

INSTRUCTION MANUAL

MW306

EC / TDS / NaCl / Temperature
Portable Meter





THANK YOU for choosing Milwaukee Instruments!

This instruction manual will provide you the necessary information for correct use of the meter.

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1. PRELIMINARY EXAMINATION

Each **MW306** portable meter is delivered in a rugged carrying case and is supplied with:

- **MA815D/1** 4-ring EC / TDS / NaCl / Temperature probe with DIN connector and 1 meter cable
- 1.5V alkaline AA battery (3 pcs.)
- Micro USB cable
- Instrument quality certificate
- Instruction manual

2. INSTRUMENT OVERVIEW

MW306 is a portable water-resistant meter with a user-friendly interface. Designed to measure four different parameters – EC, TDS, percentage of salinity in PSU (NaCl%) and temperature – the meter is suitable for multiple applications.

All measurements can be automatically (ATC) or manually temperature compensated (MTC) with a user-selectable compensation coefficient. The temperature compensation can be disabled if the actual conductivity value is required (NO TC).

The auto-ranging feature for both EC and TDS measurements automatically sets the most suitable resolution for the tested sample.

GLP data can be reviewed and retrieved from log files.

A unique device identity code protects against the risks of loss and misuse.

3. SPECIFICATIONS

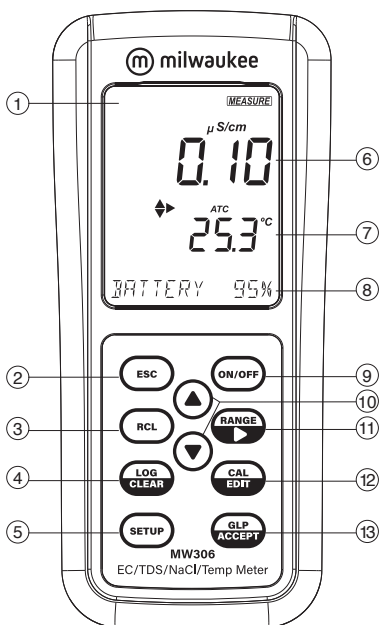
Range	EC	0.00 to 29.99 $\mu\text{S}/\text{cm}$ 3.0 to 29.9 $\mu\text{S}/\text{cm}$ 30.0 to 299.9 $\mu\text{S}/\text{cm}$ 300 to 2999 $\mu\text{S}/\text{cm}$ 3.00 to 29.99 mS/cm 30.0 to 200.0 mS/cm up to 500.0 mS/cm , absolute conductivity*
		0.00 to 14.99 ppm (mg/L) 15.0 to 149.9 ppm (mg/L) 150 to 1499 ppm (mg/L) 1.50 to 14.99 g/L 15.0 to 100.0 g/L up to 400.0 g/L absolute TDS* (with 0.80 factor)
		0.0 to 400.0 % NaCl 2.00 to 42.00 PSU 0.00 to 80.00 g/L
		Temp. -20.0 to 120.0 $^{\circ}\text{C}$; -4.0 to 248.0 $^{\circ}\text{F}$
Resolution	EC	0.01 $\mu\text{S}/\text{cm}$ 0.1 $\mu\text{S}/\text{cm}$ 1 $\mu\text{S}/\text{cm}$ 0.01 mS/cm 0.1 mS/cm
		0.01 ppm 0.1 ppm 1 ppm 0.01 g/L 0.1 g/L
		0.1% NaCl 0.01 PSU 0.01 g/L
		Temp. 0.1 $^{\circ}\text{C}$; 0.1 $^{\circ}\text{F}$
Accuracy (@ 25 $^{\circ}\text{C}$ / 77 $^{\circ}\text{F}$)	EC	$\pm 1\%$ of reading ($\pm 0.05 \mu\text{S}/\text{cm}$ or 1 digit, whichever is greater)
		$\pm 1\%$ of reading ($\pm 0.03 \text{ ppm}$ or 1 digit, whichever is greater)
		$\pm 1\%$ of reading
		Temp. $\pm 0.5 \text{ }^{\circ}\text{C}$; $\pm 0.9 \text{ }^{\circ}\text{F}$

Calibration	EC/TDS	Single cell factor calibration 6 standards: 84 µS/cm, 1413 µS/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm one-point offset: 0.00 µS/cm
	Salinity	one-point with MA9066 Salinity calibration solution
	Temp.	No temperature calibration
Temperature compensation		ATC – automatic, from -5 to 100 °C (23 to 212 °F) MTC – manual, from -20 to 120 °C (23 to 212 °F) NO TC – without temperature compensation
Conductivity temperature coefficient		0.00 to 6.00 % / °C (EC & TDS only) Default value: 1.90 % / °C
TDS factor		0.40 to 0.80 Default value: 0.50
EC probe		MA815D/1
Log		Maximum 1000 records (maximum 100 lots) On demand, 200 On stability, 200 Interval logging, 1000
PC connectivity		1 micro USB port
Battery type		3 x 1.5V alkaline AA (included)
Battery life		Approx. 200 hours of use
Auto-off		5, 10, 30, 60 min. or off
Environment		0 to 50 °C; maximum RH 95%
Dimensions		200 x 85 x 50 mm (7.9 x 3.3 x 2.0")
Casing protection level		IP67
Weight		260 g (0.57 lb)
Warranty		2 years

* Absolute conductivity (or TDS) is the conductivity value without temperature compensation.

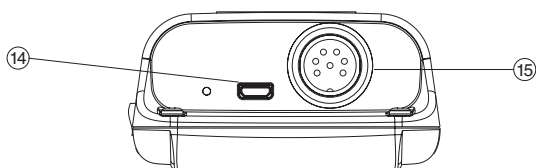
4. FUNCTIONAL & DISPLAY DESCRIPTION

Front Panel



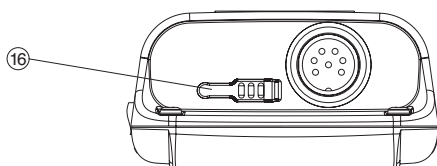
1. Liquid Crystal Display (LCD)
2. ESC key, to leave current mode
3. RCL key, to recall the logged values
4. LOG/CLEAR key, to log the reading or to clear calibration or logging
5. SETUP key, to enter setup mode
6. First LCD line
7. Second LCD line
8. Third LCD line, message area
9. ON/OFF key
10. ▲▼ keys, to change manual temperature, select setup parameters and calibration solutions
11. RANGE/► key, to select EC, TDS or Salinity
12. CAL/EDIT key, to enter/edit calibration settings, edit setup settings
13. GLP/ACCEPT key, to enter GLP or to confirm selected action

Top Panel



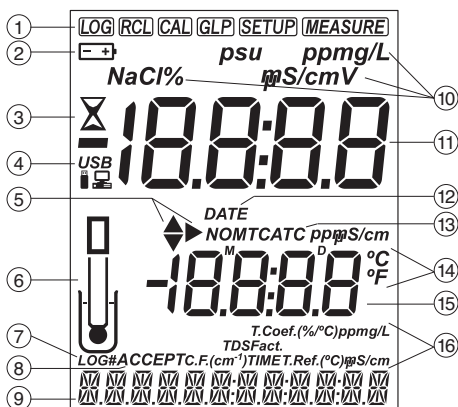
14. Micro USB port

15. Probe DIN connector



16. Micro USB port cap cover

Display Description

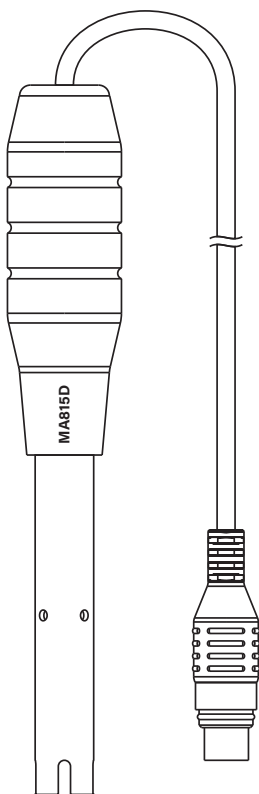


1. Mode tags
2. Battery status
3. Stability indicator
4. USB connection status
5. Arrow tags, to navigate the menu in either direction
6. Probe symbol
7. Log tag
8. Accept tag
9. Third LCD line, message area
10. Measurement units
11. First LCD line, measurement line
12. Date tag
13. Temperature compensation status (NOTC, MTC, ATC)
14. Temperature units
15. Second LCD line, temperature measurement
16. Measurement units / TDS settings

5. MA815D/1 PROBE DESCRIPTION

Main features:

- direct signal processing for noise-free measurements
- auto sensor recognition
- calibration data storage
- accurate and integrated temperature measurement



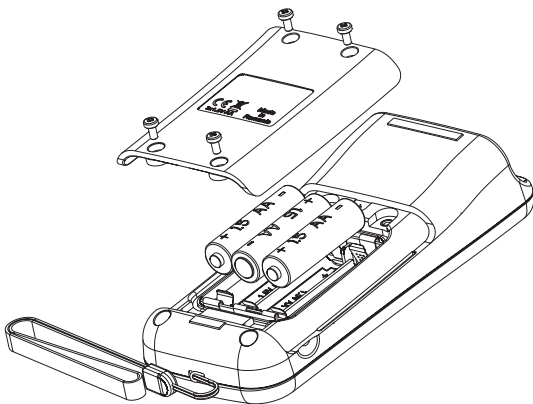
6. GENERAL OPERATIONS

6.1. BATTERY REPLACEMENT

The meter is supplied with 3 x 1.5V alkaline AA batteries.

