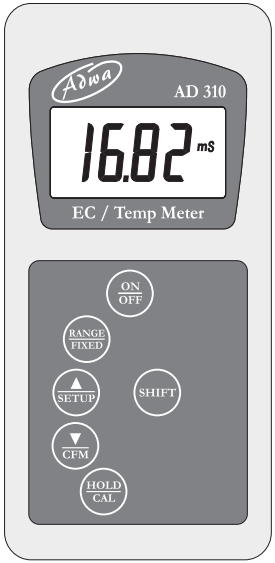
USER MANUAL

AD 310 • AD410
EC • TDS and Temperature



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 2004/108/EC and its standards, and Low Voltage Directive 2006/95/EC and its standards 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 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 three years, while probes are warranted for six 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.

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INTRODUCTION

AD310 and **AD410** are portable microprocessor-based instruments for measuring EC or TDS, and temperature.

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

Measurements are compensated for temperature effect automatically (ATC) or manually (MTC).

The temperature compensation feature can also be disabled to measure actual conductivity or TDS.

The temperature coefficient is user selectable.

The instruments also feature a measurement stability indicator.

Each model is supplied complete with:

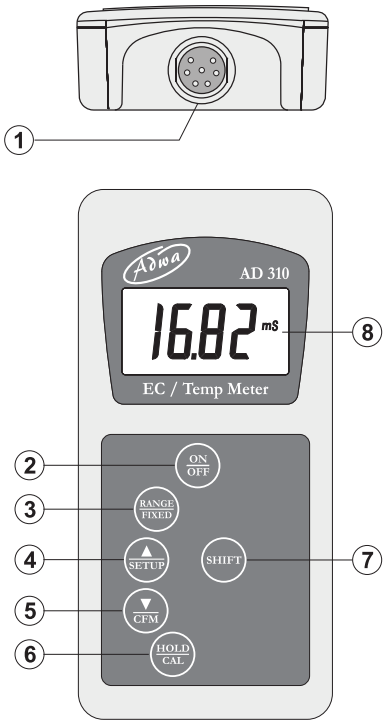
- **AD76309** conductivity probe with built-in temperature sensor and 1 m cable
- Calibration solution (20 ml sachet each):
  - 1413 µS/cm for **AD310**
  - 1382 ppm for **AD410**
- Batteries (4 x 1.5V AA alkaline)
- Instruction manual

TECHNICAL DATA

EC Range	19.99 ; 199.9 ; 1999 µS/cm
(AD310)	19.99 ; 199.9 mS/cm
TDS Range	9.99 ; 99.9 ; 999 ppm
(AD410)	9.99 ; 99.9 ppt
Temperature Range	**(both models)** -9.9 to 120.0 °C
Resolution	0.01 ; 0.1 ; 1 µS/cm 0.01 ; 0.1 mS/cm 0.01 ; 0.1 ; 1 ppm / 0.01 ; 0.1 ppt 0.1 °C
Accuracy	±1% f.s. (EC and TDS)
(@25 °C/77 °F)	±0.5 °C
EC Calibration	Offset: 0.0 µS/cm;
(AD310)	Slope: 1 point with 6 memorized standards (84.0, 1413 µS/cm; 5.00, 12.88, 80.0, 111.8 mS/cm) or one custom value
TDS Calibration	Offset: 0.0 ppm;
(AD410)	Slope: 1 point with 4 memorized standards (800, 1382 ppm; 6.44, 40.0 ppt) or one custom value

Temperature Compensation	Automatic or manual, -9.9 to 120°C
Temperature Coefficient	Selectable from 0.00 to 6.00%/°C
Reference Temperature	Selectable at 20.0 or 25.0 °C
Probe (included)	**AD76309**
Battery Type	4 x 1.5 V AA alkaline
Battery Life	Approx. 200 h of continuous use
Auto-Off	User selectable: 5 min or disabled
Environment	0 to 50 °C; RH max 95%
Dimensions	70 x 145 x 26 mm
Weight	Approx. 200 g

