



USER MANUAL

AD331 • AD332 Waterproof Portable Meters for EC and TDS Measurements

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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 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.

PROBES AND SOLUTIONS

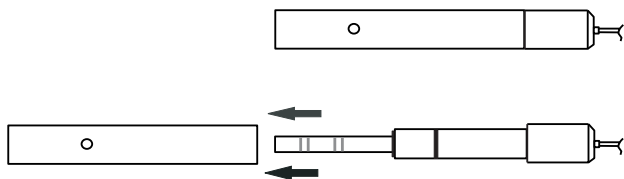
AD76309	Conductivity probe with built-in temperature sensor, DIN connector and 1 m cable
AD70030P	12.88 mS/cm EC solution, 20 ml sachet, 25 pcs
AD7030	12.88 mS/cm EC standard solution, 230 ml bottle
AD70031P	1413 μ S/cm EC standard solution, 20 ml sachet, 25 pcs
AD7031	1413 μ S/cm EC standard solution, 230 ml bottle
AD7033	84 μ S/cm solution, 230 ml bottle
AD7034	80.00 mS/cm EC standard solution, 230 ml bottle
AD7035	111.80 mS/cm EC standard solution, 230 ml bottle
AD7039	5000 μ S/cm EC standard solution, 230 ml bottle
AD70442	1500 ppm TDS standard solution, 230 ml bottle
AD9551	Serial communication cable

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.

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INTRODUCTION

AD331 and **AD332** are waterproof portable meters.

AD331 reads EC in 5 ranges and **AD332** can measure EC and TDS. Both models also read temperature.

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

Measurements are compensated for temperature effect automatically (ATC) or manually (MTC). It is also possible to disable the temperature compensation feature to measure the actual conductivity.

The temperature coefficient is user selectable.

These instruments also feature a measurement stability indicator, GLP capability, and a user selectable ID code to uniquely identify the instrument.

Moreover, **AD332** includes PC interface and printing function. Connect the meter to an external serial printer with the following printer specifications:

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

BATTERY REPLACEMENT

When batteries become too weak, the “bAtt” message appears. It is recommended to replace the batteries soon.

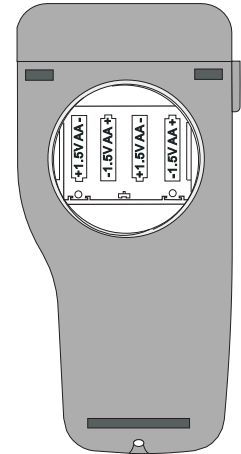
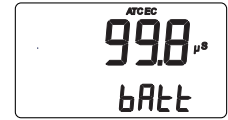
When the battery level is too low to ensure reliable readings, the meter automatically turns off.

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 cover and substitute all four 1.5 V AA alkaline batteries with new ones, while paying attention to the correct polarity.

Reattach and tighten the battery cover making sure that the gasket is in place.

Note: When batteries are removed, the meter can remember date & time for about 5 minutes. After that, it will be necessary to set again date & time through the setup procedure.



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

When a reading is logged on-demand, an automatic printout will provide the following information for EC or TDS:

LOG	
Record No	001
Date	2000/01/01
Time	00:19
EC	83.2 mS
°C	25.0

PC INTERFACE (AD332 only)

Data transmission from the instrument to the PC can be done with the **ADSW10** Windows® compatible software (optional). **ADSW10** offers graphing and on-line help feature, and data can be exported to the most popular spreadsheet programs for further analysis.

To connect the instrument to a PC, use the **AD9551** serial communication cable (optional). Make sure that the instrument is switched off and plug the cable to the instrument RS232 socket and to the PC serial port.