To replace the batteries:

1. Turn the meter off.
2. Remove the 4 screws on the back of the meter to open the battery compartment.
3. Remove the old batteries.
4. Insert the three new 1.5V AA batteries while paying attention to their polarity.
5. Close the battery compartment using the 4 screws.



Note: The meter is equipped with Battery Error Prevention System (BEPS) which automatically switches the meter off if battery level is not adequate to guarantee an accurate reading.

6.2. CONNECTING THE PROBE & TURNING THE METER ON

To prepare the instrument for use, connect the supplied **MA815D/1** probe to the DIN connector. Make sure the probe sleeve is properly in place.

The meter and the probe are now ready to use.

After measurement, switch the meter off and clean the probe before storage.

6.3. OPERATION OVERVIEW

MW306 measures up to four parameters:

- Conductivity (EC)
- Total Dissolved Solids (TDS)
- Percentage of Salinity (%NaCl)
- Temperature

Range and reference values can be configured in Setup, while the data log function helps the user to keep track of all measurements. The data log can hold up to 1000 individual measurements.

7. SETUP

Meter and measurement parameters can be viewed and modified in Setup.

1. Press SETUP to enter in Setup mode.
2. Use ▲▼ keys to move through the menu in either direction and select required parameter.

Edit and Measurement modes allow parameters directly related to measurement to be viewed and modified.

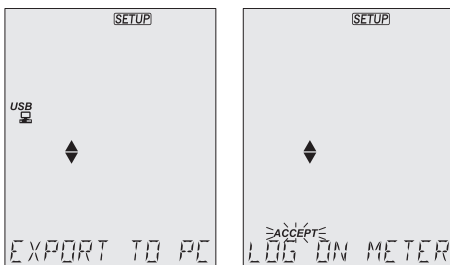
Setup menu navigation

- Press CAL/EDIT to enter Edit mode.
- Press RANGE/► to select desired option.
- Press GLP/ACCEPT to confirm.
- Press ESC (or CAL/EDIT again) to exit without saving and return to Setup menu or previous mode.

Edit and Measurement modes allow parameters directly related to measurement to be viewed and modified.

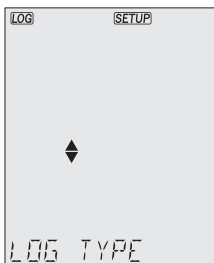
Export to PC / Log on Meter

With the micro USB cable connected, press SETUP. Press CAL/EDIT and use ▲▼ keys to select between Export to PC and Log on Meter. ACCEPT tag is displayed blinking.

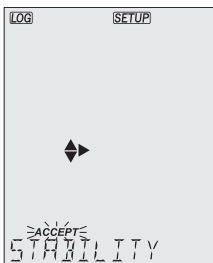
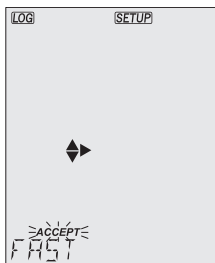
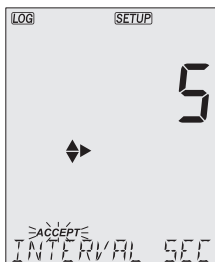


Log Type

Press SETUP, select Log Type and press CAL/EDIT to enter Edit mode. Press RANGE/► to navigate right and select between interval log, manual log and stability log.

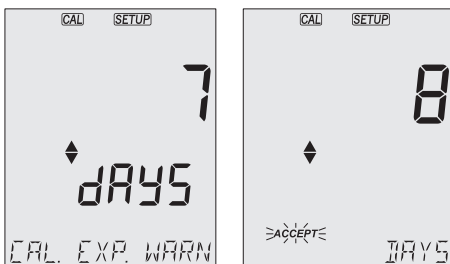


Use ▲▼ keys to set interval time (5 seconds – default, 10, 30 seconds; 1, 2, 5, 15, 30, 60, 120, 180 minutes) and stability type (fast, medium, accurate).



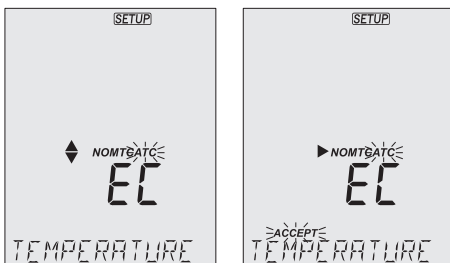
Calibration Expired Warning

Press SETUP, select Calibration Expired Warning and press CAL/EDIT to enter Edit mode. Use ▲▼ keys to select the number of days since last calibration has elapsed: 1 to 7 days (default), or off.



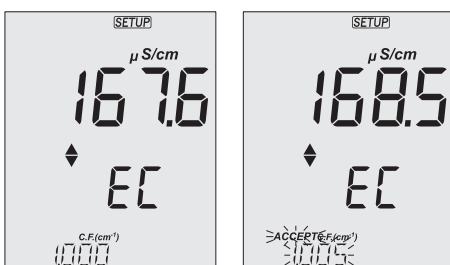
Temperature Compensation

With the probe connected, press SETUP and select Temperature Compensation (the message area displays the two words sequentially). Press CAL/EDIT to enter Edit mode. The temperature compensation status is displayed blinking. Press RANGE/► to navigate right and select between ATC, MTC and NO TC. ACCEPT tag is displayed blinking.



EC Cell Factor

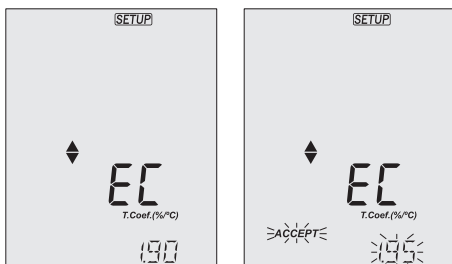
With the probe connected, press SETUP and select EC Cell Factor (C.F.). Press CAL/EDIT to enter Edit mode. Use ▲▼ keys to change the value. The set value and ACCEPT tag are displayed blinking.



Note: Setting the EC cell-factor value directly will erase any previous calibrations; and both log files and GLP will display "MANUAL" as standard.

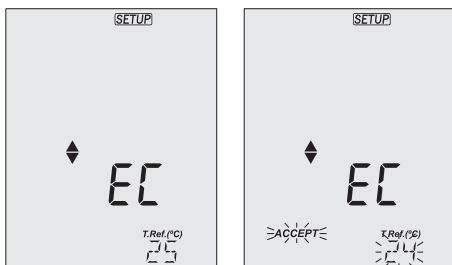
EC Temperature Coefficient

With the probe connected, press SETUP and select EC Temperature Coefficient (T.Coef.). Press CAL/EDIT to enter Edit mode and use ▲▼ keys to change the value. The set value and ACCEPT tag are displayed blinking.



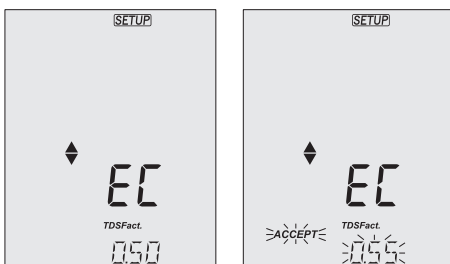
EC Temperature Reference

With the probe connected, press SETUP and select EC Temperature Reference (T.Ref.). Press CAL/EDIT to enter Edit mode. Use ▲▼ keys to change the value. The set value and ACCEPT tag are displayed blinking.



