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NH4D sc Ammonium sensor

USER MANUAL

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Section 1 Specifications

Specifications are subject to change without notice.

General information	
Measuring method	Ion-selective electrodes for ammonium and potassium, pH reference electrode
Measuring range	0.2 to 1000 mg/L [NH ₄ -N]
Lower detection limit	0.2 mg/L [NH ₄ -N]
Precision	5% of the measured value + 0.2 mg/L ¹
Reproducibility	5% of the measured value + 0.2 mg/L ¹
Response time (90%)	< 2 min
Measuring interval	Continuous
pH range	pH 5 to pH 9
Calibration methods	Sensor code for sensor cartridge 1 and 2-point matrix correction
Power consumption	1 Watt
Power supply	sc controller (sc100 and sc1000)
Data transfer	Via sc controller (sc100 and sc1000)
Ambient data	
Typical environment	Municipal waste water applications
Storage temperature	Sensor: -20 to 60 °C (-4 to 140 °F) Sensor cartridge: 5 to 40 °C (41 to 104 °F)
Operating temperature	Air: -20 to 45 °C (-4 to 113 °F)
Sample temperature	+2 to 40 °C (35 to 104 °F)
Max. flow velocity	< 4 m/s
Max. sensor immersion depth/pressure	Can be immersed 0.3 to 3.0 m (1 to 10 ft) / 0.3 hPa (4.4 psi) max.
General information on the sensor	
Sensor dimensions	360.9 mm x 48.3 mm (14.21 x 1.9 in) (L x Ø) See Figure 1 on page 4 .
Sensor cable length	10 m (33 ft) standard Optional extension cables available in 7.6 m (25 ft), 15.2 m (50 ft), 30.5 m (100 ft) Total Maximum length: 100 m (328 ft)
Sensor weight	Approx. 1326 g (46.77 oz)
Wetted materials	Only for immersed installation, sensor body 316 SS made of stainless steel with ends made of Ryton PPS [®] ² .
Installation angle	45° +/- 15° vertical in flow direction

¹ With calibration solution

² Ryton[®] is a registered trademark of Phillips 66 Co.

Specifications

1.1 Dimensions

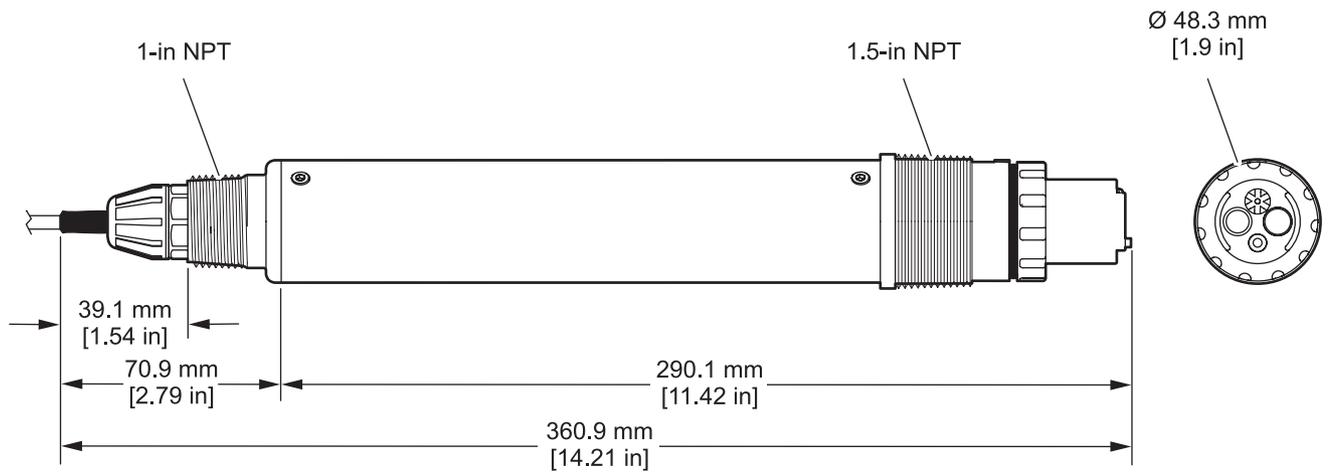


Figure 1 Stainless steel sensor dimensions

Section 2 General information

2.1 Safety information

Please read this entire manual before unpacking, setting up, or operating this equipment. Pay attention to all danger and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure that the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that specified in this manual.

2.1.1 Use of hazard information

DANGER

Indicates a potentially or imminently hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

Important Note: Information that requires special emphasis.

Note: Information that supplements points in the main text.

2.1.2 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, if noted on the instrument, will be included with a danger or caution statement in the manual.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	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: <i>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.</i>

2.2 General sensor information

The sensor was developed for municipal waste water applications.

The NH4D sc sensor (see [Figure 2 on page 6](#)) with ion-selective electrode (ISE sensor) is a continuous online process sensor for the measurement of ammonium directly in the tank. It operates without reagents and requires no further processing of the sample. The ammonium ions are measured using an ion-selective electrode.

The only wear part is the sensor cartridge (see [Figure 3 on page 6](#)). This includes the ion-selective electrodes for ammonium and potassium (compensation electrode), a pH electrode used as a reference system and a temperature sensor for temperature compensation.

An optional cleaning unit is designed for automatically cleaning the sensor head membranes and can be ordered separately. Refer to the instruction sheet supplied with the cleaning unit.

The manufacturer recommends the use of the High Output Airblast Cleaning System for the compressed air supply; this is a compressor in weather-proof plastic housing.

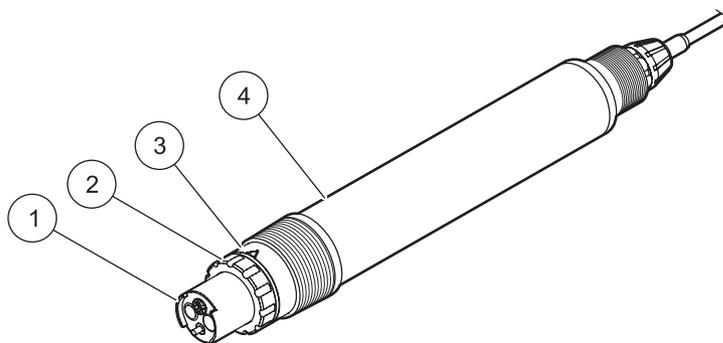


Figure 2 NH4D sc sensor

1	Sensor cartridge	3	Sensor adapter
2	Locking ring	4	Sensor housing

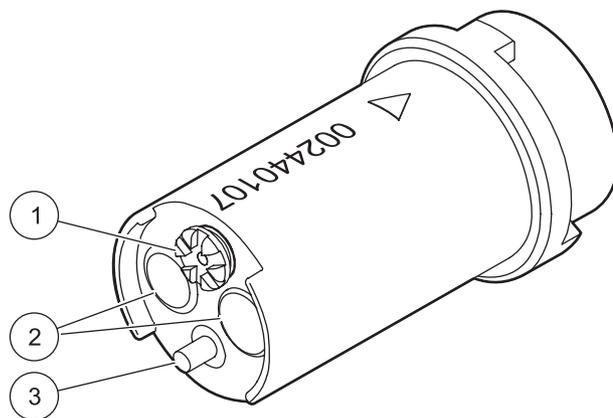


Figure 3 Sensor cartridge

1	Salt bridge	2	Membranes for ammonium and potassium	3	Temperature sensor
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2.3 Theory of operation

The NH4D sc sensor utilizes ion-selective electrode technology to measure ammonium ions (NH_4^+) in a waste water sample. Well known interferences of temperature and potassium are compensated by using appropriate built-in sensors. The reference electrode is a differential pH technology and does not have direct contact with the process and therefore is particularly stable against drift.