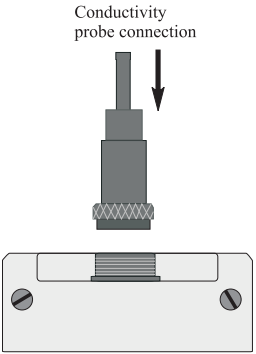
FRONT AND TOP PANELS



1. DIN connector for conductivity probe
2. **ON/OFF** key, to turn the instrument ON and OFF
3. **RANGE/FIXED** key, to select measurement unit, and to freeze current range on the LCD
4. **Up arrow/SETUP** key, to manually increase the value of temperature or other parameters, and to enter/exit setup mode
5. **Down arrow/CFM** key, to manually decrease the value of temperature or other parameters, and to confirm values
6. **HOLD/CAL** key, to freeze the reading on the LCD, and to enter/exit calibration mode
7. **SHIFT** key, to activate the key alternate function (press and hold first the SHIFT key and then the second desired key)
8. Liquid Crystal Display (LCD)

OPERATIONAL GUIDE

- Each meter is supplied complete with four 1.5 V AA alkaline batteries. Remove the battery cover, unwrap the batteries and install them while paying attention to their polarity (also see " Battery Replacement" section).
- Connect the supplied probe to the DIN connector and tighten the threaded ring. Make sure the probe sleeve is properly inserted.



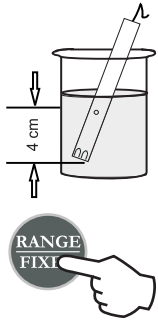
INSTRUMENT START-UP

- Turn the instrument on by pressing the ON/OFF button.

- At start-up the display will show all used segments for a few seconds (or while the button is held), followed by the reference temperature value with “rEF” indication, then enters the measurement mode.

- To save battery life, the auto-off feature automatically turns the meter off after 5 minutes with no button pressed. This feature can be disabled by entering the setup mode and selecting the “AoF” item (see “Setup” section for details).

TAKING MEASUREMENTS



- Immerse the probe into the solution to be tested. The sleeve holes must be completely submerged.
- Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.
- If needed, press RANGE until the desired EC (**AD310**), TDS (**AD410**) or temperature range is displayed.

- Allow for the reading to stabilize. The LCD will show the EC (**AD310**), TDS (**AD410**) or temperature reading in the selected range.

Notes:

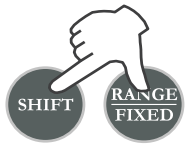
- If the meter displays only dashes "----", the reading is out of range.
- If the stability indicator (hourglass symbol) blinks, the reading is not stable.

- Make sure the meter is calibrated before taking measurements.
- If measurements are taken successively in different samples, for accurate reading it is recommended to rinse the probe thoroughly with deionized water before immersing it into the sample.

AUTORANGING

The EC (**AD310**) and TDS (**AD410**) scales are autoranging. The meter automatically sets the scale with the highest possible resolution.

By pressing SHIFT and FIXED keys, the autoranging feature is disabled. The current range is frozen on the LCD and the tag corresponding to the selected measurement range starts blinking.



To restore the autoranging feature press the SHIFT and FIXED keys again.

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

TEMPERATURE COMPENSATION

Three options are available for temperature compensation:

1. **Automatic** (ATC): the supplied probe features a built-in temperature sensor, which provides the temperature reading to automatically compensate the EC (**AD310**) or TDS (**AD410**) measurement (from -9.9 to 120.0 °C), also using the selected reference temperature.
2. **Manual** (MTC): the temperature value can be manually set using the arrow keys. The compensation is referenced to the selected reference temperature. While in MTC mode, the °C tag blinks on the LCD.
3. **No compensation** (NO): the temperature is not taken into account. The reading displayed on the LCD is the actual EC (**AD310**) or TDS (**AD410**) value.

Notes:

- The default compensation mode is ATC.
- Temperature compensation setting can be accessed by entering the setup mode and selecting the "tcE" item (see "Setup" section for details).