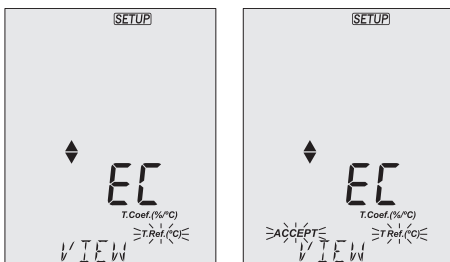
TDS Factor

With the probe connected, press SETUP and select TDS Factor. Press CAL/EDIT to enter Edit mode. Use ▲▼ keys to change the value. The factor value and ACCEPT tag are displayed blinking.



View Temperature Coefficient / Temperature Reference

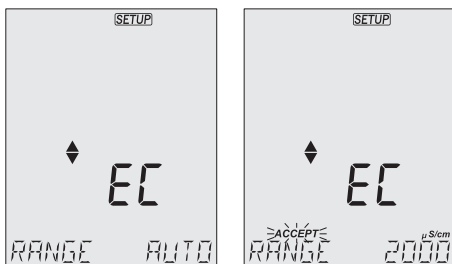
With the probe connected, press SETUP and select View Temperature Coefficient (T.Coef.) / Temperature Reference (T.Ref.). Press CAL/EDIT to enter Edit mode. The temperature coefficient/reference and ACCEPT tag are displayed blinking. Use ▲▼ keys to navigate between options.



EC Range

With the probe connected, the EC measurement can be configured as autoranging (default option) or user-selectable. When autoranging is selected, the meter automatically chooses the optimum conductivity range to maintain the highest possible accuracy.

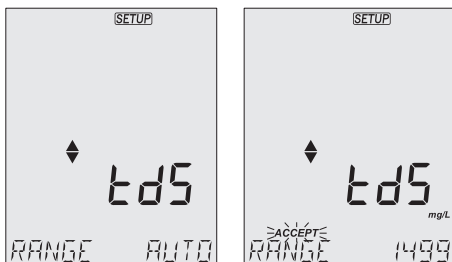
Press SETUP and select EC Range. Press CAL/EDIT to enter Edit mode. Use ▲▼ keys to change the value. ACCEPT tag is displayed blinking.



Note: The selected range is active during measurements only. Autoranging is used during calibration. If the selected fixed range is exceeded during measurement, the full-scale value of that range is displayed blinking. Logged data is displayed in $\mu\text{S/cm}$ in the .csv file.

TDS Range

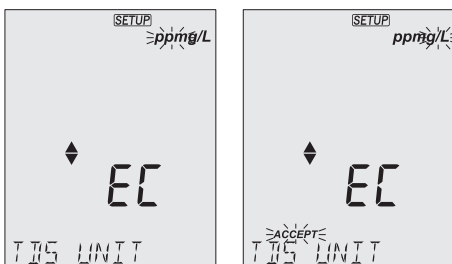
With the probe connected, the TDS measurement can be configured as autoranging (default option) or user-selectable. When autoranging is selected, the meter automatically chooses the optimum TDS range to maintain the highest possible accuracy. Press SETUP and select TDS Range. Press CAL/EDIT to enter Edit mode. Use $\blacktriangle$ $\blacktriangledown$ keys to change the value. ACCEPT tag is displayed blinking.



Note: The selected range is active during measurements only. Autoranging is used during calibration. If the selected fixed range is exceeded during measurement, the full-scale value of that range is displayed blinking. Logged data is displayed in $\mu\text{S/cm}$ in the .csv file.

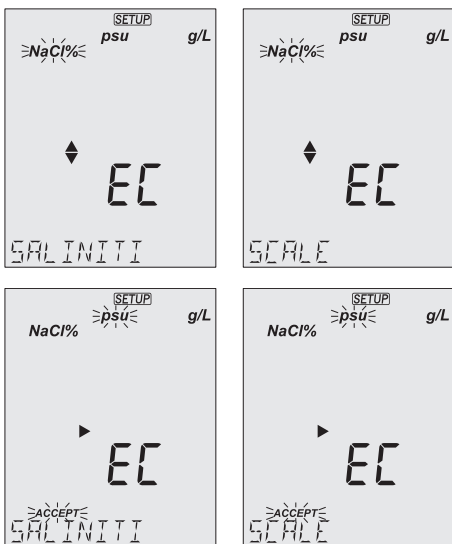
TDS Unit

With the probe connected, press SETUP, select TDS Unit and press CAL/EDIT to enter Edit mode. The current unit is displayed blinking. Press RANGE/▶ to navigate between ppm and g/L.



Salinity Scale

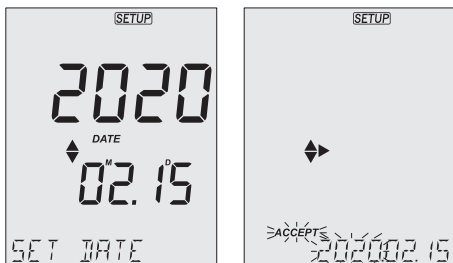
With the probe connected, press SETUP and select EC Salinity Scale. Press CAL/EDIT to enter Edit mode. The current scale is displayed blinking. Press RANGE/▶ to navigate right and select between psu, g/L and percent of NaCl. ACCEPT tag is displayed blinking.



Date

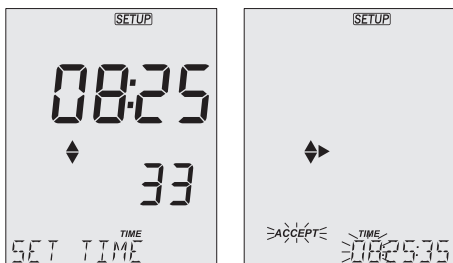
Press SETUP, select Set Date and press CAL/EDIT to enter Edit mode.

Press RANGE/▶ to navigate right and select editable value (year, month or day). Use ▲▼ keys to modify the value. ACCEPT tag is displayed blinking.



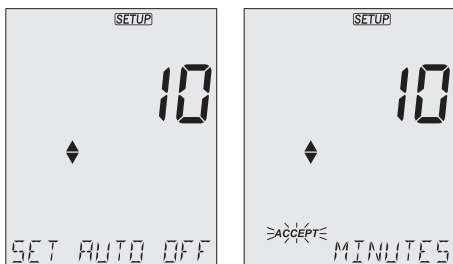
Time

Press SETUP, select Set Time and press CAL/EDIT to enter Edit mode. Press RANGE/▶ to modify editable value (hour, minute or second). Use ▲▼ keys to change the value. ACCEPT tag is displayed blinking.



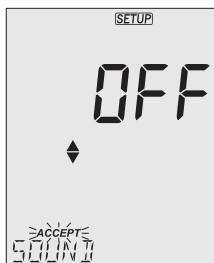
Auto Off

Press SETUP, select Set Auto Off. The current set value is displayed. Press CAL/EDIT to enter Edit mode. Use ▲▼ keys to select desired auto-off time. Available options are 5, 10 (default), 30, 60 minutes and off. ACCEPT tag is displayed blinking.



Sound

When pressed, each key will emit a short acoustic signal. Press SETUP, select Sound and press CAL/EDIT to enter Edit mode. Use ▲▼ keys to enable (on – default) or disable (off) the acoustic signal.



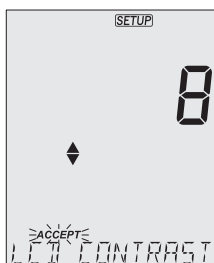
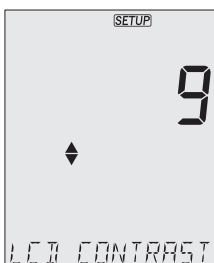
Temperature Unit

Press SETUP and select Temperature Unit. Press CAL/EDIT to enter Edit mode. Use ▲▼ keys to select temperature unit °C (default) or °F.



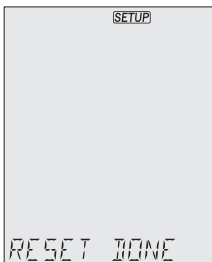
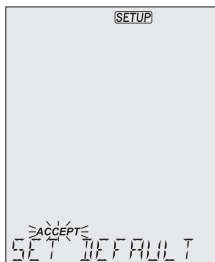
LCD Contrast

Enter Setup, select LCD Contrast and press CAL/EDIT to enter Edit mode. Use ▲▼ keys to set LCD contrast values from 1 to 9 (default value 9).