Ion-selective electrodes have a special membrane to which only a specific type of ion can adhere. As a result an ion-specific potential forms on the membrane surface. To be able to measure a potential difference, a reference electrode is required on which the sample to be measured has no effect.

CARTRICAL™ technology reduces cross-sensitivities by not only pre-calibrating each electrode individually but also calibrating all three electrodes to each other.

Section 3 Installation

DANGER

Only qualified personnel should conduct the tasks described in this section of the manual.

3.1 Unpacking the sensor

Remove the sensor from the shipping container and inspect the sensor for damage. Verify that all items listed in [Figure 4](#) are included. If any items are missing or damaged, contact the manufacturer or distributor (outside US).

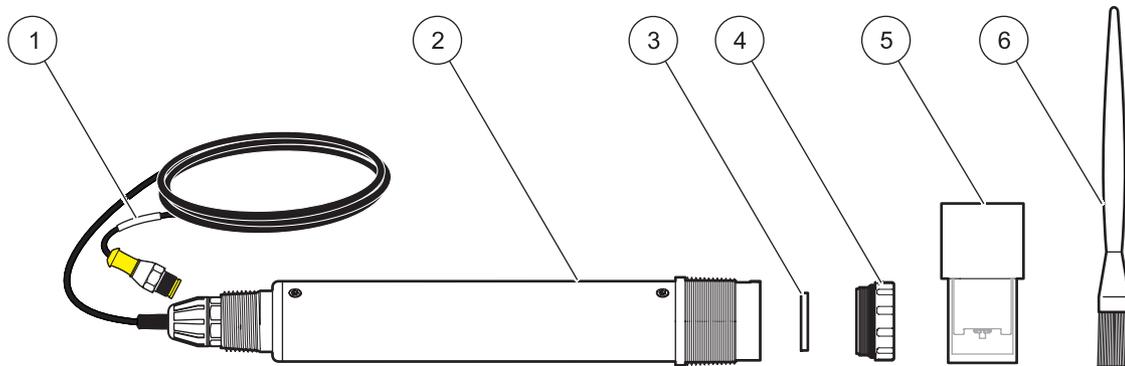


Figure 4 Items supplied

1	Sensor cable	4	Locking ring
2	NH4D sc sensor	5	Sensor cartridge (supplied in a storage container)
3	Opaque gasket	6	Cleaning brush

3.2 Unpacking the sensor cartridge

Important Note: Avoid touching the membrane on the sensor cartridge or damage to the sensor may occur.

1. Pay attention to the best before date on the certificate for sensor cartridge.
2. Remove the cap of the storage container (see [Figure 6](#) on page 11).
3. Take the sensor cartridge out of the storage container and remove the black gasket. This black gasket is not needed for installation, but maybe needed for extended storage.

Note: Make sure that the sensor cartridge is not exposed to air for more than 30 minutes.

Important Note: Before fitting the sensor cartridge in the sensor adapter, shake the sensor cartridge vigorously with the membranes directed downwards. Shaking the sensor cartridge is necessary to remove air bubbles that may form underneath the membrane.

4. Connect the sensor cartridge to the sensor (see [3.3 Sensor assembly on page 11](#)).

Important Note: The sensor cartridge only fits correctly in the sensor adapter in one position. Pay attention to the markings on the sensor cartridge and on the sensor adapter (see [Figure 7 on page 12](#)).

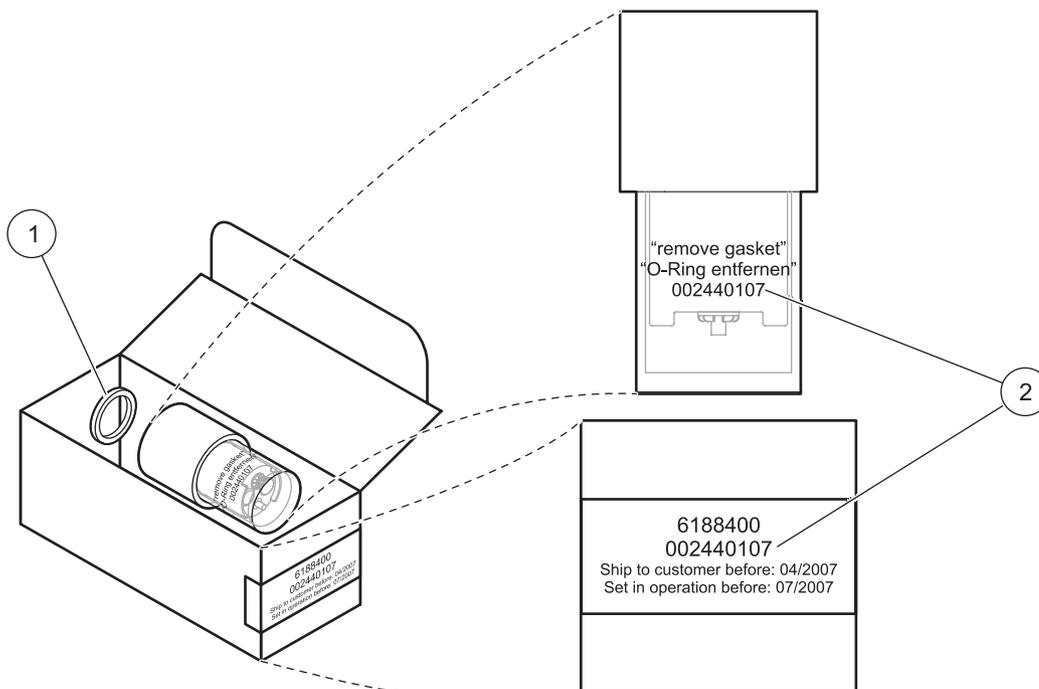


Figure 5 Storage container packaging

1 Opaque gasket	2 Serial number
-----------------	-----------------

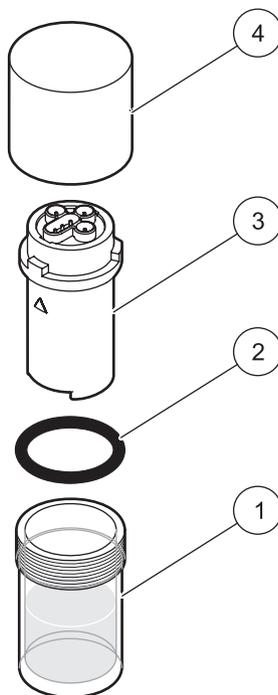


Figure 6 Storage container for sensor cartridge¹

1 Storage container	3 Sensor cartridge
2 Black gasket (remove before installation)	4 Cap

¹ Save items 1, 2 and 4 for sensor storage.

3.3 Sensor assembly

Important Note: Avoid touching the membranes on the sensor cartridge or damage to the sensor may occur.

1. Remove the black gasket.
2. Ensure that opaque gasket is in place.

Important Note: Without opaque gasket damage of the sensor will occur.

3. Align the markings on the sensor cartridge with the sensor adapter (see [Figure 7 on page 12](#)) and connect the sensor cartridge into the sensor adapter.
4. Attach the locking ring over the sensor head and hand-tighten.

