DOC023.53.90137

AN-ISE sc ammonium and nitrate combination sensor

USER MANUAL

07/2010, Edition 1

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Section 1 Specifications

These are subject to change without notice.

General Information	
Measuring method	Potentiometric measurement using ion-selective electrodes (ISE) for ammonium, potassium, nitrate and chloride, reference system
Measuring range	0 to 1000 mg/L [NH_4–N] 0 to 1000 mg/L [K+] 0 to 1000 mg/L [NO_3–N] 0 to 1000 mg/L [Cl^-]
Precision	5% of the measured value + 0.2 mg/L[1] (ammonium and nitrate)
Reproducibility	5% of the measured value + 0.2 mg/L1 (ammonium and nitrate)
Response time (90 %)	< 3 minutes (5 to 50 mg/L NO_3–N/NH_4–N)
Measuring interval	Continuous
pH range	pH 5 to pH 9
Calibration methods	Sensor code for sensor cartridge 1 and 2 point value correction or matrix correction
Power consumption	1 W
Power supply	Via sc controller
Data transfer	Via sc controller
Ambient data	
Typical environment	Used in the biological phase of municipal wastewater treatment
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 at a depth of 0.3 to 3.0 m [1 to 10 ft]; maximum pressure: 0.3 bar (4.4 psi).
Max. Compressed air output during cleaning unit operation	3.1 bar (45 psi)
General information about the probe	
Probe dimensions	320 mm × 84.5 mm (12.6 × 3.3 in.) (Length × Ø) Refer to Figure 1, Page 6.
Length of probe cable	Standard: 10 m [33.8 ft] Extension cables are available as an option in the following lengths: 5, 10, 15, 20, 30, 50 m [16.4, 33.8, 49.2, 65.6, 98.4, 164 ft]. Maximum overall length: 100 m [328 ft]
Probe weight	Approximately 2380 g (63.6 oz)
Wetted materials	Only for immersed installations: Probe: stainless steel (1.4571), ASA + PC, silicon, PVC and PU Sensor cartridge: PVC, POM, ABS, stainless steel (1.4571), NBR Optional cleaning unit: TPE, PUR, stainless steel (1.4571)
Installation angle	45° +/– 15° vertical in flow direction

[1] With standard solutions and ISE electrodes under laboratory conditions

1.1 Dimensions

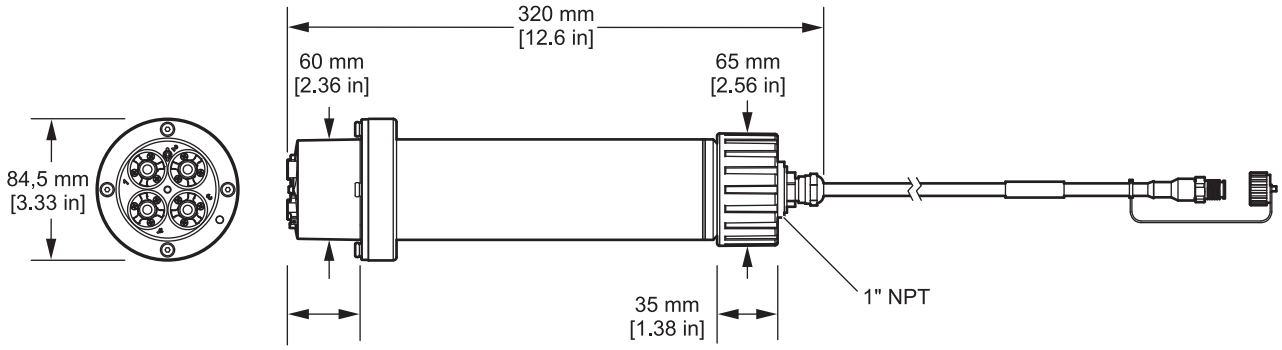

Figure 1 Dimensions of stainless steel probe

Section 2 General Information

2.1 Safety information

Please read the entire operating instructions before the instrument is unpacked, set up or put into operation. 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 make sure that the protection provided by this instrument is not impaired, do not use or install this instrument in any manner other than that specified in these operating instructions.