Default Values

Press SETUP, select Set Default and press CAL/EDIT to enter Edit mode. Press GLP/ACCEPT to return to default values or press ESC (or CAL/EDIT) to exit without saving and return to previous screen. "RESET DONE" message confirms that the meter performs with default settings.



Instrument Firmware Version

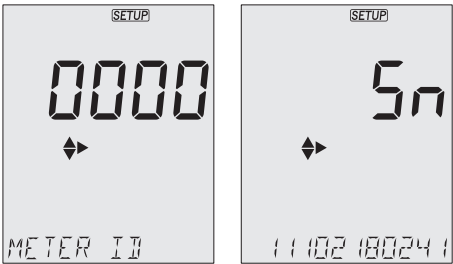
Press SETUP, select Instrument Firmware. The firmware version is displayed on the first LCD line.





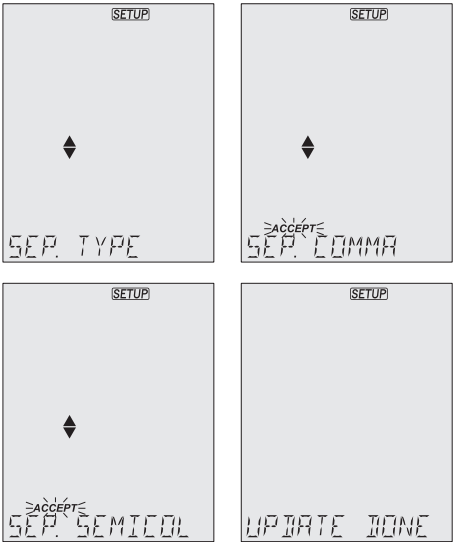
Meter ID / Serial Number

Press SETUP, select Meter ID and press CAL/EDIT to enter Edit mode. Use ▲▼ keys to assign meter ID (identification number) from 0 to 9999. Press RANGE/▶ to view meter's serial number.



Separator Type

Press SETUP, select Separator Type and press CAL/EDIT to enter Edit mode. Use ▲▼ keys to select character separator (semicolon or comma) to separate columns in the .csv file.



8. EC / TDS

8.1. PREPARATION

Pour small quantities of conductivity calibration solution into clean beakers. To minimize cross-contamination, use two beakers: one for rinsing the probe and the other for calibration.

Note: When the meter is switched on, it will start measuring with the previously selected range (conductivity, TDS or salinity).

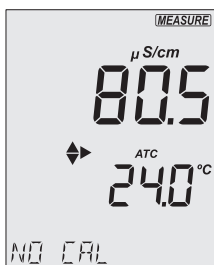
8.2. CALIBRATION

General Guidelines

For better accuracy frequent calibration is recommended.

The probe should be calibrated:

- whenever is replaced
- after testing aggressive samples
- when high accuracy is required
- if "NO CAL" is displayed on the third LCD line
- at least once a week.



Before performing a calibration inspect the probe for debris or blockages.

It is recommended to always use an EC calibration standard that is close to the sample.

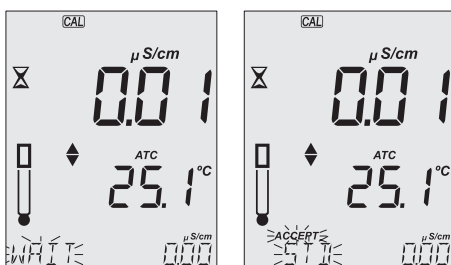
Calibrating EC is a one-point operation. Selectable calibration points are 0.00 μ S for offset and 84 μ S, 1413 μ S/cm, 5.00 mS/cm, 12.88 mS/cm, 80.0 mS/cm, 111.8 mS/cm for slope.

Procedure

Press CAL/EDIT to enter calibration. The CAL tag is displayed at the top of the LCD display. The first LCD line displays the EC reading and the third LCD line displays the closest calibration point.

When the reading is stable and close to the selected calibration standard, STD and ACCEPT tags are displayed blinking.

Press GLP/ACCEPT key to confirm calibration. The instrument displays "SAVING", stores the calibration values and returns to measurement mode.



Zero Calibration

For zero calibration, to correct readings around 0.00 $\mu\text{S}/\text{cm}$, keep the dry probe in the air. The slope is evaluated when the calibration is performed in any other point.

One-point Calibration

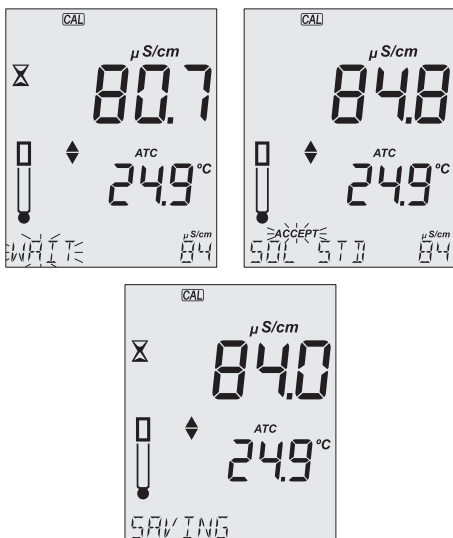
Place the probe in the calibration solution making sure that the sleeve holes are completely submersed. Center the probe away from the bottom or beaker walls.

Lift and lower the probe to refill the center cavity and tap the probe repeatedly to remove any air bubbles that may have been trapped inside the sleeve.

Press CAL/EDIT to enter calibration. Use the ▲▼ keys to select a different standard value. The hourglass symbol and "WAIT" message (blinking) are displayed until the reading is stable.

When the reading is stable and close to the selected calibration standard, SOL STD and ACCEPT tags are displayed blinking.

Press GLP/ACCEPT key to confirm calibration. The instrument displays "SAVING", stores the calibration values and returns to measurement mode.



The TDS reading is automatically derived from the EC reading and no calibration is needed.

Manual Calibration

This option may be used to perform a manual calibration in a custom standard, i.e. to set the cell-constant value directly.

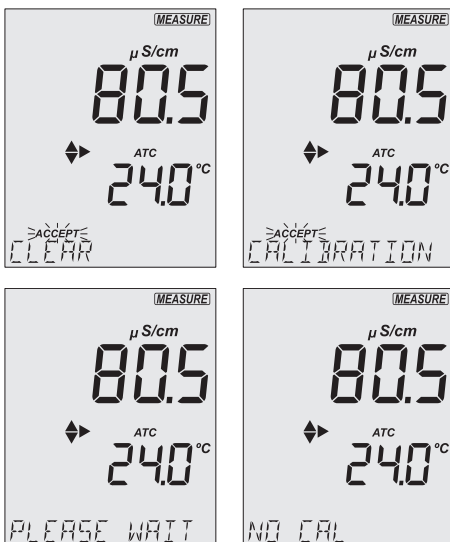
To minimize cross-contamination, use two beakers: one for rinsing the probe and the other for calibration.

1. Rinse the probe in the calibration standard and shake off any excess solution (first beaker).
2. Place the probe in the standard ensuring that the sleeve holes are covered with solution (second beaker).
3. Press SETUP and use the ▲▼ keys to select C.F. (cm⁻¹).
4. Press CAL/EDIT.
5. Use the ▲▼ keys to modify C.F. (cm⁻¹) until the display reads the Custom Standard value.
6. Press GLP/ACCEPT. "MANUAL CALIBRATION CLEARS PREVIOUS CALIBRATIONS" is displayed on the third LCD line. CAL and ACCEPT tags are displayed blinking.
7. Press GLP/ACCEPT to confirm or press ESC to exit without changing.

Note: Using manual calibration will erase previous calibrations; and both log files and GLP will display "MANUAL" as standard.

Clear Calibration

Press CAL/EDIT to enter Calibration mode, then press LOG/CLEAR. ACCEPT tag is displayed blinking and "CLEAR CALIBRATION" message on the third LCD line. To confirm, press GLP/ACCEPT. "PLEASE WAIT" message is displayed followed by "NO CAL" confirmation screen.



8.3. MEASUREMENT

Conductivity Measurement

When connected, the **MA815D/1** probe is automatically recognized. Place the calibrated probe in the sample, making sure that the sleeve holes are completely submerged. Tap the probe to remove any air bubbles that may be trapped inside the sleeve.

To change to EC mode, press RANGE/►.

The conductivity value is displayed on the first LCD line, the temperature on the second LCD line and calibration or range-specific information on the third LCD line.