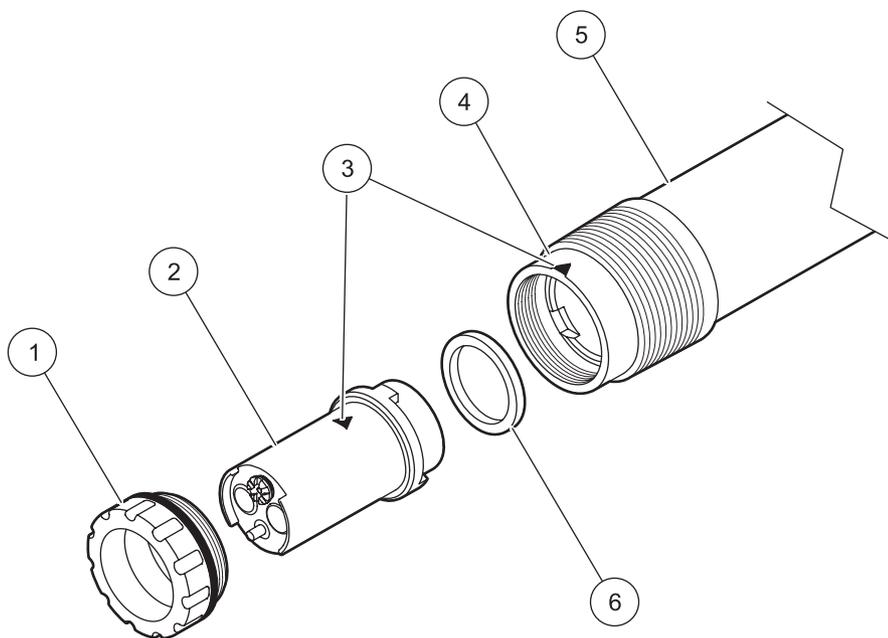


Figure 7 Sensor assembly

1	Locking ring	4	Sensor adapter
2	Sensor cartridge	5	Sensor housing
3	Alignment arrows	6	Opaque gasket

3.4 Installation of the sensor in the sample flow

Installation kits are available for the installation of the sensor with or without a cleaning unit for a wide range of requirements.

The following must always be considered prior to installation:

- Install the sensor where the sample that comes into contact with the sensor is representative of the entire process.
- Position the sensor at least 200 mm (7.87 in.) from the tank wall.
- When using a chain bracket, ensure that the sensor cannot hit the tank wall when it moves.
- Immerse the sensor at an angle of approx. $45^{\circ} \pm 15^{\circ}$ so that air bubbles cannot remain underneath the membranes.
- Ensure that the sensor is fully immersed.
- When using the cleaning unit refer to the supplied Instruction Sheet.
- Refer to the instructions supplied with the optional mounting accessories for detailed installation information (see [Figure 8 on page 13](#)).

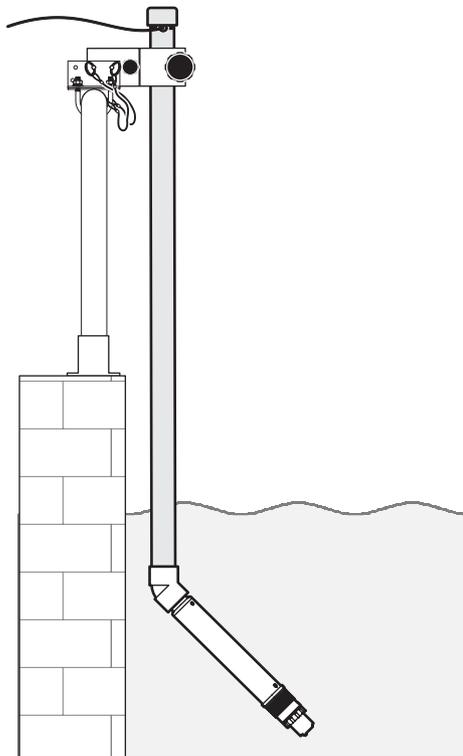


Figure 8 Example of sensor installation

3.5 Connection/wiring of the sensor to the sc controller

DANGER

Although the sc controller is certified for Class 1, Division 2 Hazardous Locations, it is only certified when installed with sensors listed in Control Drawings 5860078.

The sc controller and this sensor are NOT suitable for use in Class 1, Division 2 Hazardous Locations.

3.5.1 Connect the sensor to the sc controller (non-hazardous location)

3.5.1.1 Connect the sensor with quick-connect fittings

The sensor cable is supplied with a keyed quick-connect fitting for easy attachment to the controller (see [Figure 9 on page 14](#)). Retain the connector cap to seal the connector opening in case the sensor must be removed. Optional extension cables may be purchased to extend the sensor cable length.

1. Unscrew the protective cap on the socket on the controller.
2. Insert the connector in the socket and hand-tighten the union nut.

Note: When using an sc1000 controller, Do not use the middle connection for the sensors as this is reserved for the display module.

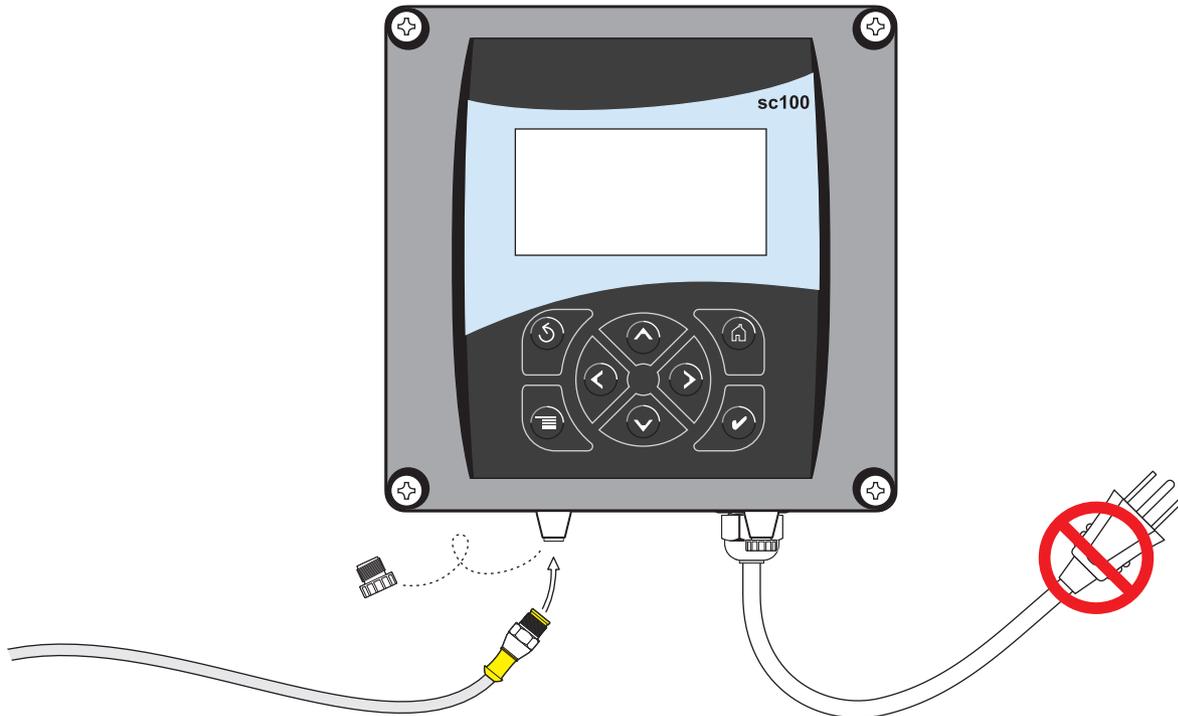


Figure 9 Connect the sensor using quick-connect fitting on the sc100 controller

3.5.1.2 Hard-wiring the sensor to the controller (only sc100)

1. Disconnect power to the controller if powered.
2. Open the controller cover.
3. Disconnect and remove the existing connections between quick-connect fitting and terminal strip J5.
4. Remove the quick-connect fitting and the wires and install the threaded plug in the opening to maintain the environmental rating (see [Figure 10 on page 15](#)).
5. Cut the connector from the sensor cable.
6. Strip the insulation on the cable back 2.5 cm (1 in.). Strip 6 mm (¼ in.) of each individual wire end. Seat insulation against the connector with no bare wire exposed.
7. Pass the cable through conduit and a conduit hub or a strain relief (Cat. No. 16664) and an available access hole in the controller enclosure. Tighten the strain relief fitting.
8. Use of a strain relief fitting other than Cat. No. 16664 may result in a hazard. Use only the recommended strain relief fitting.