- If the temperature compensation is active, measurements are compensated using the temperature coefficient (default value 1.90 %/°C). To change the temperature coefficient, enter the setup mode and select the "tc" item (see "Setup" section for details).
- If the temperature reading is out of the -9.9 to 120.0 °C interval and the ATC option is selected, the temperature full scale value will be displayed, together with the °C tag blinking.
- The reference temperature can be set at 20.0 or 25.0 °C. When the reference temperature is changed, the temperature coefficient must be manually adjusted by the user.

  For example, if α is the coefficient with reference temperature of 25 °C, if changing the temperature to 20 °C, the new coefficient can be calculated with the following formula:

  $$\beta=\alpha/(1-\alpha/20)$$

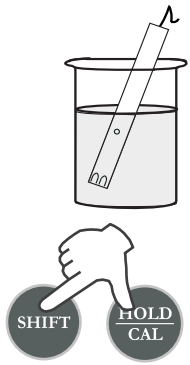
  If α=1.90%/°C, then β=2.10%/°C.

CALIBRATION

STANDARD CALIBRATION

EC (**AD310**) or TDS (**AD410**) calibration is a single point procedure. Selectable points are 0.00, 84.0 and 1413 µS/cm, 5.00, 12.88, 80.0 and 111.8 mS/cm for EC calibration (**AD310**); 800, 1382 ppm and 6.44, 40.0 ppt for TDS calibration (**AD410**).

- Rinse the probe with selected calibration solution or deionized water, then immerse it into the solution. The sleeve holes must be completely submerged.
- Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.
- To enter calibration mode, press SHIFT and then CAL from measurement mode.



- The LCD will show the “CAL” message for a few seconds, followed by the not calibrated EC (**AD310**) or TDS (**AD410**) reading together with blinking hourglass symbol.

- If necessary, use the arrow keys to select the desired standard value. The display will show the “buF” message for a few seconds, followed by the current standard buffer selection. Use the arrow keys to select the desired value.

- When the reading is stable, the hourglass symbol stops blinking. Press SHIFT and CFM key to confirm calibration.

- The instrument displays the “Str” message and returns to measurement mode.

- For zero calibration, simply leave the dry probe in the air.

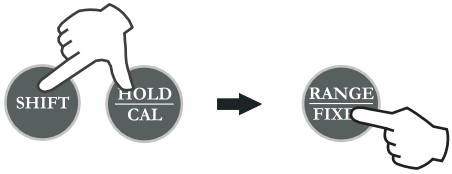
Notes:

- If temperature is out of range, the "buF" message and the °C tag blink on the LCD. If the reading is too far from the expected value, "buF" message blinks.
- For best results calibrate using a standard value close to the sample to be measured.
- During standard calibration the meter uses 1.90%/°C compensation coefficient. If the setup item "tc" has been set to different value, when exiting calibration mode, the value shown on the LCD might be different from the nominal standard value.

CUSTOM CALIBRATION

It is also possible to perform the EC (**AD310**) or TDS (**AD410**) calibration using a custom solution.

- Immerse the probe into the custom calibration solution. Press SHIFT and CAL keys to enter the calibration and then RANGE to enter custom calibration mode.



- The “CSt” message appears for a few seconds, then the LCD displays the not calibrated temperature compensated EC (or TDS) reading. Pressing SHIFT and RANGE keys, the LCD will show the temperature compensated EC (or TDS) reading, factory calibrated with cell value k=1. Since zero calibration is not allowed in custom mode, if one of the above readings is zero, the display will show “buF” message and readings alternately.
- Using the arrow keys, adjust the displayed EC (or TDS) measurement to the desired value.
- The maximum allowed adjustment is ± 40% around the temperature compensated reading, factory calibrated with cell value k=1.

- When the reading is stable, the hourglass tag stops blinking. Press SHIFT and CFM keys to confirm calibration.

- The instrument displays the “Str” message and returns to measurement mode.

Notes:

- The calibrated custom value is considered the value of the calibration solution at the selected reference temperature.
- It is possible to set the cell constant value directly, without following the calibration procedure. To set the cell constant enter the setup mode and select the “CEL” item (see “Setup” section for details).
- The temperature reading is not used during custom calibration.

TEMPERATURE ADJUSTMENT

Temperature reading can be manually fine-tuned following below instructions.