Specifications:

Isolated 8-bit data transmission

Baud rate: 2400

Start bit: 1

Stop bit: 1

Parity bit: none

All models are supplied complete with:

- **AD76309** conductivity probe with built-in temperature sensor and 1 m cable
- Calibration solution (20 ml sachet each):
 - 1413 $\mu\text{S/cm}$ EC standard solution
 - 12,88 mS/cm EC standard solution
- 1.5 V AA alkaline batteries (4 pcs)
- User manual

TECHNICAL DATA

EC Range	19.99 ; 199.9 ; 1999 μ S/cm 19.99 ; 199.9 mS/cm
TDS Range (AD332)	9.99 ; 99.9 ; 999 ppm 9.99 ; 99.9 ppt
Temperature Range	-9.9 to 120.0 $^{\circ}$ C
Resolution	0.01 ; 0.1 ; 1 μ S/cm 0.01 ; 0.1 mS/cm 0.01 ; 0.1 ; 1 ppm / 0.01 ; 0.1 ppt 0.1 $^{\circ}$ C
Accuracy (@20$^{\circ}$C/68$^{\circ}$F)	\pm 1% f.s. (EC and TDS) \pm 0.5 $^{\circ}$ C
EC Calibration	Offset: 0.0 μ S/cm; Slope: 1 point with 6 memorized standards (84.0, 1413 μ S/cm; 5.00, 12.88, 80.0, 111.8 mS/cm) or one custom value
Temperature Compensation	Automatic or manual, -9.9 to 120 $^{\circ}$ C
Temperature Coefficient	Selectable from 0.00 to 10.00% / $^{\circ}$ C

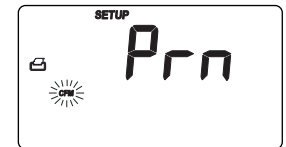
When in GLP mode, the printout provides the following information:

GLP	
Instr ID	0005
Date	2000/01/01
Time	00:34
Cell	0.961
Cal Buffer	
EC	8.00 mS

When in SETUP mode, the following information are printed:

SETUP REPORT	
Instr ID	0005
Date	2000/01/01
Time	00:34
TC	01.90 %
TCE	Atc
Temp REF	25.0
TDS Factor	0.50
Cell	1.000
AutoOff	OFF
Printer	On
Version	1.0

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.



PRINTING (AD332 only)

When connected to an external serial printer, a complete set of information can be printed. Use the **AD9551** serial communication cable (optional).

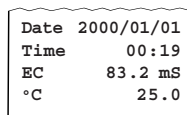
Printer specifications:

- 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 SHIFT+PRINT keys, or automatically for log-on-demand mode.

Note: To cancel printing, press SHIFT+PRINT again.

While in EC measurement mode, the printout provides the following information.



A rectangular box with a decorative border containing the following text:
Date 2000/01/01
Time 00:19
EC 83.2 mS
°C 25.0

Note: For TDS measurement mode, the TDS reading will be printed.

TDS Factor (AD332 only)	Selectable from 0.40 to 1.00 (default value: 0.50)
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Reference Temperature

Selectable from 15.0 to 30.0 °C

Log-on-demand	Up to 250 samples
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Probe (included)	AD76309
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PC Interface & Printer (AD332 only)

RS232 port; external serial printer

Battery Type	4 x 1.5 V AA alkaline batteries
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Battery Life	Approx. 200 h of continuous use
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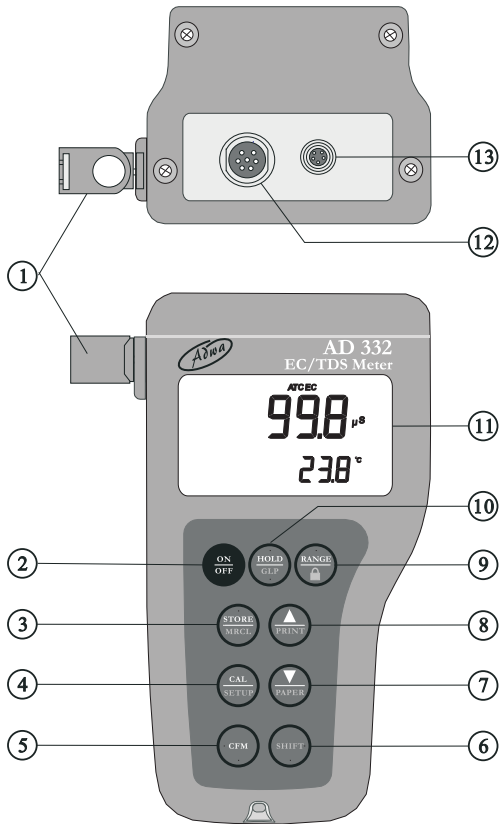
Auto-Off	User selectable: 5 min or disabled
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Environment	0 to 50°C; RH max 95%
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Dimensions	188 x 96 x 70 mm
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Weight	460 g
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FRONT AND TOP PANELS