9. Reinstall the plug on the sensor access opening to maintain the environmental rating.
10. Wire as described in [Table 1](#).
11. Close and secure the cover.

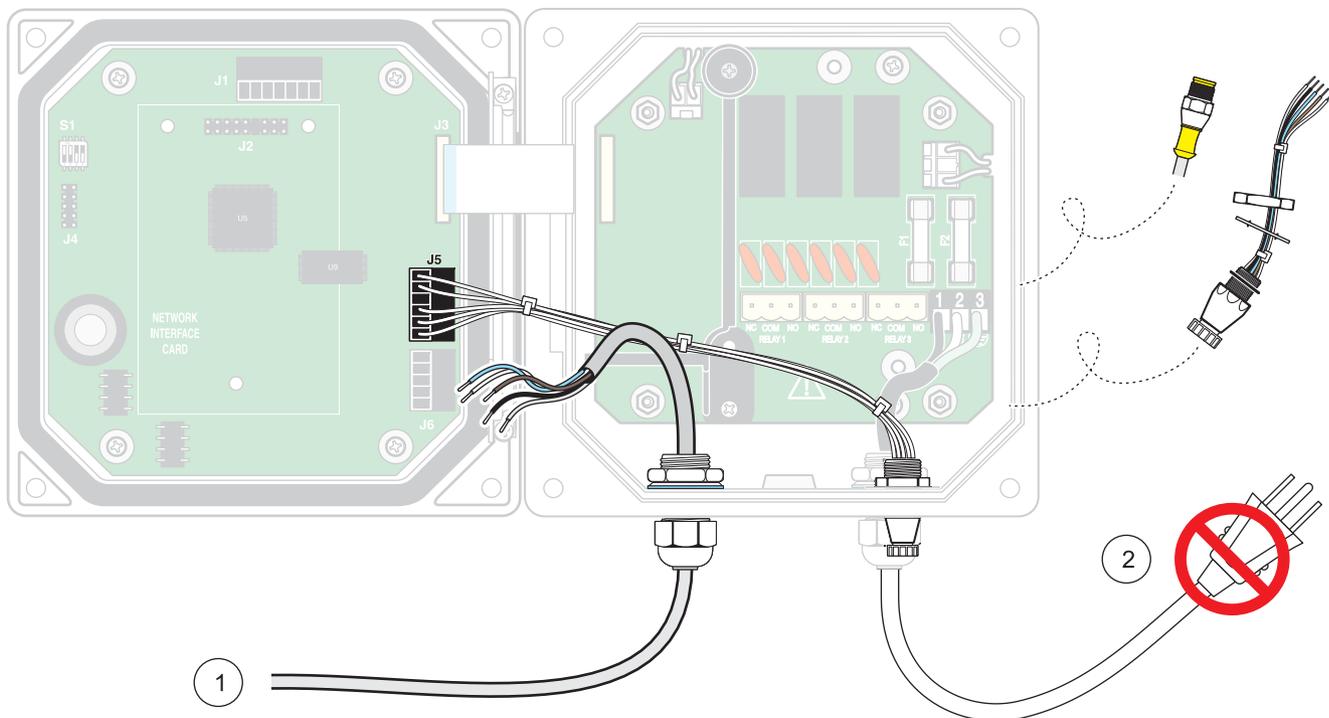


Figure 10 Hard-wiring the sensor (only sc100)

1 From probe	2 Disconnect power
---------------------	---------------------------

Table 1 Terminal block J5 connections

Terminal number	Terminal assignment	Wire color
1	Data (+)	blue
2	Data (-)	white
3	Service request	No connection
4	+12 V-DC	brown
5	Circuit common	black
6	Shield	Shield (grey wire on existing quick-connect fitting)

Section 4 Operation

4.1 Using an sc controller

Before using the sensor in combination with an sc controller, refer to the controller user manual for navigation information.

4.2 Sensor setup

When a sensor is installed for the first time, the serial number of the sensor is displayed as the sensor name. The sensor name can be changed as follows:

1. Select **MAIN MENU**.
2. From the Main Menu, select **SENSOR SETUP** and confirm.
3. Select the appropriate sensor if more than one sensor is attached and confirm.
4. Select **CONFIGURE** and confirm.
5. Select **EDIT NAME** and edit the name. Confirm or cancel to return to the Sensor Setup menu.

4.3 Sensor data logging

The sc controller provides a data log and an event log for each sensor. The data log contains the measured data at selected intervals. The event log contains a large number of events that occur on the instruments, such as configuration changes, alarms and warnings, etc. The data log and the event log can be exported to CSV format. The logs can be downloaded through the digital network port, service port, or the IrDA port. DataCom is needed for downloading logs to a computer. For information on downloading the logs, refer to the sc controller user manual.

4.4 Sensor diagnostics menu

SELECT SENSOR	
ERROR LIST	Displays all actual error messages.
WARNING LIST	Displays all actual warnings.

4.5 Sensor setup menu

SELECT SENSOR (if there is more than one sensor)

CALIBRATE	
SENSOR CODE	Enter sensor cartridge code. Select ACTIVATE or EXIT. ACTIVATE: start the sensor code calibration.

4.5 Sensor setup menu (continued)

CALIBRATE (continued)	
MATRIX CORR	Inline correction to the sample matrix. You can correct up to two points with wide as possible differences at different times. Select 1ST POINT or 2ND POINT or STATUS or EXIT.
	1ST POINT: 1st correction point. Select MEAS CONC or EDIT CONC. MEAS CONC: Store the current value to the time of sampling for the reference value (1st correction point). Select SLOPE CORR or OFFSET CORR. SLOPE CORR: Only after 2 point correction: Re-correction of 1st correction point; 2nd correction point retains unchanged OFFSET CORR: offset of 2 point correction by an additive value; potassium value can be adjusted too EDIT CONC: edit the value referring to lab analytic
	2ND POINT: 2nd correction point. Select MEAS CONC or EDIT CONC. MEAS CONC: Store the current value to the time of sampling for the reference value (2nd correction point) EDIT CONC: edit the value referring to lab analytic. Select ACCEPT or IGNORE
	STATUS: shows status of matrix correction
PREVIOUS CAL	Shows data of previous calibration. Select ACTIVATE or EXIT.
	ACTIVATE: re-activate previous calibration
CAL DATA	AMMONIUM: calibration data for Ammonium
	POTASSIUM: calibration data for Potassium
	mV MATRIX CORR: calibration data for matrix correction
	SENSOR CODE: shows sensor code
	mV SENS CODE: mV reading of sensor code
	PRECIOUS CAL: calibration data of previous calibration
	CALIBRATE: link to calibration menu
CONFIGURE	
AIRBLAST	Choose interval for automatic cleaning /test mode (every 2 minutes compressor is active for 10 seconds)
AIRBLAST HOLD	Choose delay time until all outputs (display, mA output...) show the actual value after airblaster is switched off
K+ COMPENSAT.	Activate/deactivate Potassium compensation
LOG SETUP	Choose logger interval
EDIT NAME	Edit name up to 10-digit in combination of numbers and letters
SET °C OR °F	Choose temperature unit °C or °F
RESET CONFIGURE	Reset the configuration to factory setting
DIAG/TEST	
PROBE INFO	Information of connected sensor. Select SERIAL NUMBER or SOFTWARE VERS. or DRIVER VERS
	SERIAL NUMBER: serial number of connected sensor SOFTWARE VERS: Software Version DRIVER VERS: Driver version