To enter the temperature adjustment, press SHIFT and CAL keys from temperature range. The LCD will display the factory default temperature.

Adjust the temperature reading on the LCD using the arrow keys. The maximum allowed adjustment is ±1.0ºC around current reading.

Press SHIFT and CFM keys to confirm. The meter returns to measurement mode and displays the new temperature.

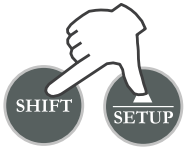
Notes:

- Press SHIFT and CAL keys to escape without any changes.
- To enter temperature adjustment mode, the probe must be connected and the ATC mode must be set.

SETUP

Setup mode allows to view and modify the instrument parameters.

To enter setup mode, press SHIFT and then SETUP key from measurement mode. The “SEt” message is displayed for a few seconds, followed by the code of the setup item.



Select the desired setup item using the arrow keys, then press SHIFT and then CFM to select and edit the setup item value. Use the arrow keys to change the current value. Press SHIFT and then CFM to confirm.

Note: Press SHIFT and then SETUP key before confirmation to escape without changing the previously set value.

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

Item	Description	Valid values	Default
tc	Temperature coefficient	0.00 to 6.00% / ℃	1.90
tcE	Temp. compensation mode	Atc, Mtc, no	Atc
rEF	Reference temperature	20.0 or 25.0 ℃	25.0 ℃
CEL	Cell constant (K)	0.500 to 1.700	1.000
AoF	Auto-off enable	On, Off	Off
vEr	Firmware release		

HOLD FUNCTION

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

The “H” tag lights up.

RANGE key is active while in “Hold” mode.

Press the HOLD key again to return to normal measurements.

BATTERY REPLACEMENT

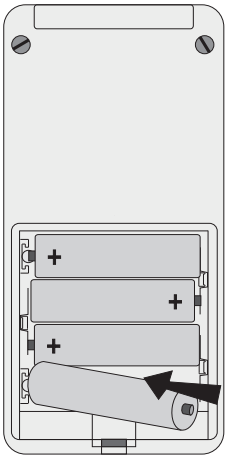
When batteries become weak, the battery symbol lights up.

It is recommended to replace the batteries soon.

When the battery level is too low to ensure reliable readings, the meter automatically turns off.

Battery replacement must only take place in a safe area and using the battery type specified in this instruction manual.

To replace rundown batteries, remove the battery compartment cover on the rear of the meter and substitute all four 1.5 V AA alkaline batteries with new ones, while paying attention to the correct polarity.



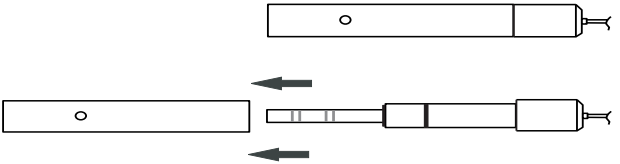
Reattach the battery compartment cover.

PROBE MAINTENANCE

After measurements, rinse the probe with clean water.

If a more thorough cleaning is required, remove the probe sleeve and clean the probe with a cloth or a non-abrasive detergent.

Make sure to reinsert the sleeve onto the probe properly and in the right direction.



After cleaning the probe, recalibrate the instrument.

PROBES AND SOLUTIONS

AD76309	Conductivity probe with built-in temperature sensor, DIN connector, 1 m cable
AD70031P	1413 µS/cm EC standard solution, 20 ml sachet, 25 pcs.
AD70030P	12.88 mS/cm EC standard solution, 20 ml sachet, 25 pcs.
AD70032P	1382 ppm TDS standard solution, 20 ml sachet, 25 pcs.
AD7030	12.88 mS/cm EC standard solution, 230 ml
AD7031	1413 µS/cm EC standard solution, 230 ml
AD7032	1382 ppm TDS standard solution, 230 ml
AD7033	84 µS/cm EC standard solution, 230 ml
AD7039	5000 µS/cm EC standard solution, 230 ml
AD7034	80.00 mS/cm EC standard solution, 230 ml
AD7035	111.80 mS/cm EC standard solution, 230 ml

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