- Press CFM to confirm deletion or SHIFT+HOLD again to escape without deleting data.

Note: If no samples are stored in memory and a deletion is attempted, the meter shows the "Zero" message and then returns to measurement mode.

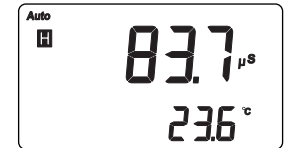
HOLD FUNCTION

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



The "Auto" and "H" tags will blink on the LCD until the reading is stabilized.

When the reading becomes stable, the "Auto" and "H" tags stop blinking and the reading is frozen.



Press the HOLD key again to return to normal measurement mode.

DELETING STORED DATA

The meter allows to delete a single sample or all the memory at one time.

To delete a single sample proceed as follows:

- Enter the viewing stored data mode and select the desired sample number.
- Press the HOLD key. "dEL" and "CFM" will start blinking.
- Press CFM to confirm deletion or HOLD again to escape without deleting data. When scrolling through stored data, if a deleted sample is selected, the meter will display the "nuLL" message.



To delete all data in memory:

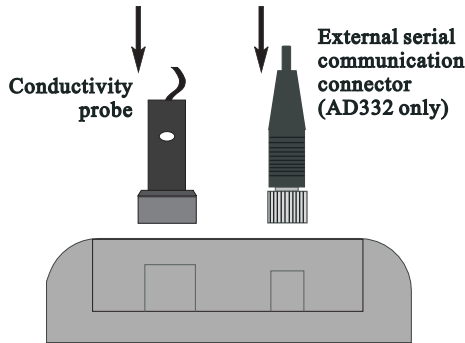
- Enter the viewing stored data mode.
- Press SHIFT+HOLD keys. "dEL" and "CFM" will start blinking and the "ALL" message is displayed on the secondary LCD.



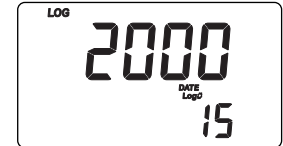
1. Probe holder
2. **ON/OFF** key, to turn the instrument ON and OFF
3. **STORE/MRCL** key, to store the measured data and to recall stored data
4. **CAL/SETUP** key, to enter/exit calibration and setup mode
5. **CFM** key, to confirm values
6. **SHIFT** key, to activate the key alternate function
Press and hold first the SHIFT key and then the second desired key
7. **Down arrow/PAPER** key, to manually decrease the value of temperature or other parameters and to pull out the printer paper
8. **Up arrow/PRINT** key, to manually increase the value of temperature or other parameters and to obtain a printout or cancel printing
9. **RANGE (AD332)** or **NEXT (AD331)/"lock"** key, to select measurement unit or switch the focused data, and to freeze current range on the LCD
10. **HOLD/GLP** key, to freeze the first stable reading on the LCD and to display Good Laboratory Practice information
11. Liquid Crystal Display (LCD)
12. DIN connector for conductivity probe
13. RS232 port for serial printer or PC connection