4.5 Sensor setup menu (continued)

DIAG/TEST (continued)	
CAL DATA	Calibration data. Select AMMONIUM, POTASSIUM, mV MATRIX CORR, SENSOR CODE, mV SENSOR CODE, PREVIOUS CAL or CALIBRATE.
	AMMONIUM: calibration data for Ammonium
	POTASSIUM: calibration data for Potassium
	mV MATRIX CORR: calibration data for matrix correction
	SENSOR CODE: shows sensor code
	mV SENSOR CODE: mV reading of sensor code
	PREVIOUS CAL: calibration data of previous calibration
	CALIBRATE: link to calibration menu
SERVICE	Service menu. Select TEST CARTRIDGE or ENTER PASSCODE.
	TEST CARTRIDGE: Sensor check with test cartridge
	ENTER PASSCODE: passcode protected service menu

4.6 Calibration

The membranes used on the ion-selective electrodes are not 100% selective due to other substances that may affect the measurement.

Potassium has the largest interference effect on the ammonium membrane, this problem is compensated in the NH4D sc sensor using the integrated potassium electrode.

CARTRICAL™ is a compact sensor cartridge with three electrodes, which are perfectly factory calibrated to each other.

Cross sensitivities between ammonium and potassium are automatically eliminated. Solids do not interfere with the measurement. NH4D sc is calibration-free. Due to matrix effects calibration and validation can not be performed with standard solutions. A matrix correction can be carried out quickly and easily at any time.

The manufacturer recommends performing a matrix correction in the water to be measured to compensate for other interferences earliest after 12 hours in operation. Optional 1- or 2-point inline matrix correction adapts sensor to the waste water matrix.

4.6.1 Sensor code calibration

When activating a new sensor cartridge or during initial calibration, the sensor code must be entered. By default the sensor code is FFFFFFFFFFFFFFFFFF. But with this code the sensor is not ready for operation. The sensor code is a 16 character code (letters and numbers) and will be supplied with the sensor cartridge certificate. The code contains the factory calibration for the sensor cartridge which includes a multi-point ammonium and potassium calibration and the cross sensitivity of potassium on ammonium and vice versa.

When the code is entered, the sensor is completely calibrated.

To change the sensor code:

1. Select **SENSOR SETUP>NH4D SC>CALIBRATE>SENSORCODE.**
2. Enter the 16-character sensor code.
3. Confirm to activate the sensor code.

All old calibration data are now overwritten with the new calibration data from the sensor code. The sensor code data are checked by the system. If an error is indicated, check the sensor code and if necessary repeat the entry of the sensor code.

Note: When the sensor code is entered, the matrix correction can be reset to the factory calibration at any time.

4.6.2 Matrix correction overview

The laboratory reference value

At the time of sampling for a laboratory reference value, the actual measured value will be stored.

The laboratory value (reference value) of the water sample will be stored as ammonium nitrogen (NH₄-N). This reference value replaces the prior value measured by the sensor.

Ammonium matrix correction

The ammonium matrix correction can be a 1-point or 2-point matrix correction. Both calibration points can be adjusted in any order and can be selected as a high or low point.

For a 1-point matrix correction the matrix is compensated. This procedure can be used for a relatively constant matrix, as well as for an ammonium concentration with little fluctuation.

Use a 2-point matrix correction when the matrix changes and with large fluctuations in ammonium concentration. The 2-point matrix correction increases the measurement accuracy over a larger measuring range, and the matrix is used at both low and high concentrations.

The selected points should be at concentrations as far apart as possible.

Potassium matrix correction

The potassium value can be corrected only in conjunction with the first correction point. Determine the potassium value in the laboratory from the same sample. However, correction is only

recommended in case of deviations more than 10 mg/L K⁺ between displayed value and laboratory result.

Note: If there is no possibility to determine potassium in the laboratory, confirm the potassium value the sensor provides.

4.6.3 Matrix correction

4.6.3.1 Determine the first point for matrix correction

After the actual measured value is stored, proceed as follows:

1. Select **SENSOR SETUP>NH4D SC>CALIBRATE>MATRIX CORR>1ST POINT>MEAS CONC.**

1ST POINT	
NH4-N:	XX.X mg/L
DRIFT	X.XX mV
PRESS ENTER	

The actual measured value for ammonium is displayed. The drift indicates whether the measured value is stable. A value below 1 mV is acceptable.

2. Confirm the actual value for ammonium.

1ST POINT	
K+:	XX.X mg/L
DRIFT	X.XX mV
PRESS ENTER	

The actual measured value for potassium is displayed. The drift indicates whether the measured value is stable. A value below 1 mV is acceptable.

3. Take a water sample for laboratory analysis as close as possible to the sensor.
4. Confirm the actual value for potassium.

The values for ammonium and potassium are stored now.

5. Analyze the sample immediately after taking the sample as their content will change quickly.

4.6.3.2 Correction with reference values

After determining the laboratory reference value(s), proceed as follows:

1. Select **SENSOR SETUP>NH4D SC>CALIBRATE>MATRIX CORR>1ST POINT>EDIT CONC.**

SET NH4-N CONC1
(+X.Y)
mg/L

2. Enter the laboratory (reference) value measured for NH₄-N. Confirm to calibrate the value.

Operation

SET K+ CONC1

(+X.Y)
mg/L

The stored potassium value appears.

3. Enter the potassium laboratory (reference) value and confirm. The saved value is calibrated with the entered value or confirm to retain the saved value.
4. Confirm to activate the 1st point matrix correction.

MATRIX CORR

NH4-N	X.Ymg/L
CORR	X.Y
K+	X.Ymg/L
SLOPE	XX.Y

After the values are confirmed the new correction data appears.

Note: CORR refers to NH4-N, SLOPE refers to K+.

4.6.3.3 Determine a 2nd correction point

To correct a 2nd point, choose a time when the ammonium concentration is significantly higher or lower. This procedure has to be performed within one week of 1st point correction.

1. Follow steps 1–4 of section [4.6.3.1 Determine the first point for matrix correction on page 21](#).

MATRIX CORR

1ST POINT
2ND POINT
STATUS
EXIT

2. Select **2ND POINT**.

3. Proceed as described for matrix correction point 1.

Note: There is no 2nd correction point for potassium.
If the ammonium differences between the 1st and 2nd correction point is too close, it is displayed "DIFFERENCES TO 1ST POINT CONC TOO LOW".

4. Confirm to activate the 2nd point matrix correction.
5. Select **ACCEPT** to activate the matrix correction.
6. Select **IGNORE** to discard it. The previous correction is still active.

4.6.3.4 1st correction point adjustment

1ST POINT

SLOPE CORR
OFFSET CORR

If a complete 2nd point matrix correction has been carried out and the 1st point needs to be adjusted, choose one of the following options:

SLOPE CORR: Correction of slope

OFFSET CORR: Offset and potassium value can be adjusted

Note: OFFSET CORR is recommended for stable processes with little variation.

4.6.3.5 Status of matrix correction

To check the status of the matrix correction, proceed as follows:

1. Select **SENSOR SETUP>NH4D SC>CALIBRATE>MATRIX CORR>STATUS**.

STATUS	
1st P.:	01/01/00
CONC:	X.Y mg/L
2nd P.:	01/01/00
CONC:	X.Y mg/L

Date and concentration values for the 1st and the 2nd matrix correction are displayed.

