User Manual

Conductivity Probe: Model CDC40101, CDC40103, CDC40105, CDC40110, CDC40115 or CDC40130

Safety information

Precautionary labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. A symbol on the instrument is referenced in the manual with a precautionary statement.

⌧	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August of 2005. In conformity with European local and national regulations (EU Directive 2002/96/EC), European electrical equipment users must now return old or end-of-life equipment to the Producer for disposal at no charge to the user. *Note: For return for recycling, please contact the equipment producer or supplier for instructions on how to return end-of-life equipment, producer-supplied electrical accessories, and all auxiliary items for proper disposal.*

Specifications

*Note: Specifications are subject to change without notice.*

Specifications	Details
Probe type	Graphite, 4-pole conductivity probe
Conductivity range	0.01 µS/cm to 200.0 mS/cm
Cell constant	0.40 cm^{-1} ±10%
Conductivity resolution	0.0 to 19.99 µS/cm: 0.01 µS/cm 20.0 to 199.9 µS/cm: 0.1 µS/cm 200 to 1999 µS/cm: 1 µS/cm 2.00 to 19.99 mS/cm: 0.01 mS/cm 20.0 to 200.0 mS/cm: 0.1 mS/cm
Conductivity accuracy	±0.5% of reading
TDS (total dissolved solids) range	0 to 50,000 mg/L as NaCl
TDS resolution	0.0 to 19.99 mg/L: 0.01 mg/L 200 to 1999 mg/L: 1 mg/L 2.00 to 19.99 g/L: 0.01 g/L 20.0 to 50.0 g/L: 0.1 g/L
TDS accuracy	±0.5% of reading
Sample salinity range	0 to 42 (ppt) (‰)
Salinity resolution	0.01 parts per thousand (ppt) (‰)
Salinity accuracy	±1 parts per thousand (ppt) (‰)
Temperature accuracy	±0.3 °C (±0.54 °F)
Operating temperature range	-10 to 110 °C (14 to 230 °F)
Storage temperature range	5 to 40 °C (41 to 104 °F)
Minimum sample depth	45 mm (1.77 in.)
Dimensions (standard)	Diameter: 15 mm (0.59 in.) Length: 184 mm (7.24 in.) Cable length: 1 or 3 m (3.28 or 9.84 ft)

Specifications	Details
Dimensions (rugged)	Diameter: 46 mm (1.81 in.)
	Length: 223 mm (8.73 in.)
	Cable length: 5, 10, 15 or 30 m (16.40, 32.81, 49.21 or 98.42 ft)
Cable connection	M12 digital output and connector compatible with HQd meters

Product overview

The CDC401 series probe is a graphite, 4-pole conductivity probe (Figure 1). The CDC40101 or CDC40103 standard conductivity probe is available with a 1 or 3 m (3.28 or 9.84 ft) cable and is intended for laboratory use. The CDC40105, CDC40110, CDC40115 or CDC40130 rugged conductivity probe is available with a 5, 10, 15 or 30 m (16.40, 32.81, 49.21 or 98.42 ft) cable. The probe measures electrical conductivity, salinity, resistivity or total dissolved solids (TDS) in wastewater, drinking water and general applications.

Figure 1 Probe overview
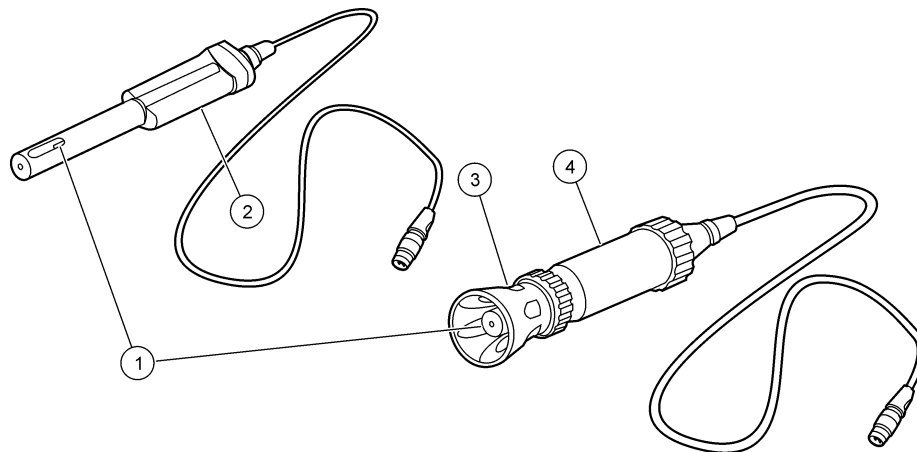
1	Temperature sensor and 4-pole graphite design conductivity cell	**3**	Shroud (rugged model)
2	Standard probe (1 or 3 meter cable)	**4**	Rugged probe (5, 10, 15, or 30 meter cable)