OPERATIONAL GUIDE

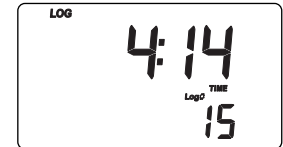
- The meter is supplied complete with four 1.5 V AA alkaline batteries. Remove the battery cover, unwrap the batteries and install them while paying attention to their polarity (see “Battery Replacement” section for details).
- Connect the supplied probe to the DIN connector and tighten the threaded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



- Year



- Time



- EC or TDS reading (only dashes "----" means reading out of range or probe not connected)



- Temperature reading (only dashes "----" means reading out of range)



- To skip to next or previous sample, use the up or down arrow key respectively. For example, if the up arrow key is pressed while a sample reading is displayed, the meter shows the reading of next sample.
- To return to measurement mode, press SHIFT+MRCL at any time.

VIEWING STORED DATA

To retrieve memorized information, press SHIFT and then MRCL keys.



The primary LCD displays the date (day & month) and the secondary LCD shows the number of last stored sample.



If no samples are stored into memory, the "ZERO" message is displayed.

- Select the desired sample number using the arrow keys. If the up arrow key is pressed while the last sample is displayed, the meter returns to the first sample.
- Press RANGE (or NEXT) to view the remaining data for the selected sample as shown in the next page.

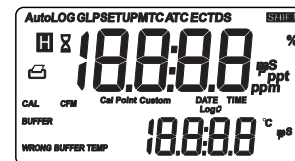


INSTRUMENT START-UP

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



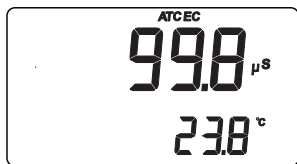
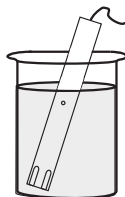
- At start-up the display will show all used segments for a few seconds (or while the button is held), followed by the reference temperature value with "rEF" indication, then enters the measurement mode.



- 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 through the "AoFF" setup 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 (AD332) until the EC or TDS range is selected on the LCD.
- Allow for the reading to stabilize. The primary LCD displays the measurement in the selected range, while the secondary LCD shows the temperature reading.



LOG-ON-DEMAND

To store current reading into memory, press STORE key from measurement mode.



The LCD will display for a few seconds the "Stor" message together with the "Log" tag and the sample number.



By pressing the STORE key a complete set of information is memorized: date, time, EC or TDS and temperature readings.

Up to 250 samples can be stored into memory.

When the memory is full and the STORE key is pressed, the sample will not be stored and the LCD will display the "FULL" message.



In this case, it is necessary to delete the last sample or all logged data to proceed.

Calibration with custom solution.



If the cell constant was changed after calibration (through the “CELL” setup item), this information is not displayed. If RANGE (or NEXT) is pressed while the last parameter is displayed, the meter returns to measurement mode.

Notes:

- To exit GLP mode at any time, press SHIFT+GLP.
- If calibration has never been performed, after displaying the ID code, the meter will show the "no CAL" message blinking. Press RANGE (or NEXT) or SHIFT+GLP to return to measurement mode.
- For **AD332**, only last EC calibration data are available. No calibration data can be recalled for TDS. If SHIFT+GLP are pressed from TDS measurement mode, the meter will display the ID code only. Press SHIFT+GLP again to return to measurement mode.
- GLP data are not affected by zero calibrations.

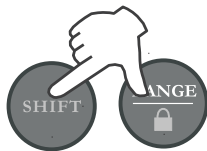
Notes:

- 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 next sample.
- For **AD332**: the TDS reading is obtained by multiplying the EC value by the TDS factor (default: 0.50). This factor can be selected by the user (0.40 to 1.00) through the "tdS" setup item (see “Setup” section for details).

AUTORANGING

The EC and TDS scales are autoranging. The meter automatically sets the scale with the highest possible resolution.

By pressing SHIFT and “lock” keys, the autoranging feature is disabled and the current range is frozen on the LCD.



The μS , mS, ppm or ppt tag (depending on the selected measurement mode and range) starts blinking.

To restore the autoranging option press the SHIFT and “lock” 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.