To toggle between information displayed on the third LCD line, use the ▲▼ keys. The user can review the set values, date and time prior to measurement.



Readings can be temperature compensated.

- **Automatic Temperature Compensation (ATC), default:** The probe has a built-in temperature sensor; the temperature value is used to automatically compensate the EC / TDS reading.

When in ATC mode, ATC tag is displayed and measurements are compensated using the temperature coefficient. Recommended default value for water samples is 1.90% / °C. Temperature compensation is referenced to the selected reference temperature.

Use the $\blacktriangle \blacktriangledown$ keys to view the current temperature coefficient. The value is displayed along with the Cell Factor (C.F.) on the third LCD line.

To change the temperature coefficient, see SETUP section for details.

A temperature coefficient must also be set for the sample.

Note: If the reading outside of range when the range is set to automatic, the full-scale value (200.0 mS/cm for MTC/ATC or 500.0 mS/cm for No TC) is displayed blinking.

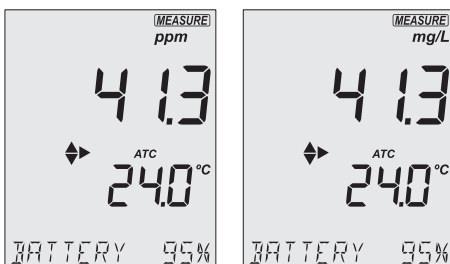
- **Manual (MTC):** The temperature value, shown on the second LCD line, can be manually set using the ▲▼ keys. When in MTC mode, the °C tag is displayed blinking.
- **No Temperature Compensation (NOTC):** The temperature value is displayed, but not taken into account. When this option is selected, the NOTC tag is displayed. The reading displayed on the first LCD line is the uncompensated EC or TDS value.

Note: Temperature-compensation and absolute conductivity (NOTC) are configured in Setup.

TDS Measurement

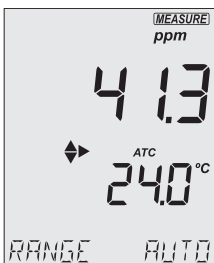
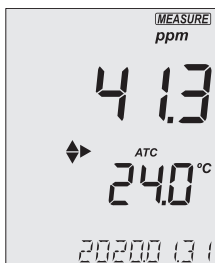
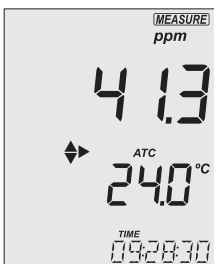
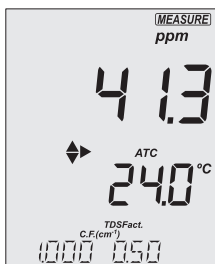
Press RANGE/▶ to select TDS range.

- The TDS reading is displayed on the first LCD line and the temperature reading on the second LCD line.
- Measured value is displayed in the set parameter unit (ppm or mg/L). See SETUP section for details.



Note: Values above 1500 ppm (1500 mg/L) are displayed only in g/L unit.

To toggle between information displayed on the third LCD line, use the ▲▼ keys. The user can review the set values, date and time prior to measurement.

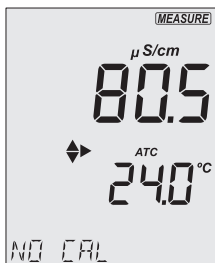


- If the reading is out of range, the full-scale value (100.0 g/L for MTC / ATC mode or 400.0 g/L for NoTC TDS) is displayed blinking.

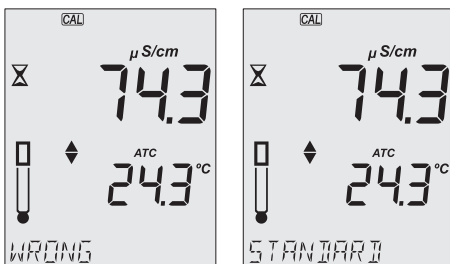
8.4. WARNINGS & MESSAGES

Messages Displayed During Calibration

- "NO CAL" message indicates that the probe needs to be calibrated or that the previous calibration has been deleted.



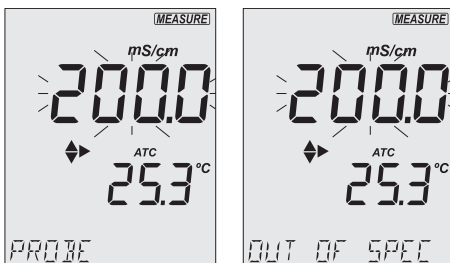
- If the reading exceeds expected value, "WRONG STANDARD" message is displayed and calibration can not be confirmed. Check that correct calibration solution has been used and / or clean the probe. See PROBE MAINTENANCE section for details.



- When using ATC mode, if the temperature of the solution is outside the accepted interval, the "WRONG STANDARD" message is displayed. The °C tag and the temperature are displayed blinking.

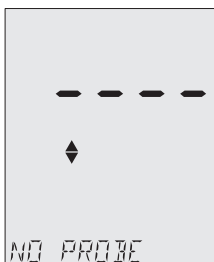
Messages Displayed During Measurement

- If the EC measurement and / or temperature exceed the limit of the probe.



The message "PROBE OUT OF SPEC" is displayed alternatively on the third LCD line. The range / temperature limit is displayed blinking.

- If EC temperature exceeds the range of the meter (120 °C), the value is displayed blinking.
- If the probe is not connected, "NO PROBE" message is displayed on the LCD.



Messages Displayed During Interval Logging

- If EC temperature exceeds the limit of the probe or meter specifications, "OUT OF SPEC" message is displayed alternatively with the Log specific messages.
- If the probe sensor is disconnected or damaged, logging stops with "Log end - Probe disconnected" message in the log file. "NO PROBE" message is displayed on the LCD.

9. SALINITY

9.1. PREPARATION

Pour small quantities of **MA9066** salinity calibration solution into clean beakers. To minimize cross-contamination, use two beakers: one for rinsing the probe and the other for calibration.

Note: When the meter is switched on, it starts measuring with the previously selected range (conductivity, TDS or salinity).

9.2. CALIBRATION

Press RANGE/► to select the Salinity mode. The NaCl% tag is displayed.

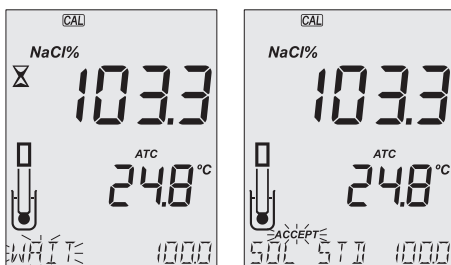
NaCl % calibration is a one-point calibration at 100.0% NaCl.

Place the probe in the calibration solution making sure that the sleeve holes are completely submersed. Center the probe away from the bottom or beaker walls.

Lift and lower the probe to refill the center cavity and tap the probe repeatedly to remove any air bubbles that may have been trapped inside the sleeve.

Press CAL/EDIT to enter to calibration mode. The CAL tag is displayed at the top of the screen. The first LCD line displays the NaCl reading and the third LCD line the closest calibration point.

The hourglass symbol and "WAIT" message (blinking) are displayed until the reading is stable.



When the reading is stable and close to the selected calibration standard, "SOL STD" message and ACCEPT tag (blinking) are displayed.



Press GLP/ACCEPT key to confirm calibration. The instrument displays "SAVING", stores the calibration values and returns to Measurement mode.

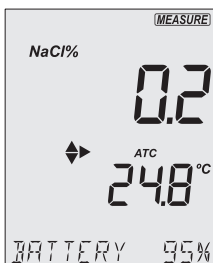
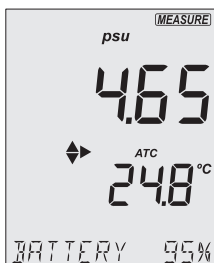
Note: A new EC calibration automatically clears the NaCl % calibration. "NO CAL" message is displayed blinking.

9.3. MEASUREMENT

MW306 supports three seawater salinity scales:

- Practical Salinity Units (PSU)
- Natural Seawater (g/L)
- Percentage (NaCl %)

Press RANGE/► to select salinity scales. Verify that the required scale is configured in SETUP.



Note: These units are for determining salinity and they refer to general use of saltwater. Practical salinity and natural seawater require a conductivity calibration. NaCl % requires calibration in MA9066 standard.

PSU - Practical Salinity Units

The practical salinity (S) of seawater relates the ratio of electrical conductivity of a standard seawater sample at 15 °C and 1 atmosphere to a potassium chloride solution (KCl) with a mass of 32.4356 g/Kg water at the same temperature and pressure.