Calibration

| **Before calibration:** |
|---|
| The probe must have the correct service-life time stamp. Set the date and time in the meter before the probe is attached. |
| It is not necessary to recalibrate when moving a calibrated probe from one HQd meter to another if the additional meter is configured to use the same calibration options. |
| To view the current calibration, push ▱ , select View Probe Data, then select View Current Calibration. |
| If any two probes are connected, push the **UP** or **DOWN** arrow to change to the single display mode in order to show the Calibrate option. |
| If a rugged probe, remove the shroud from the probe (refer to Remove the shroud on page 8). |

Calibration notes:

- Do not touch the tip of the probe.
- Additional conductivity standards can be selected in the Calibration Options menu.
- The cell constant is derived from the calibration standard.
- Do not dilute conductivity standards and samples.

- The meter will automatically correct the calibration measurement to the selected reference temperature (20 or 25 °C) using the default NaCl-based, non-linear temperature coefficient. Settings can be changed in the CDC401 Calibration Options menu.
- The calibration is recorded in the probe and the data log. The calibration is also sent to a PC, printer or flash memory stick if connected.
- Air bubbles under the sensor tip when submerged can cause slow response or error in measurement. If bubbles are present, gently shake the probe until bubbles are removed.
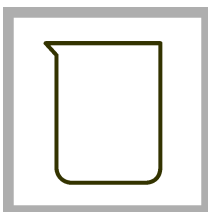- If a calibration error occurs, refer to Troubleshooting on page 9.

Calibration procedure:
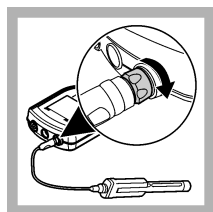
1. Connect the probe to the meter. Make sure that the cable locking nut is securely connected to the meter. Turn on the meter.
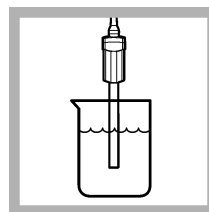

2. Push **Calibrate**. The display shows the conductivity standard solution that is necessary for calibration.

3. Add fresh conductivity standard solution to a beaker or an appropriate container.

4. Rinse the probe with deionized water. Blot dry with a lint-free cloth.

5. Put the probe in the standard solution and stir gently. Make sure that the temperature sensor is completely submerged.

6. Push **Read**. Stir gently. The display will show "Stabilizing" and a progress bar as the probe stabilizes in the standard. The display shows the standard solution value that has just been read and shows the temperature corrected value when the reading is stable.

7. Push **Done** to view the calibration summary.

8. Push **Store** to accept the calibration and return to the measurement mode. If a rugged probe, install the shroud on the probe (refer to Install the shroud on page 9).

Sample measurement

| **Before measurement:** |
|---|
| The probe must have the correct service-life time stamp. Set the date and time in the meter before the probe is attached. |
| If complete traceability is necessary, enter a sample ID and operator ID before measurement. Refer to the HQd meter manual for more information. |
| To display other parameters (TDS, salinity or resistivity), push ⚑ , select CDC401 Settings and then Current Method. |
| When using the CDC401 probe with the LDO101 probe to do auto salinity correction, set the CDC401 probe to measure salinity. Refer to Change measurement options on page 6. |
| Regular calibration is required for the best measurement accuracy (refer to Calibration on page 2). |
| If a rugged probe, make sure that the shroud is installed. Damage to the sensing elements can occur if the shroud is not installed during field use. Damage under these conditions is not covered by the product warranty. |
| To deploy a rugged probe at a distance, toss the probe body with a gentle underhand throw. Do not swing the probe by the cable as this may cause injury to the user, will cause severe strain on the cable and will shorten the service life of the probe. |

Measurement notes:

- Do not touch the tip of the probe.
- Stabilization times with smaller concentration changes generally will be longer and can be minimized by correct stirring and conditioning. Experiment to determine the correct stir rate if necessary.
- Data is automatically stored in the data log when **Press to Read** or **Interval** is selected in the Measurement Mode. When **Continuous** is selected, data will only be stored when **Store** is selected.
- Air bubbles under the sensor tip when submerged can cause slow response or error in measurement. If bubbles are present, gently shake the probe until bubbles are removed.
- If a measurement error occurs, refer to Troubleshooting on page 9.
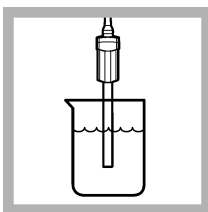
Measurement procedure:

Note: Procedure also applies for rugged model probes.
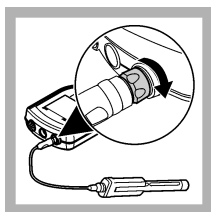
1. Connect the probe to the meter. Make sure that the cable locking nut is securely connected to the meter. Turn on the meter.

2. Rinse the probe with deionized water. Blot dry with a lint-free cloth.

3. Put the probe into the sample so that the temperature sensor is completely submerged. Do not put the probe on the bottom or sides of the container.

4. Push **Read**. The display will show "Stabilizing" and a progress bar as the probe stabilizes in the sample. The display will show the lock icon when the reading stabilizes. The measurement is automatically corrected to the selected reference temperature (20 or 25 °C).
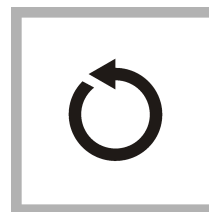
5. Repeat steps 2 - 4 for additional measurements. When measurements are done, store the probe (refer to Storage on page 9).

Run a check standard

The run check standard feature validates instrument performance between sample measurements. Use the run check standard feature for periodic or user-defined interval measurements of a traceable standard solution. Set the criteria for check standards from the CDC401 Settings menu.

Note: Access control must be off or a valid password must be entered before any of the check standard method options can be changed.

1. Push ⚒ . The Full Access Options menu is shown.
2. Select Run Check Standard.
    Note: Select the correct probe if two probes are connected to the meter.
3. Get the standard solution shown on the display.
4. Rinse the probe with deionized water. Blot dry with a lint-free cloth.
5. Put the probe in the standard solution until the temperature sensor is completely submerged. Move the probe up or down or gently tap on the beaker to remove air bubbles from the probe.
6. Push **Read**. The display will show "Stabilizing" and a progress bar as the reading stabilizes. The display shows the value of the check standard and either Check Standard Passed or Check Standard Failed.
7. If the display shows **Check Standard Passed**, the check standard measurement is within the accepted limits set by the administrative user. Select **Done** to continue with the sample measurement.
8. If the display shows **Check Standard Failed**, the measurement is outside of accepted limits set by the administrative user and a recalibration is recommended. If the acceptance criteria is set to Cal Expires on Failure: Yes, the display shows the calibration icon and a question mark until the probe is recalibrated. To correct the probe calibration and status indicator, calibrate the probe (refer to Calibration on page 2).

Advanced operation

Parameter-specific settings can be changed through the Full Access Options menu. Details about menu navigation, available options and how to change them are given in the screens, tables and procedures throughout this section.
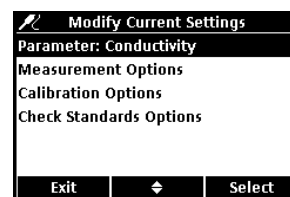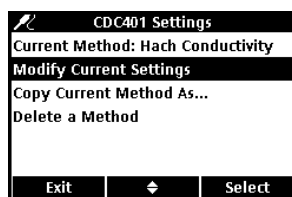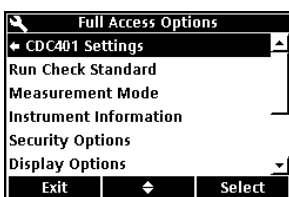
The settings that can be changed are shown in Table 1.

Table 1 Parameter-specific settings

Setting	Options
Parameter	• Conductivity • Salinity • TDS • Resistivity
Measurement Options	• Units • Measurement limits • Temperature correction • Correction factor (if linear temperature correction is selected) • Reference temperature (if a temperature correction is selected)

Table 1 Parameter-specific settings (continued)

Setting	Options
Calibration Options	• Standard • Calibration reminder • Standard units (if Custom option is selected) • Standard value (if Custom option is selected) • Reference temperature (if Custom option is selected) • Temperature correction (if Custom option is selected)
Check Standards Options	• Standard solution for calibration verification • Reminder • Acceptance criteria

Change measurement options

Methods are groups of default or user-defined settings relevant to specific applications. If the meter is set to the default method and the Modify Current Settings option is chosen, a prompt for a new name is shown after the changes are entered. The settings are saved with this name to distinguish them from the default method settings, which cannot be changed. A saved method can be used instead of multiple adjustments to the individual settings. Changes made to a user defined method are automatically saved with the existing name. Multiple methods can be saved for the same probe on each meter.