2.1.1 Hazard information in these operating instructions

⚠DANGER

Indicates a potentially or imminently hazardous situation that, if not avoided, results in death or serious injury.

⚠WARNING

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

⚠CAUTION

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

NOTICE

Indicates a situation that, if not avoided, could result in damage to the instrument. 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 operating instructions.

	This symbol, if noted on the instrument, references the user manual for operation and/or safety information.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems after 12 August 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 manufacturer for disposal at no charge to the user. ***Note:*** *For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment, manufacturer-supplied electrical accessories, and all auxiliary items for proper disposal.*

2.2 General information about the probe

The probe was developed for use in municipal wastewater applications.

The AN-ISE sc probe (please refer to Figure 2) with ion-selective electrodes (ISE probe) is a continuously operating online process probe for directly measuring ammonium and nitrate in reservoirs. It operates without reagents and requires no further processing of the sample. The ammonium/nitrate ions are measured using an ion-selective electrode.

The only wearing part is the sensor cartridge (please refer to Figure 3, Page 9) (order number LZY694). The sensor cartridge consists of the ion-selective electrodes for ammonium and potassium (compensation electrode for ammonium) or nitrate and chloride (compensation electrode for nitrate), a pHD reference system and a temperature sensor for temperature compensation.

An additional cleaning unit designed for automatically cleaning the sensor cartridge membranes can be ordered separately. Refer to the instruction sheet supplied with the cleaning unit.

The manufacturer recommends using the High Output Air Blast system for the compressed air supply (refer to 7.2 Accessories, page 39); this is a compressor in weather-proof plastic housing.

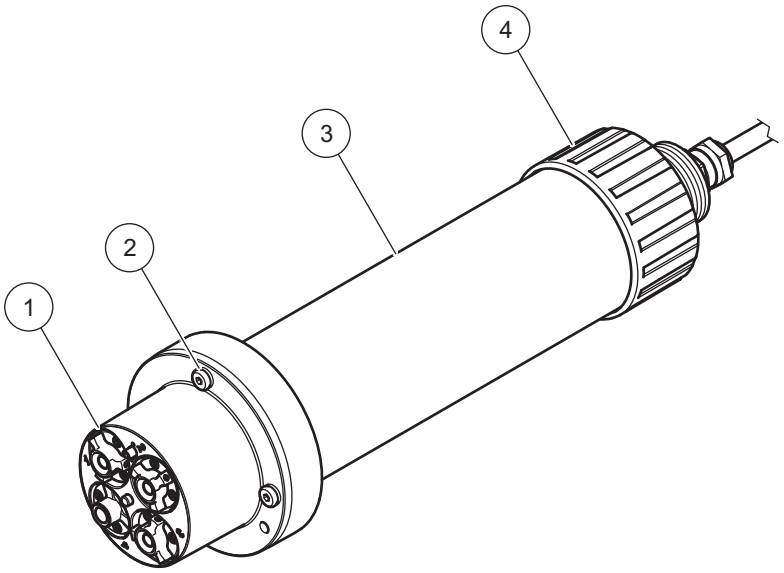

Figure 2 AN-ISE sc probe

1	Sensor cartridge	**3**	Probe body
2	Fixing bolt for sensor cartridge	**4**	Union nut

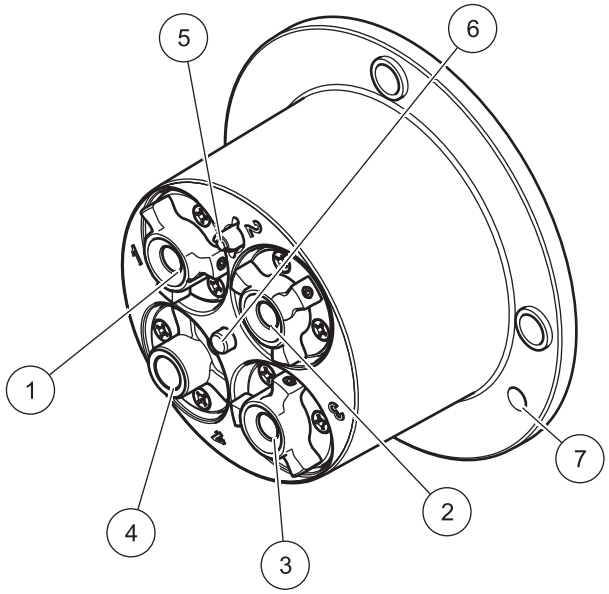

Figure 3 Sensor cartridge

1	Ammonium electrode	**5**	Reference system
2	Nitrate electrode	**6**	Temperature sensor
3	Potassium electrode	**7**	Marker hole for assembling the probe
4	Chloride electrode		