The ratio is equal to 1, and S = 35. The practical salinity scale may be applied to values to through 42.00 PSU at temperatures between -2 to 35 °C.

Salinity of a sample in practical salinity units (PSU) is calculated using the following formula:

$$R_T = \frac{C_T(\text{sample})}{C(35, 15) \cdot r_T}$$

$$r_t = 1.0031 \cdot 10^{-9} T^4 - 6.9698 \cdot 10^{-7} T^3 + 1.104259 \cdot 10^{-4} T^2 + 2.00564 \cdot 10^{-2} T + 6.766097 \cdot 10^{-1}$$

$$\text{Sal} = \sum_{k=0}^5 a_k \cdot R_T^{\frac{k}{2}} + f(t) \cdot \sum_{k=0}^5 b_k R_T^{\frac{k}{2}} - \frac{c_0}{1 + 1.5X + X^2} - \frac{c_1 f(t)}{1 + Y^{\frac{1}{2}} + Y^{\frac{3}{2}}}$$

$$f(t) = \frac{T - 15}{1 + 0.0162 \cdot (T - 15)}$$

where:

R_T	ratio of sample conductivity to standard conductivity at Temperature = (T) °C
$C_T(\text{sample})$	uncompensated conductivity at T °C
$C(35, 15) = 42.914 \text{ mS/cm}$	the corresponding conductivity of KCl solution containing a mass of 32.4356 g KCl/1 Kg solution
r_T	temperature compensation polynomial

$$a_0 = 0.008$$

$$a_1 = -0.1692$$

$$a_2 = 25.3851$$

$$a_3 = 14.0941$$

$$a_4 = -7.0261$$

$$a_5 = 2.7081$$

$$b_0 = 0.0005$$

$$b_1 = -0.0056$$

$$b_2 = -0.0066$$

$$b_3 = -0.0375$$

$$b_4 = 0.0636$$

$$b_5 = -0.01442$$

$$c_0 = 0.008$$

$$c_1 = 0.0005$$

$$X = 400R_T$$

$$Y = 100R_T$$

NaCl% Percentage

In this scale 100% salinity is equivalent to roughly 10% solids.

If the reading is outside the range, the full-scale value (400.0%) will be displayed blinking.

Natural Sea Water

The Natural Sea Water scale extends from 0.00 to 80.00 g/L. It determines salinity based upon a conductivity ratio of sample to "standard seawater" at 15 °C.

$$R_{15} = \frac{C_T(\text{Sample})}{C(35, 15) \cdot r_T}$$

where:

R_{15} is the conductivity ratio

$C_T(\text{sample})$ is uncompensated conductivity at T °C

$C(35, 15) = 42.914$ mS/cm is the corresponding conductivity of KCl solution containing a mass of 32.4356 g KCl/1 Kg solution

r_T is temperature compensation polynomial

Salinity (S) is defined by the following equation:

$$S = -0.08996 + 28.2929729R_{15} + 12.80832R_{15}^2 - 10.67869R_{15}^3 + 5.98624R_{15}^4 - 1.32311R_{15}^5$$

Note: The formula can be applied for temperatures between 10 and 31 °C.

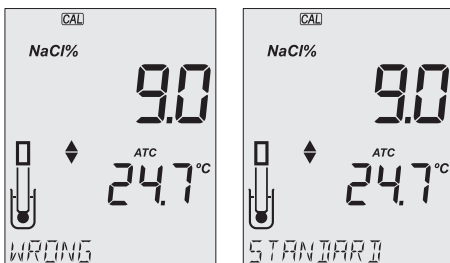
9.4. WARNINGS & MESSAGES

Messages Displayed During Calibration

- If an EC calibration is performed, the NaCl calibration is automatically cleared. "CAL EXPIRED" message is displayed. A new NaCl % calibration is required.



- If the reading exceeds expected calibration standard, "WRONG STANDARD" message is displayed and calibration can not be confirmed. Check if the correct calibration solution has been used and / or clean the probe. See PROBE MAINTENANCE section for details.



Messages Displayed During Measurement

- If the temperature is outside the 0.0 to 60.0 °C range, "WRONG STANDARD TEMPERATURE" message is displayed. The temperature value is displayed blinking.
- If the temperature of the calibration solution is outside the 0.0 – 60.0 °C (32.0 – 140.0 °F) range, "WRONG STANDARD" message is displayed. °C tag is displayed blinking.

10. PROBE MAINTENANCE

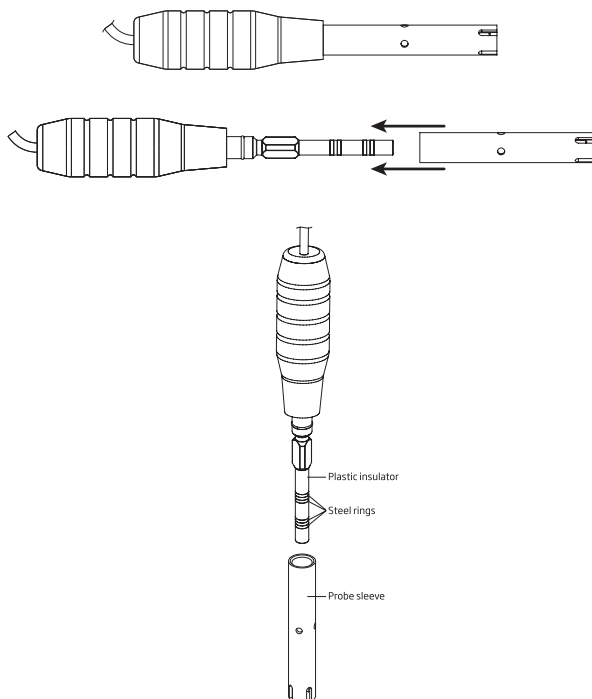
Regular Maintenance

1. Inspect the probe for any scratches or cracks. If any present, replace the probe.
2. Inspect the cable. The connection cable and insulation must be intact.
3. Connectors should be clean and dry.
4. Rinse off salt deposits with water.

Cleaning Procedure

Rinse the probe with clean water after measurements. If a more thorough cleaning is required, remove the probe sleeve and clean the probe with a cloth and a nonabrasive detergent. Make sure to re-insert the sleeve properly and in the right direction. After cleaning, recalibrate the probe.

Take great care while handling the probe. Make sure the probe sleeve is tight and correctly inserted.



11. LOGGING

MW306 features three different types of logging: manual log on demand, log on stability and interval logging. The logging type is configured in Setup. See SETUP section for details.

The meter can hold up to 1000 log records. It can hold up to 200 manual log on demand records, up to 200 log on stability records, up to 1000 interval logging records.

Note: *An interval logging lot can hold up to 600 records. When an interval logging session exceeds 600 records, two log files are generated automatically.*

Logging records are grouped in lots (up to 100 lots). Lot numbering goes up to 999 and restarts if all lots are deleted. Manual log on demand and log on stability are each stored in a separate lot.

When log memory is full, "LOG FULL" is displayed on the third LCD line and logging ceases. The meter returns to the Measurement mode. See Deleting Data procedure.

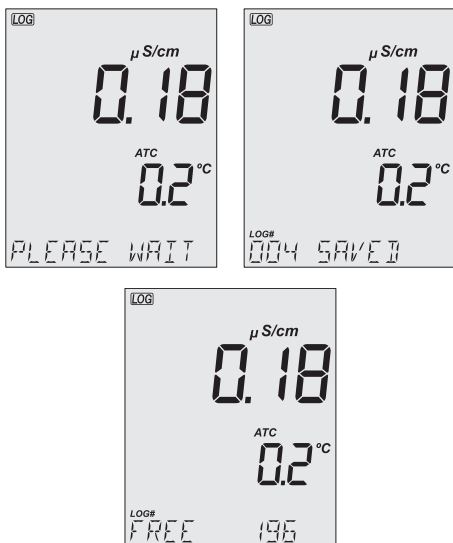
11.1. TYPES OF LOGGING

1. **Manual log on demand:** Readings are logged each time LOG/CLEAR is pressed. All readings are stored in a single lot for the measurement type. New records made on different days are stored in the same lot.
2. **Log on stability:** Readings are logged each time LOG/CLEAR is pressed and the stability criteria is reached. Stability criteria may be set to fast, medium or accurate.
3. **Interval logging:** A continuous log that is recorded in a given time interval (i.e. every 5, 10 minutes) set by the user.