Table 2 lists the five default methods available for the CDC401 conductivity cell.

Table 2 Default methods

Options	Description
Hach Conductivity	Default method with conductivity measurement values. Conductivity is typically used for natural water samples.
Hach TDS	Default method with TDS measurement values. TDS is typically used to estimate the amount of total dissolved solids in the sample. The conductivity value is also shown in the Detailed Reading screen.
Hach Salinity	Default method with salinity measurement values. Salinity is typically used for samples with a high salt content, such as sea water. The conductivity value will also be shown in the Detailed Reading screen.
Hach Resistivity	Default method with resistivity measurement values. Resistivity is typically used for ultra pure water applications.
Default	—

1. Make sure a probe is connected to the meter.
2. Push ⚒ and select CDC401 Settings.
3. Select Modify Current Settings.
4. Select Parameter to change the parameter that is shown in the display.
5. Select Measurement Options and update the settings:

Option	Description
Units—Conductivity	Sets the units for conductivity—Auto (default), µS/cm or mS/cm. When Auto is selected, the units will automatically change to mS/cm when the sample conductivity is high and µS/cm when the conductivity is low. Select µS/cm or mS/cm to always show the same units.
Units—Salinity	Sets the units for salinity—‰ (default), g/kg, <unitless> or ppt (parts per thousand).

Option	Description
Measurement Limits	Sets the measurement limits—Lower limit (default: 0.01 µS/cm; 0 ‰) or Upper limit (default: 400000.00 µS/cm; 42 ‰).
	The measurement limits can be set to match the acceptable values for the sample. When the measurement is above the upper limit setting or below the lower limit setting, the meter shows an "Out of limits" message. This message is an alert to a potential problem with the process conditions.
Temperature Correction	Sets the temperature correction—None, Linear, NaCl non-linear (default) or Natural Water.
	The conductivity of a sample changes when the temperature changes. Temperature correction shows the conductivity at the user-selected reference temperature. Temperature correction can be changed or turned off when the parameter is set to conductivity, TDS or resistivity.
Correction Factor	When the temperature correction is set to linear, this sets a correction factor based on the sample type—% per °C (default: 1.90% per °C). The correction factor may need to be identified experimentally. For example, the factor for ultrapure water is 4.55% per °C and the factor for NaCl salt solution 2.125% per °C.
Reference Temperature	When the parameter is set to conductivity, TDS or resistivity, sets the reference temperature for temperature correction—20 °C or 25 °C (default).
TDS Form	When the parameter is set to TDS, sets the conversion factor from conductivity to total dissolved solids—NaCl (default, factor 0.5) or Custom. To change the factor, select Custom and enter the conversion factor and temperature correction information.
	Note: Labels and options may vary depending on the units selected.

6. If prompted, enter a name for the new method settings. Additional changes made to the settings of an existing method are automatically saved with the same method name.
7. Push **EXIT** until the meter returns to the measurement mode.

Change calibration options

1. Make sure a probe is connected to the meter.
2. Push ⚒ and select CDC401 Settings.
3. Select Modify Current Settings.
4. Select Calibration Options and update the settings:

Option	Description
Standard	Sets the conductivity calibration standard—
	• 1 D KCl, 111.3 mS/cm, 25 °C
	• 0.1 D KCl, 12.85 mS/cm, 25 °C
	• 0.01 D KCl, 1408 µS/cm, 25 °C
	• 0.1 M KCl, 12.88 mS/cm, 25 °C
	• 0.01 M KCl, 1413 µS/cm, 25 °C
	• 0.001 M KCl, 146.93 µS/cm, 25 °C
	• NaCl, 18 mS/cm, 25 °C
	• NaCl, 1000 µS/cm, 25 °C
	• NaCl, 25 µS/cm, 25 °C
	• NaCl, 0.05%, 1015 µS/cm, 25 °C
	• Seawater (S=35)
	• Custom

Option	Description
Standard Units	When Standard is set to Custom, sets the units for the custom calibration standard.
Standard Value	When Standard is set to Custom, sets the values for the custom calibration standard.
Reference Temperature	When Standard is set to Custom, sets the reference temperature for the custom calibration standard.
Temperature Correction	When Standard is set to Custom, sets the temperature correction for the custom calibration standard.