Section 5 Maintenance

Important Note: Only qualified personnel should conduct the tasks described in this section of the manual.

5.1 Maintenance schedule

Maintenance task	30 days ¹	every 6 months
Clean sensor ²	x	
Replace the sensor cartridge ^{3, 4}		x
Check sensor for damage	x	
Check measured value by lab reference analysis and correct values by inline matrix correction if required (as stipulated by the related authorities) ³	x	

¹ Recommendation: weekly during the first month in operation

² The frequency of cleaning depends on the application. In some applications more or less frequent cleaning may be necessary.

³ In typical operating conditions; a different interval may be required depending on the specific application and local conditions.

⁴ Sensor cartridges are wear parts and are not covered by the instrument warranty.

Note: Do not check the sensor with usual $\text{NH}_4\text{-N}$ standard solutions, because only calibration solutions with artificial matrix generate plausible measurements.

5.2 Clean the sensor

Important Note:

Do not touch the membranes with fingers.

Do not clean the sensor cartridge with sharp objects that may cause scratches and do not use any chemical cleaning agent.

1. Clean the sensor cartridge with the soft brush supplied.
2. Clean the sensor body with a sponge or brush.
3. Rinse the sensor with clean warm water.

5.3 Replace the sensor cartridge

The sensor cartridge is replaced as described below and in [Figure 11 on page 26](#).

1. Clean the sensor and thoroughly dry the sensor cartridge and the sensor adapter.
2. Unscrew the locking ring and remove.

Important Note: Sensor cartridge has to direct downwards. Take care of contacts between sensor and sensor cartridge. The contacts have to remain dry.

3. Pull the sensor cartridge out of the sensor adapter and dispose off the old sensor cartridge per applicable regulations.
4. Ensure that the new opaque gasket is installed during every cartridge replacement.
5. Insert the new sensor cartridge in the sensor adapter.

Important Note: The sensor cartridge only fits correctly in the sensor adapter in one position. Pay attention to the markings on the sensor cartridge and on the sensor adapter.

6. Insert the locking ring over the sensor cartridge and hand-tighten.

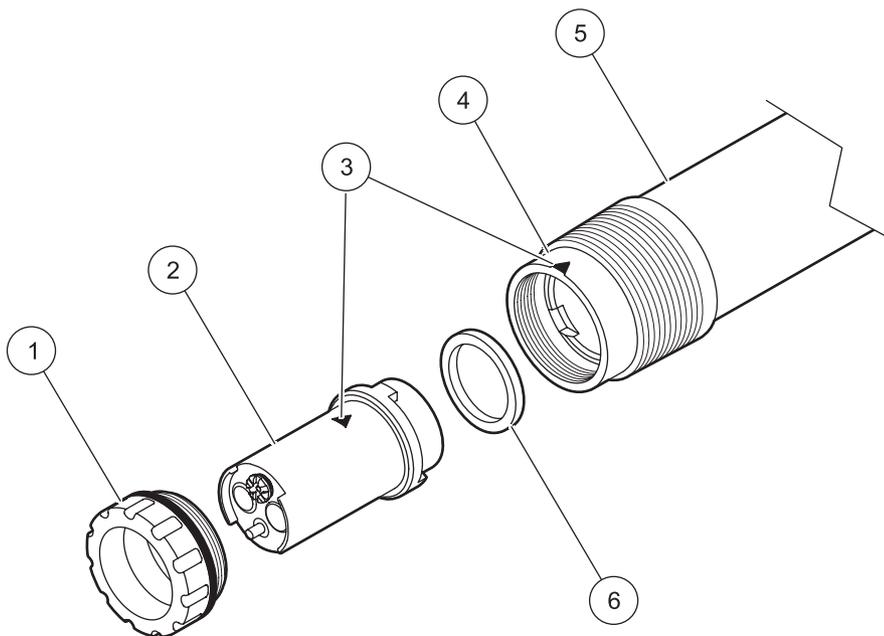


Figure 11 Sensor cartridge replacement

1	Locking ring	4	Sensor adapter
2	Sensor cartridge	5	Sensor housing
3	Markings	6	Opaque gasket

5.4 Storage

Remove the sensor from the sample flow and clean the sensor thoroughly.

Short term storage

Keep the membranes and the salt bridge moist. This will help avoid long response times when placing the sensor back in the sample flow, or the correct operation of the sensor is not guaranteed anymore.

Long term storage

Important Note: Use the delivered storage container, fill with drinking water (NO DISTILLED WATER) and ensure that the sensor cartridge remains wet.

Check the membranes and ensure they are still moist every 2–4 weeks, depending on environmental conditions.

Note: A storage container is supplied to keep the sensor cartridge moist. Keep sensor cartridge capped within the storage container during short and long term storage. Refer to [Section 1 Specifications on page 3](#) for storage temperatures.

Note: Black gasket is needed for sealing function. Refer to [Figure 6 on page 11](#).

Sensor and sensor cartridge

Note: Take care of contacts between sensor and sensor cartridge. The contacts have to be dry. Store in a dry place.

Section 6 Troubleshooting

6.1 Error messages

When the sensor is experiencing an error condition, the sensor reading on the measurement screen will flash and the relays and analog outputs associated with this sensor will be held. Errors are defined in [Table 2](#).

Table 2 Error Codes

Displayed Errors	Definition	Resolution
OFFSET LOW	Offset is too low	Refer to 6.3.2 Troubleshooting during calibration on page 33 .
OFFSET HIGH	Offset is too high	
SLOPE LOW	Slope is too low	
SLOPE HIGH	Slope is too high	
BLANK RANGE!	Blank is out of range	
K+ CAL NOT OK!	Multiple calibration failure	
NH4 CAL NOT OK!	Multiple calibration failure	
K+ CROSS!	Cross sensitivity of potassium is out of range	
NH4 CROSS!	Cross sensitivity of ammonium is out of range	
SENS CODE!	Sensor code calibration failure	
NH4 mV RANGE!	Ammonium mV value is out of range	Refer to 6.3.1 Troubleshooting during operation on page 32 .
K+ mV RANGE!	Potassium mV value is out of range	
TEMP OUT RANGE	Temperature is out of range	
PHD OUT RANGE!	pHD reference value is out of range	

6.2 Warnings

A sensor warning will leave all menus, relays and outputs functioning normally, but will cause a warning icon to flash.

Warnings may be used to trigger a relay and users can set warning levels to define the severity. Warnings are defined in [Table 3](#).

Table 3 Warning Codes

Displayed warnings	Definition	Resolution
OFFSET LOW	Offset is low	Refer to 6.3.2 Troubleshooting during calibration on page 33 .
OFFSET HIGH	Offset is high	
SLOPE LOW	Slope is low	
SLOPE HIGH	Slope is high	
BLANK RANGE!	Blank is close to limit	
K+ CAL NOT OK!	Multiple calibration warning	
NH4 CAL NOT OK!	Multiple calibration warning	
K+ CROSS!	Cross sensitivity of potassium is close to limit	
NH4 CROSS!	Cross sensitivity of ammonium is close to limit	
NH4 mV RANGE!	Ammonium mV value is close to limit	
K+ mV RANGE!	Potassium mV value is close to limit	
TEMP OUT RANGE	Temperature is close to limit	
PHD OUT RANGE!	pHD reference value is close to limit	

6.3 Measurement values troubleshooting

Sympton	Corrective action
Incorrect measurement values	Clean the sensor cartridge using a brush and/or rinse the sensor cartridge with clean water (without cleaning agents) and wipe the sensor cartridge carefully with a soft clean cloth.
Continous incorrect measurement values	<p>Check the calibration data of ammonia and potassium</p> <ol style="list-style-type: none">1. Select: SENSOR SETUP>DIAG/TEST>CAL DATA>AMMONIUM resp. POTASSIUM<ul style="list-style-type: none">• If OKAY is not displayed select CALIBRATE>SENSOR CODE>ACTIVATE to activate the sensor code calibration and carry out a 2nd point matrix correction (see section 4.6.3.3 on page 22).• If OKAY is displayed carry out a 1st point matrix correction (see section 4.6.3.1 on page 21). Optional a 2nd point matrix correction, (see section 4.6.3.3 on page 22) can also be performed.2. Check measurement values again.