A complete set of GLP information including date, time, range selection, temperature reading and calibration information is stored with each log.

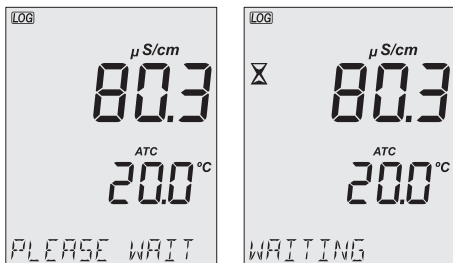
Manual Log on Demand

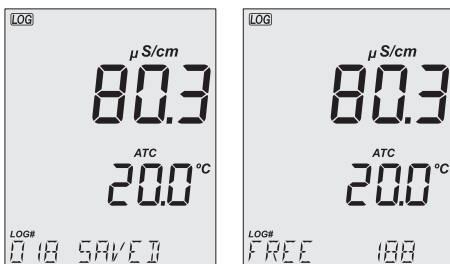
When Manual log is selected, records are added to the log file every time LOG/CLEAR is pressed. "PLEASE WAIT" is displayed followed by the number of saved logs and available log space.



Log on Stability

When Stability log is selected, records are added to the log file every time LOG/CLEAR is pressed. When LOG/CLEAR is pressed, "PLEASE WAIT" is displayed followed by "WAITING". Once the reading is stable, the number of saved logs is displayed followed by available log space.





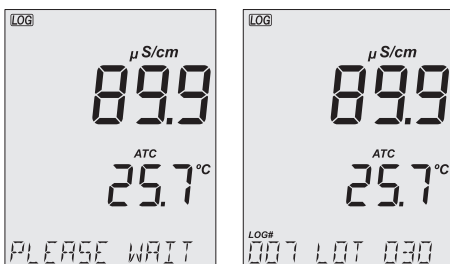
With "WAITING" message displayed, press ESC or LOG/CLEAR again to exit without logging.

Interval Logging

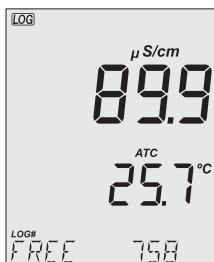
When Interval logging is selected, a new lot is created and records are added to it at the selected time interval, until LOG/CLEAR is pressed again. Pressing LOG/CLEAR stops the log session within the active lot.

If the maximum lot number is exceeded, "MAX LOTS" is displayed and some lots need to be deleted.

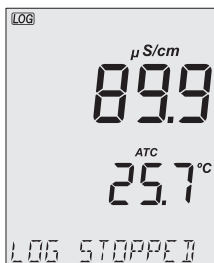
When LOG/CLEAR is pressed, "PLEASE WAIT" message is displayed followed by available log space. During active logging, lot information is displayed on the third LCD line indicating where data will be saved.



When RANGE/► is pressed during logging, the number of available logs is displayed. Press RANGE/► again to return to active logging screen.



When LOG/CLEAR is pressed again (or ESC), "LOG STOPPED" is displayed indicating the end of interval logging session.



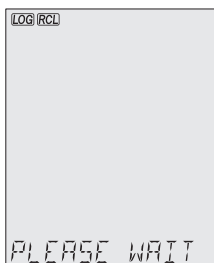
When a sensor failure is detected, "OUT OF SPEC" is displayed.

11.2. DATA MANAGEMENT

Press RCL to view, delete and export data.

Viewing Data

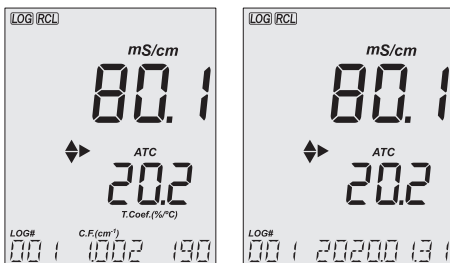
When RCL is pressed, LOG RECALL tag is displayed together with the total number of logs. Press GLP/ACCEPT to confirm action.



Note: When ACCEPT tag is displayed, press RANGE/▶ to enter EXPORT ALL screen.

Use the ▲▼ keys to select the log type (or lot number within interval logging) and press GLP/ACCEPT to confirm.

When a lot is selected, use ▲▼ keys to view different logs. Press RANGE/► to view log assigned data (date, time, cell factor, temperature coefficient, temperature reference).

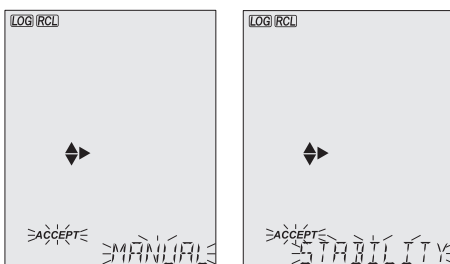


If the selected log type does not contain any records "NO MANUAL / LOGS" message is displayed.

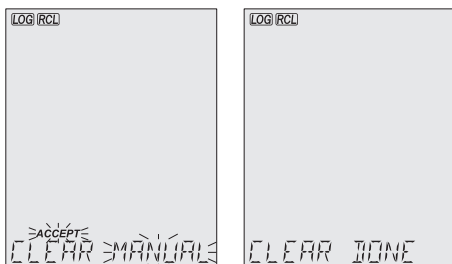
Deleting Data

Manual Log on Demand & Stability Log

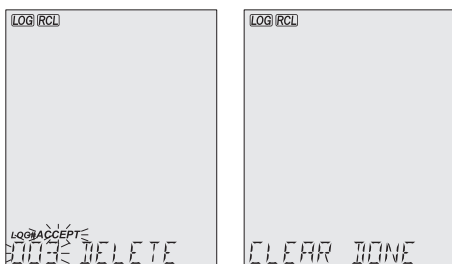
Press RCL then GLP/ACCEPT. Use the ▲▼ keys to navigate between log types (manual or stability).



With log type selected, press LOG/CLEAR to delete the entire lot. Press GLP/ACCEPT to confirm. "CLEAR DONE" is displayed for a few seconds after selected log has been deleted. "NO MANUAL / LOGS" or "NO STABILITY / LOGS" is displayed. Press ESC to return to previous screen.



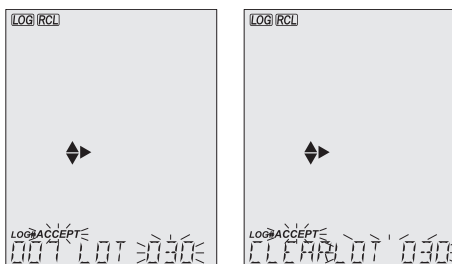
Use the ▲▼ keys to navigate between records. With the record selected, press LOG/CLEAR to delete. Press GLP/ACCEPT to confirm. If needed, press CAL/EDIT or ESC to return without saving. "CLEAR DONE" is displayed for a few seconds after selected lot has been deleted.



Log on Interval

Press RCL and then GLP/ACCEPT. Use the ▲▼ keys to navigate between interval lots.

Press LOG/CLEAR to delete lot.



"PLEASE WAIT" and then "CLEAR DONE" is displayed for a few seconds after selected lot has been deleted.



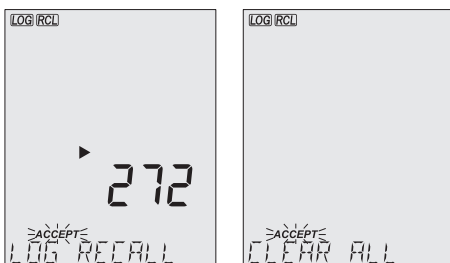
A lot number is used to identify a particular set of data. Lot numbers are allocated successively up to 999, even if some lots have been deleted.

If log space is full (100 lots) users need to delete some of them to free up log space.

If lot number has reached 999, users need to delete all lots to restart lot numbering.

Delete All

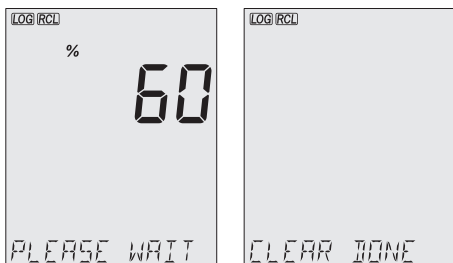
Press RCL and the total number of logs is displayed. Press LOG/CLEAR to delete all logs.



"CLEAR ALL" will be displayed with ACCEPT tag blinking.

Press GLP/ACCEPT to confirm. Press ESC or LOG/CLEAR again to exit without deleting.