5. Select Calibration Reminder and update the settings:

Option	Description
Reminder Repeat	Meter will make an audible sound when calibration is due and repeat the sound at selected interval—Off, 2 h, 4 h, 8 h, 2 d, 5 d or 7 d.
Expires	Calibration expires after the selected time—Immediately, Reminder + 30 min, Reminder + 1 h, Reminder + 2 h or Continue Reading. *Note: The meter cannot be used to read samples after calibration has expired unless Continue Reading is selected.*

6. If prompted, enter a name for the new method settings. Additional changes made to the settings of an existing method are automatically saved with the same method name.

7. Push **EXIT** until the meter returns to the measurement mode.

Maintenance

Clean the probe

Clean the probe when:

- Drifting/inaccurate readings or slow stabilization time occurs as a result of mineral or sample buildup on the electrodes.
- The slope is out of range as a result of mineral or sample buildup on the electrodes.

Before a rugged probe can be cleaned, the shroud must be removed (refer to Remove the shroud on page 8). Install the shroud after the probe is clean (refer to Install the shroud on page 9).

For general contaminants:

1. Rinse the probe with deionized water and blot dry with a lint-free cloth.

For greases and oils:

1. Soak the glass bulb in a warm detergent solution for up to 2 hours.
2. Rinse or soak the probe for 1 minute in deionized water.
3. Blot dry with a lint-free cloth.

For mineral buildup:

1. Soak the probe in a dilute 10% hydrochloric acid (HCl) solution for no more than 5 minutes.
2. Rinse or soak the probe for 1 minute in deionized water.
3. Blot dry with a lint-free cloth.

Remove the shroud

1. Loosen and remove the locking ring.
2. Slide the shroud and locking ring off the probe.

Install the shroud

1. Put the locking ring on the probe with the threads toward the probe.
2. Slide the shroud on the probe until it is against the locking groove.
3. Hand-tighten the locking ring on the shroud.

Storage

Between uses, make sure the probe is dry and store it in ambient conditions. Rugged probes may be stored with the shroud installed if the storage container is sufficiently large.

Troubleshooting

Message or symptom	Possible cause	Action
Probe not supported	Software not updated	To download the most current version of the software, refer to the applicable product page on the manufacturer's website. Refer to the HQd Series meter manual for specific instructions for the meter model.
	HQd meter does not support IntelliCAL® probe	Contact a Technical Support Representative.
Connect a probe or probe requires service	Probe not connected correctly	Disconnect, then connect the probe. Tighten the locking nut.
	Software not updated	To download the most current version of the software, refer to the applicable product page on the manufacturer's website. Refer to the HQd Series meter manual.
	Large number of methods stored on the probe	Continue to let probe connect. Do not disconnect the probe.
	Damaged probe	Make sure there is connectivity with another probe or meter to confirm isolated issue with probe. Contact a Technical Support Representative.
Slow stabilization time	Mineral or sample buildup on electrodes	Clean the probe (refer to Clean the probe on page 8).
	Bubbles trapped under probe tip	Make sure that the sample concentration and temperature are both within the range of the CDC401 probe.
Out of range	Temperature and/or pressure sensor error	Make sure that the temperature and pressure sensors are both reading correctly.
	Damaged probe	Replace the conductivity probe or contact a Technical Support Representative.
	CO2 absorption in LIS/high purity samples	Replace the conductivity probe or contact a Technical Support Representative.
	Bubbles trapped under probe tip	Make sure that the sample concentration and temperature are both within the range of the CDC401 probe.

Message or symptom	Possible cause	Action
Drifting/Inaccurate readings	Incorrect settings	Measurement Options—Make sure that Temp Correction (Correction Factor if not set as NaCl) and reference temperature are both correct.
		Calibration Options—Make sure that Standard Value, Reference Temperature and Temp Correction are all correct.
	Mineral or sample buildup on cell	Clean the probe (refer to Clean the probe on page 8).
	CO2 absorption in LIS/high purity samples	Isolate LIS/high purity samples to prevent sample contamination.
	Bubbles trapped under probe tip	Gently shake the probe until bubbles are removed.
Calibration failed - Out of limits/Out of range	Incorrect settings	Measurement Options—Make sure that Temp Correction (Correction Factor if not set as NaCl) and reference temperature are both correct.
		Calibration Options—Make sure that Standard Value, Reference Temperature and Temp Correction are all correct.

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