<p>Continous incorrect measurement values (continued)</p>	<p>Check the contacts of the sensor cartridge (contacts have to be dry).</p> <ol style="list-style-type: none"> 1. Remove the locking ring (see Figure 6 on page 11). <p>Note: <i>The sensor must be directed downwards!</i></p> <ol style="list-style-type: none"> 2. Remove the sensor cartridge and check if the opaque gasket is in place. Check carefully if the contacts are dry. 3. If the contacts are wet <ul style="list-style-type: none"> • Dry the contacts with a tissue. • Check again if the opaque gasket is still in place. • Clean the sensor cartridge thread. • Reassemble the sensor cartridge. 4. Check measurement values again (only in case contacts are wet). <ul style="list-style-type: none"> • If the measurement values are still incorrect, remove the sensor cartridge and dry the sensor in a warm room over night. <p>Important Note: <i>Keep membranes of the sensor cartridge wet in a small beaker! Refer to section 5.4 on page 27.</i></p> <ul style="list-style-type: none"> • If the measurement values are still incorrect contact our service department. 																
	<p>Check the sensor electronic by using the test cartridge (Cat. No.:6188300)</p> <ol style="list-style-type: none"> 1. Select: SENSOR SETUP>DIAG>TEST>SERVICE>TEST CARTRIDGE 2. Compare the displayed values with the guide values. The displayed values should be in the same range like the guide values below: <table border="0"> <tr> <td></td> <td>SIGNAL –226.2 mV</td> </tr> <tr> <td>AMMONIUM:</td> <td>MEAS 2274.4 mV</td> </tr> <tr> <td></td> <td>REF 2500.6 mV</td> </tr> <tr> <td></td> <td>WAIT STABILIZING</td> </tr> <tr> <td></td> <td>SIGNAL –2.9 mV</td> </tr> <tr> <td>POTASSIUM:</td> <td>MEAS 2497.7 mV</td> </tr> <tr> <td></td> <td>REF 2500.6 mV</td> </tr> <tr> <td>TEMP:</td> <td>TEMP 24.8 °C/76.6 °F</td> </tr> </table> <ul style="list-style-type: none"> • If the test cartridge data are within range, the sensor electronics are functional. • If the test cartridge data are not within range contact our service department. 		SIGNAL –226.2 mV	AMMONIUM:	MEAS 2274.4 mV		REF 2500.6 mV		WAIT STABILIZING		SIGNAL –2.9 mV	POTASSIUM:	MEAS 2497.7 mV		REF 2500.6 mV	TEMP:	TEMP 24.8 °C/76.6 °F
		SIGNAL –226.2 mV															
AMMONIUM:	MEAS 2274.4 mV																
	REF 2500.6 mV																
	WAIT STABILIZING																
	SIGNAL –2.9 mV																
POTASSIUM:	MEAS 2497.7 mV																
	REF 2500.6 mV																
TEMP:	TEMP 24.8 °C/76.6 °F																
<p>Replace the Sensor Cartridge</p> <p>If the measurement values are still incorrect the sensor cartridge (Cat.-No.: 6188400) must be replaced (see section 5.3 on page 25).</p>																	

6.3.1 Troubleshooting during operation

Sympton	Corrective action
Measurement values not feasible/stable or operation errors/warnings	Verify that the installation is suitable (e.g. air bubbles, submersion depth, installation angle, sample composition, flow rate, temperature...).
	Verify that membranes are clean. If not, clean the sensor cartridge using a soft brush (provided with sensor) and/or rinse the sensor with clean water (without cleaning agents) and wipe the sensor carefully with a soft clean cloth.
	Verify that cleaning unit/High Output Air Blast is functional (if used). 1. Select: SENSOR SETUP>CONFIGURE>AIRBLAST>TEST MODE or refer to corresponding instruction sheets/manuals
	Check calibration data of ammonium and potassium. 1. Select: SENSOR SETUP>DIAG/TEST>CAL DATA>AMMONIUM resp. POTASSIUM <ul style="list-style-type: none"> • If OKAY is not displayed select CALIBRATE>SENSOR CODE>ACTIVATE to activate the sensor code calibration and carry out a 1st point matrix correction (see section 4.6.3.1 on page 21). • If OKAY is displayed carry out a 1st point matrix correction (see section 4.6.3.1 on page 21). Optional a 2nd point matrix correction, (see section 4.6.3.3 on page 22) can also be performed. 2. Check measurement values again.
	Check age of sensor cartridge (last 4 digits of serial number MMY). If the sensor cartridge is older than 18 months of that date it must be replaced.
	Check the contacts of the sensor cartridge (contacts have to be dry). 1. Remove the locking ring (see Figure 6 on page 11). <i>Note: The sensor must be directed downwards!</i> 2. Remove the sensor cartridge and check if the opaque gasket is in place. Check carefully if the contacts are dry. 3. If the contacts are wet <ul style="list-style-type: none"> • Dry the contacts with a tissue. • Check again if the opaque gasket is still in place. • Clean the sensor cartridge thread. • Reassemble the sensor cartridge. 4. Check measurement values again (only in case contacts are wet). <ul style="list-style-type: none"> • If the measurement values are still incorrect, remove the sensor cartridge and dry the sensor in a warm room over night. <i>Important Note: Keep membranes of the sensor cartridge wet in a small beaker! Refer to section 5.4 on page 27.</i> 5. If the measurement values are still incorrect contact our service department.

<p>Measurement values not feasible/stable or operation errors/warnings</p>	<p>Check the sensor electronic by using the test cartridge (Cat. No.: 6188300).</p> <ol style="list-style-type: none"> 1. Select: SENSOR SETUP>DIAG/TEST>SERVICE>TEST CARTRIDGE 2. Compare the displayed values with the guide values. The displayed values should be in the same range like the guide values below: <ul style="list-style-type: none"> AMMONIUM: SIGNAL -226.2 mV MEAS 2274.4 mV REF 2500.6 mV WAIT STABILIZING POTASSIUM: SIGNAL -2.9 mV MEAS 2497.7 mV REF 2500.6 mV TEMP: TEMP 24.8 °C/76.6 °F <ul style="list-style-type: none"> • If the test cartridge data are within range, the sensor electronics are functional. <ul style="list-style-type: none"> TEST CARTRIDGE TEST CARTRIDGE OKAY PRESS ENTER • If test cartridge check is not successful, contact our service department <ul style="list-style-type: none"> TEST CARTRIDGE TEST CARTRIDGE FAIL! PRESS ENTER
	<p>If measurement values are still not feasible, replace the sensor cartridge (Cat. No.: 6188400). Perform a sensor code calibration and optional 1st point or 2nd point matrix correction. Refer to 4.6.3 Matrix correction on page 21.</p>

6.3.2 Troubleshooting during calibration

Calibration errors/warnings

1. SENS CODE>NH4 CROSS>K+ CROSS>BLANK RANGE

- Based on the certificate, verify that the sensor code is entered correctly.
- If "FFFFFFFFFFFFFFFF" appears, no sensor code has been entered
- If sensor code was entered correctly, contact service department

2. OFFSET LOW>OFFSET HIGH>SLOPE LOW>SLOPE HIGH>K+ CAL NOT OK>NH4 CAL NOT OK

- Refer to [6.3.1 Troubleshooting during operation on page 32](#).