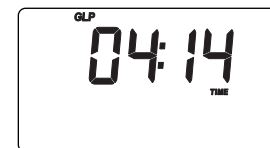
Last calibration date (day and month).



Last calibration date (year).



Last calibration time.



Cell constant (K)



Calibration with standard solution.



GOOD LABORATORY PRACTICE

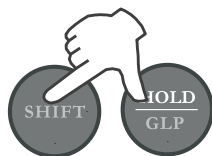
Good Laboratory Practice (GLP) is a set of functions that allows storage and retrieval of data regarding the status of the system.

After a successful calibration, the meter automatically stores the date and time of calibration, the used calibration solution and the resulting cell constant value.

All this information can be recalled by the user.

To view the last calibration data, press SHIFT and then GLP keys.

The first information appearing on the LCD is the meter "id" code.



By repeatedly pressing RANGE (or NEXT) key, all GLP data are displayed as shown in the next pages.



TEMPERATURE COMPENSATION

Three options are available for temperature compensation:

1. **Automatic (ATC):** the EC probe features a built-in temperature sensor, which allows automatic compensation of the EC or TDS measurements.
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 secondary LCD.
3. **No compensation (No TC):** the temperature is not taken into account. The reading displayed on the primary LCD is the actual EC or TDS value.

Notes:

- The default compensation mode is ATC.
- Temperature compensation setting can be accessed through the "tcE" setup item (see "Setup" section for details).
- If the temperature compensation is active, measurements are compensated using the temperature coefficient (default value 1.90 %/°C).

The temperature coefficient can be modified through the “tc” setup item (see “Setup” section for details).

- If the temperature reading is out of the -9.9 to 120.0°C range and the ATC option is selected, the temperature full scale value and the °C tag will blink on the secondary LCD.

- The reference temperature can be set from 15 to 30°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, when changing the temperature to 20°C, the new coefficient can be calculated with the following formula:

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

If $\alpha = 1.90\%/^{\circ}\text{C}$, then $\beta = 2.10\%/^{\circ}\text{C}$.

- **For AD332, always set reference temperature to 25°C when measuring TDS.**

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 10.00%/°C	1.90
tcE	Temp.compensation mode	Atc, Mtc, notc	Atc
rEF	Reference temperature	15.0 to 30.0 °C	25.0 °C
tdS	TDS factor (*)	0.40 to 1.00	0.50
CELL	Cell constant (K)	0.500 to 1.700	1.000
AoFF	Auto-off feature	On, Off	Off
	Printer Status (*)	On/Off	Off
YEAr	Year	2000 to 2098	2000
DATE	Date (DD.MM)	01.01 to 31.12	01.01
TIME	Time (hh:mm)	01:01 to 23:59	00:00
id	Meter identification code	0000 to 9999	0000
vEr	Firmware release		

(*) For AD332 only.



Use the arrow keys to change the value.
If there is another part of the item to be set (e.g. month in setting up the current date), press RANGE (or NEXT) and the part to be changed will start blinking.



Use the arrow keys to change the value and then press CFM to confirm.

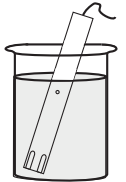
Note: To escape without changing the previously set value, press SHIFT and then SETUP before confirming.

EC CALIBRATION

EC calibration is performed for both meters. For **AD332**, since the TDS values are automatically derived from the EC readings, no specific calibration for TDS is needed.

Selectable points for EC calibration are 0.00, 84.0 and 1413 $\mu\text{S}/\text{cm}$, 5.00, 12.88, 80.0 and 111.8 mS/cm .

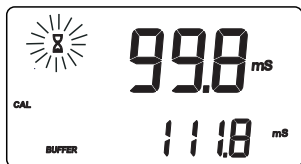
- Rinse the probe with selected standard or deionized water, then immerse it into the calibration solution. The sleeve holes must be completely submerged.
- Tap the probe repeatedly to remove any air bubbles that may be trapped inside the sleeve.
- To enter calibration mode, press the CAL key from the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



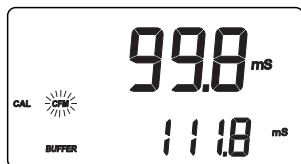
Note: For **AD332**, pressing CAL when TDS range is selected has no effect.



