by the date given below. Denver Instrument GmbH reserves the right to make changes to the technology, features, specifications, and design of the equipment without notice.

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