Section 7 Replacement Parts and Accessories

7.1 Spare parts

Description	Catalog number
User manual	DOC027.53.00745
NH4D sc (Sensor with 10 m (32.8 ft.) integral cable and one pre-calibrated Sensor Cartridge)	LXV437.99.00002
Calibrated sensor cartridge ¹	6188400
Cleaning brush	6183600
Locking ring kit	6176900
Opaque gasket	HZD176

¹ Sensor cartridges are wearing parts that are not covered by the instrument warranty.

7.2 Accessories

Description	Catalog number
Cleaning Unit	LZY331
Rail Mount Kit	6184900
Chain Mount Kit	LZX914.99.12400
High Output Air Blast 115 V version	6174100
High Output Air Blast 230 V version	6174200
Test cartridge	6188300

7.3 Corresponding Documentation

Description	Catalog number
Instruction sheet Cleaning Unit	DOC306.53.00747
Instruction sheet Rail Mounting	DOC306.53.00145
Instruction sheet Chain Mounting	DOC306.53.00147
Manual HOAB	DOC027.53.00746
Manual sc100	DOC023.52.00032
Manual sc1000	DOC023.52.03260

Section 8 How to Order

There is a template for each company in the #Templates directory. Use the appropriate template for each company/brand (Astro, Radiometer, Lachat, Sigma, HST, Hach Environmental). The follow is for Hach branded products.

U.S.A. Customers

By Telephone:

6:30 a.m. to 5:00 p.m. MST
Monday through Friday
(800) 227-HACH (800-227-4224)

By Fax:

(970) 669-2932

By Mail:

Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389 U.S.A.

Ordering information by e-mail: orders@hach.com

Information Required

- Hach account number (if available)
- Billing address
- Your name and phone number
- Shipping address
- Purchase order number
- Catalog number
- Brief description or model number
- Quantity

International Customers

Hach maintains a worldwide network of dealers and distributors. To locate the representative nearest you, send an e-mail to: intl@hach.com or contact:

Hach Company World Headquarters; Loveland, Colorado, U.S.A.
Telephone: (970) 669-3050; Fax: (970) 669-2932

Technical and Customer Service (U.S.A. only)

Hach Technical and Customer Service Department personnel are eager to answer questions about our products and their use. Specialists in analytical methods, they are happy to put their talents to work for you.

Call 1-800-227-4224 or e-mail techhelp@hach.com

Section 9 **Repair Service**

Authorization must be obtained from Hach Company before sending any items for repair. Please contact the Hach Service Center serving your location.

In the United States:

Hach Company
Ames Service
100 Dayton Avenue
Ames, Iowa 50010
(800) 227-4224 (U.S.A. only)
FAX: (515) 232-3835

In Canada:

Hach Sales & Service Canada Ltd.
1313 Border Street, Unit 34
Winnipeg, Manitoba
R3H 0X4
(800) 665-7635 (Canada only)
Telephone: (204) 632-5598
FAX: (204) 694-5134
E-mail: canada@hach.com

**In Latin America, the Caribbean, the Far East,
Indian Subcontinent, Africa, Europe, or the Middle East:**

Hach Company World Headquarters,
P.O. Box 389
Loveland, Colorado, 80539-0389 U.S.A.
Telephone: (970) 669-3050
FAX: (970) 669-2932
E-mail: intl@hach.com

Section 10 Limited Warranty

Hach Company warrants its products to the original purchaser against any defects that are due to faulty material or workmanship for a period of one year from date of shipment unless otherwise noted in the product manual.

In the event that a defect is discovered during the warranty period, Hach Company agrees that, at its option, it will repair or replace the defective product or refund the purchase price excluding original shipping and handling charges. Any product repaired or replaced under this warranty will be warranted only for the remainder of the original product warranty period.

This warranty does not apply to consumable products such as chemical reagents; or consumable components of a product, such as, but not limited to, lamps and tubing.

Contact Hach Company or your distributor to initiate warranty support. Products may not be returned without authorization from Hach Company.

Limitations

This warranty does not cover:

- Damage caused by acts of God, natural disaster, labor unrest, acts of war (declared or undeclared), terrorism, civil strife or acts of any governmental jurisdiction
- Damage caused by misuse, neglect, accident or improper application or installation
- Damage caused by any repair or attempted repair not authorized by Hach Company
- Any product not used in accordance with the instructions furnished by Hach Company
- Freight charges to return merchandise to Hach Company
- Freight charges on expedited or express shipment of warranted parts or product
- Travel fees associated with on-site warranty repair

This warranty contains the sole express warranty made by Hach Company in connection with its products. All implied warranties, including without limitation, the warranties of merchantability and fitness for a particular purpose, are expressly disclaimed.

Some states within the United States do not allow the disclaimer of implied warranties and if this is true in your state the above limitation may not apply to you. This warranty gives you specific rights, and you may also have other rights that vary from state to state.

This warranty constitutes the final, complete, and exclusive statement of warranty terms and no person is authorized to make any other warranties or representations on behalf of Hach Company.

Limitation of Remedies

The remedies of repair, replacement or refund of purchase price as stated above are the exclusive remedies for the breach of this warranty. On the basis of strict liability or under any other legal theory, in no event shall Hach Company be liable for any incidental or consequential damages of any kind for breach of warranty or negligence.

Section 11 Certification

Interference immunity

The device has been tested with an sc100 and sc1000 controller for electromagnetic compatibility (EMC) in the industrial environment in accordance with the following standard(s):

EN 61326 (EMC Requirements for Electrical Equipment for Measurement, Control and Laboratory Use) per 2004/108/EC: Supporting test records and compliance certification by Hach Company.

Immunity

IEC 1000-4-2 (EN 61000-4-2) Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrostatic discharge immunity test. Basic EMC publication (criterion B)

IEC 1000-4-3 (EN 61000-4-3) Electromagnetic compatibility (EMC). Testing and measurement techniques. Radiated, radio-frequency, electromagnetic field immunity test. Part 4-3 : Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test (criterion A)

IEC 1000-4-4 (EN 61000-4-4) Electromagnetic compatibility (EMC). Testing and measurement techniques. Electrical fast transient/burst immunity test. Basic EMC publication (criterion B)

IEC 1000-4-5 (EN 61000-4-5) Electromagnetic compatibility (EMC). Testing and measurement techniques. Surge immunity test (criterion B)

IEC 1000-4-6 (EN 61000-4-6) Electromagnetic compatibility (EMC). Testing and measurement techniques. Immunity to conducted disturbances, induced by radio-frequency fields (criterion A)

IEC 1000-4-11 (EN 61000-4-11) Electromagnetic compatibility (EMC). Testing and measurement techniques. Voltage dips, short interruptions and voltage variations immunity tests (criterion B)

Emissions

The device has been tested for high frequency emissions in accordance with the following standard(s):

As per EMC directive 89/336/EEC: EN 61326 (Electrical equipment for measurement, control and laboratory use. EMC requirements), class A emission limits. Validation of the test by Hach Company.

EN 61000-3-2 Electromagnetic compatibility (EMC). Limits for harmonic current emissions.

EN 61000-3-3 Electromagnetic compatibility (EMC). Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems connection.

Other test standard(s) in interference emissions:

EN 55011 (CISPR 11), Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment

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