- For zero calibration, simply leave the dry probe in the air. The "CAL" and "BUFFER" tags light up.
- The primary LCD displays the not calibrated EC or TDS reading, while the secondary LCD shows one of the available standard values. The hourglass symbol blinks.



- If necessary, use the arrow keys to select the desired standard value.
- When the reading is stable, the CFM tag starts blinking. Press CFM to confirm calibration.

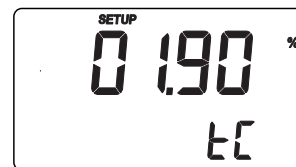
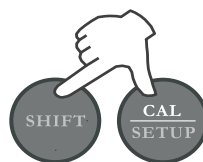


- The instrument displays the "Stor Good" message and returns to measurement mode.

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 SETUP tag lights up. The primary LCD will display the temperature coefficient (default value 1.90%/°C), while the secondary LCD shows the code of the current setup item.



Select the desired setup item using the arrow keys, then press CFM to select and edit the setup item. The current value of the selected item starts blinking (if the parameter can be modified).



TEMPERATURE ADJUSTMENT

Temperature reading can be manually fine-tuned as explained in this section.

Press SHIFT and CFM keys to enter the temperature adjustment mode. Both primary and secondary LCDs will display the current temperature reading for a few seconds, followed by the default temperature reading.



Adjust the temperature value on the primary LCD using the arrow keys. The maximum allowed adjustment is $\pm 1.0^{\circ}\text{C}$ around the current reading.



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

Notes:

- Press SHIFT and CFM keys to escape without changing.
- To enter temperature adjustment mode, the probe must be connected and the meter must be in ATC mode.

Notes:

- If the temperature is out of range, the "WRONG BUFFER TEMP" message blinks on the LCD. If the reading is too far from the expected value, "WRONG BUFFER" blinks.
- For best results, use a calibration solution with EC (or TDS) value close to the sample to be measured.
- During calibration the meter compensates using the $1.90\%/^{\circ}\text{C}$ coefficient. If the setup item "tc" has been set to a different value, when exiting calibration mode, the displayed value might be different from the nominal standard value.

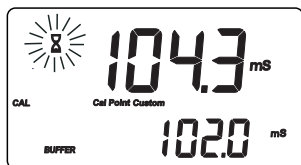
CUSTOM CALIBRATION

Calibration can be also performed with a custom calibration solution.

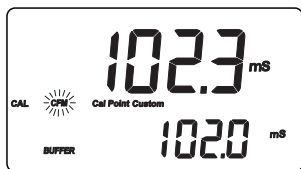
- Immerse the probe into the custom calibration solution and select the proper EC (or TDS) range. Press first CAL to enter the calibration mode and then RANGE (or NEXT) to enter the custom calibration.



- The "CAL", "BUFFER" and "Cal Point Custom" tags light up. The primary LCD displays the not calibrated temperature compensated reading, while the secondary LCD shows the temperature compensated reading, factory calibrated with cell value $k=1$. The hour-glass symbol blinks.



- Using the arrow keys, adjust the reading displayed on the primary LCD to the desired value.
- The maximum adjustment is $\pm 40\%$ around the value displayed on the secondary LCD.
- When the reading is stable, the CFM tag starts blinking. Press CFM to confirm calibration.



- The instrument displays the "Stor Good" message and returns to measurement mode.

Notes:

- Zero calibration is not allowed in custom mode.
- The calibrated custom value is considered the value of the calibration solution at the selected reference temperature.
- The cell constant value can be set directly through the "CELL" setup item, without following the calibration procedure (see "Setup" section for details).
- Temperature reading is not used during custom calibration.