"PLEASE WAIT" and the percent cleared will be displayed until completed.



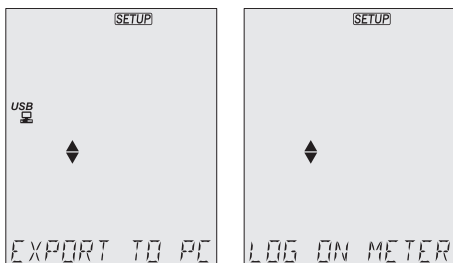
Export Data to PC

Turn the meter on and connect to the PC using the supplied micro USB cable.

Press SETUP then CAL/EDIT. Use up/down keys and select "EXPORT TO PC". The PC detects the meter as a removable drive and the PC icon is displayed on the LCD.

To enable logging: Press SETUP then CAL/EDIT. Use up/down keys and select "LOG ON METER". ACCEPT tag is displayed blinking.

Press GLP/ACCEPT to confirm. The meter disconnects from the PC. Press ESC to exit without saving.



Use a file manager (e.g. Windows Explorer, MacOS Finder) to move the files from the meter to the PC.

The .csv file (comma separated values) may be opened with any text editor or spreadsheet application. File encoding is Western Europe (ISO-8859-1).

Field separator may be set as comma or semicolon. See Separator Type in Setup section.

Files with interval lots are named as ECLOT, followed by lot number, e.g. ECLOT001, ECLOT002.

Manual logs are named as ECLOTMAN, and stability logs are named as ECLOTSTAB.

Note: If “°C!” appears in logged data, the probe was used beyond its operation specifications and the data is not considered reliable. If “°C!!” appears in logged data, the meter was in MTC mode. If “°C!!!” appears in logged data, the meter was in NO TC mode and the displayed temperature value is for reference only.

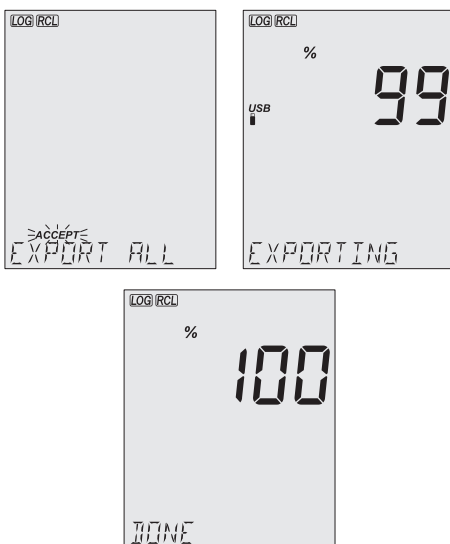
Export Data to USB

Logged data can be transferred to a micro USB flash drive.

Note: An OTG adapter from micro USB to USB A and a USB flash drive can be used as well.

Insert a micro USB flash drive into the micro USB port located on the top of the meter.

Press RCL then RANGE/▶ to select the “EXPORT ALL” option. Press GLP/ACCEPT to confirm.



When the export is finished, the USB flash drive can be removed. Logged data can be transferred separately by lots. Use the ▲▼ keys to select required lot and use RANGE/▶ to select the export option. Press GLP/ACCEPT to confirm.

Note: Do not remove USB drive during an active export transfer.

Logging Messages & Warnings

- "BATTERY LOW" message is displayed blinking and the export is not executed if battery level is low.
- "NO MEMSTICK" message is displayed if the micro USB flash drive is missing or not inserted properly.
- When identically named lots have already been exported to USB, the "OVR." message appears with the overwritten lot number blinking. Use the ▲▼ keys to scroll between "YES", "NO", "YES ALL", "NO ALL" options. Press GLP/ACCEPT to confirm.

12. GLP

Good Laboratory Practice (GLP) allows the user to store and recall calibration data. Correlating readings with specific calibrations ensures uniformity and consistency.

GLP information is included with every data log.

12.1. EC/TDS INFORMATION

EC calibration data is stored automatically after a successful calibration.

To view the EC calibration data, press GLP/ACCEPT when the instrument is in EC measurement mode. Use the ▲▼ keys to scroll through the calibration data displayed on the third LCD line:

- cell factor
- offset
- EC standard solution
- temperature coefficient (T.Coef.)
- temperature reference - user selected (T.Ref.)
- time
- date
- calibration expiration time

The cell factor in cm^{-1} is determined from the calibration with the current reading.

Press ESC or GLP/ACCEPT to return measurement mode.

12.2. NaCl% INFORMATION

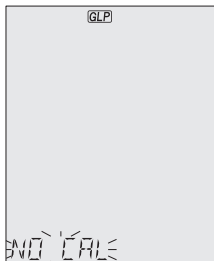
Salinity calibration data is stored automatically after a successful calibration.

To view the salinity calibration data, press GLP/ACCEPT when the instrument is in salinity measurement mode. Use the ▲▼ keys to scroll through the calibration data displayed on the third LCD line:

- cell factor
- coefficient
- salinity standard solution
- time
- date
- calibration expiration time

Press ESC or GLP/ACCEPT to return to measurement mode.

Note: A new EC calibration automatically clears the NaCl % calibration . "NO CAL" message is displayed blinking.



13. TROUBLESHOOTING

Symptoms	Problem	Solution
Slow reponse / Excessive drift	Dirty probe	Remove and clean the sleeve. Make sure the four rings on the probe are clean.
Reading fluctuates up and down (noise).	Probe sleeve not placed correctly; air bubbles inside sleeve.	Make sure the sleeve is correctly placed. Tap the probe to remove air bubbles.
Display shows EC, TDS or NaCl reading blinking.	Reading out of range	Recalibrate the meter. Check the sample is within measurable range. Make sure the autoranging feature is not enabled.
Meter fails to calibrate or gives faulty readings	Broken probe	Replace the probe.
Meter shuts off	Auto-off feature is enabled and the meter shuts off after 10 minutes of non-use.	Press ON/OFF to restart the meter.
At startup the meter displays all LCD tags permanently	One of the keys is blocked.	Check the keyboard or contact Milwaukee Instruments Service Center.
"Internal Er X" message	Internal error	Restart the meter. If the error persists, contact Milwaukee Instruments Service Center.

14. ACCESSORIES

MA815D/1	4-ring EC / TDS / NaCl / Temperature probe with DIN connector
MA9060	12880 $\mu\text{S}/\text{cm}$ Calibration solution (230 ml)
MA9061	1413 $\mu\text{S}/\text{cm}$ Calibration solution (230 ml)
MA9063	84 $\mu\text{S}/\text{cm}$ Calibration solution (230 ml)
MA9064	80000 $\mu\text{S}/\text{cm}$ Calibration solution (230 ml)
MA9065	111.8 mS/cm Calibration solution (230 ml)
MA9066	NaCl 100% Calibration solution (230 ml)
MA9069	5000 $\mu\text{S}/\text{cm}$ Calibration solution (230 ml)

CERTIFICATION

Milwaukee Instruments conform to the CE European Directives.



Disposal of Electrical & Electronic Equipment. Do not treat this product as household waste. Hand it over to the appropriate collection point for the recycling of electrical and electronic equipment.

Disposal of waste batteries. This product contains batteries. Do not dispose of them with other household waste. Hand them over to the appropriate collection point for recycling.



Please note: proper product and battery disposal prevents potential negative consequences for human health and the environment. For detailed information, contact your local household waste disposal service or go to **www.milwaukeeinstruments.com** (US only) or **www.milwaukeeinst.com**.

RECOMMENDATION

Before using this product, make sure it is entirely suitable for your specific application and for the environment in which it is used. Any modification introduced by the user to the supplied equipment may compromise the meter's performance. For your and the meter's safety do not use or store the meter in hazardous environment. To avoid damage or burn, do not perform any measurement in microwave ovens.

WARRANTY

This instrument is warranted against defects in materials and manufacturing for a period of 2 years from the date of purchase. Electrodes and Probes are warranted for 6 months. This warranty is limited to repair or free of charge replacement if the instrument cannot be repaired. Damage due to accidents, misuse, tampering or lack of prescribed maintenance is not covered by warranty. If service is required, contact your local Milwaukee Instruments Technical Service. If the repair is not covered by the warranty, you will be notified of the charges incurred. When shipping any meter, make sure it is properly packaged for complete protection.

Milwaukee Instruments reserves the right to make improvements in design, construction and appearance of its products without advance notice.

THANK YOU FOR CHOOSING



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