2.3 Theory of operation

The AN-ISE sc probe uses the ion-selective electrode to measure ammonium ions (NH_4^+) and nitrate ions (NO_3^-) in a wastewater sample. Common interfering factors due to potassium, chloride and temperature are compensated for by means of the relevant built-in electrodes. The reference system is designed using pH-differential technology and is therefore particularly stable in terms of drift and contamination.

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 measure a potential difference, a reference system is required that will not be affected by the sample to be measured.

The CARTRICAL™ technology reduces cross sensitivity by calibrating not only the individual electrodes against each other, but also the measuring electrodes with the compensation electrodes and the reference; this is carried out at the factory.

Section 3 Installation

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

3.1 Unpack the probe

Remove the probe from the shipping container and inspect it for damage. Verify that all items listed in Figure 4 are included. If any items are missing or damaged, contact the manufacturer or distributor.

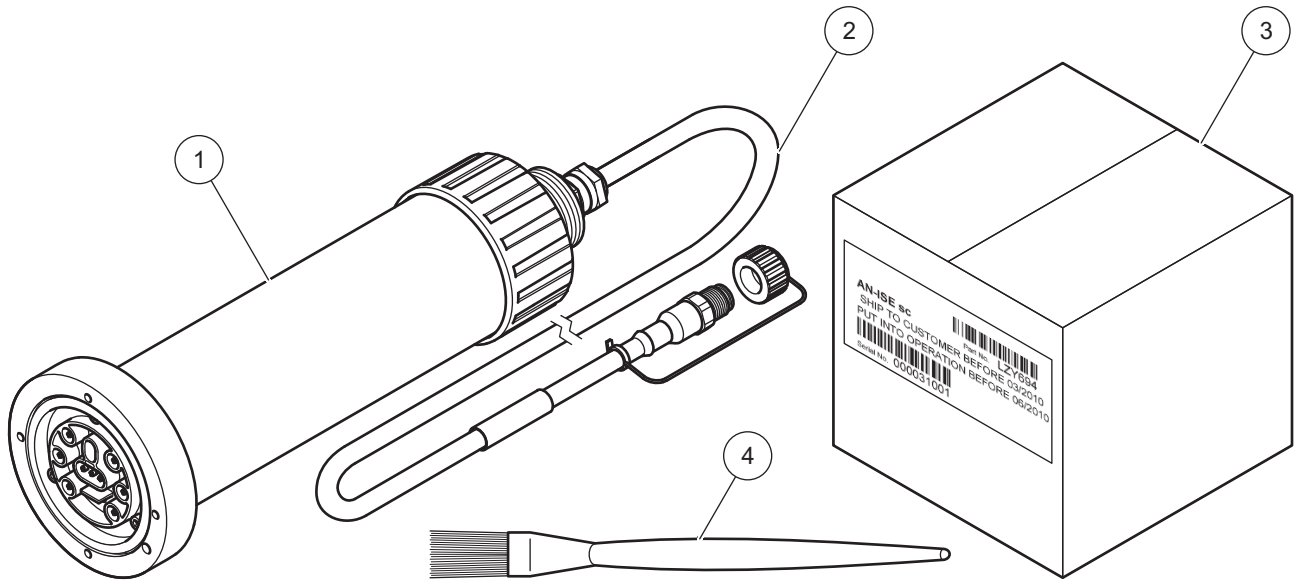

Figure 4 Product contents

1	Probe	**3**	Sensor cartridge packaging
2	Probe cable	**4**	Cleaning brush

3.2 Unpacking the sensor cartridge

NOTICE

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

Make a note of the date on the sensor cartridge certificate. It is not an expiration date, but indicates the optimum date to put the sensor cartridge into operation to ensure a maximum service life.

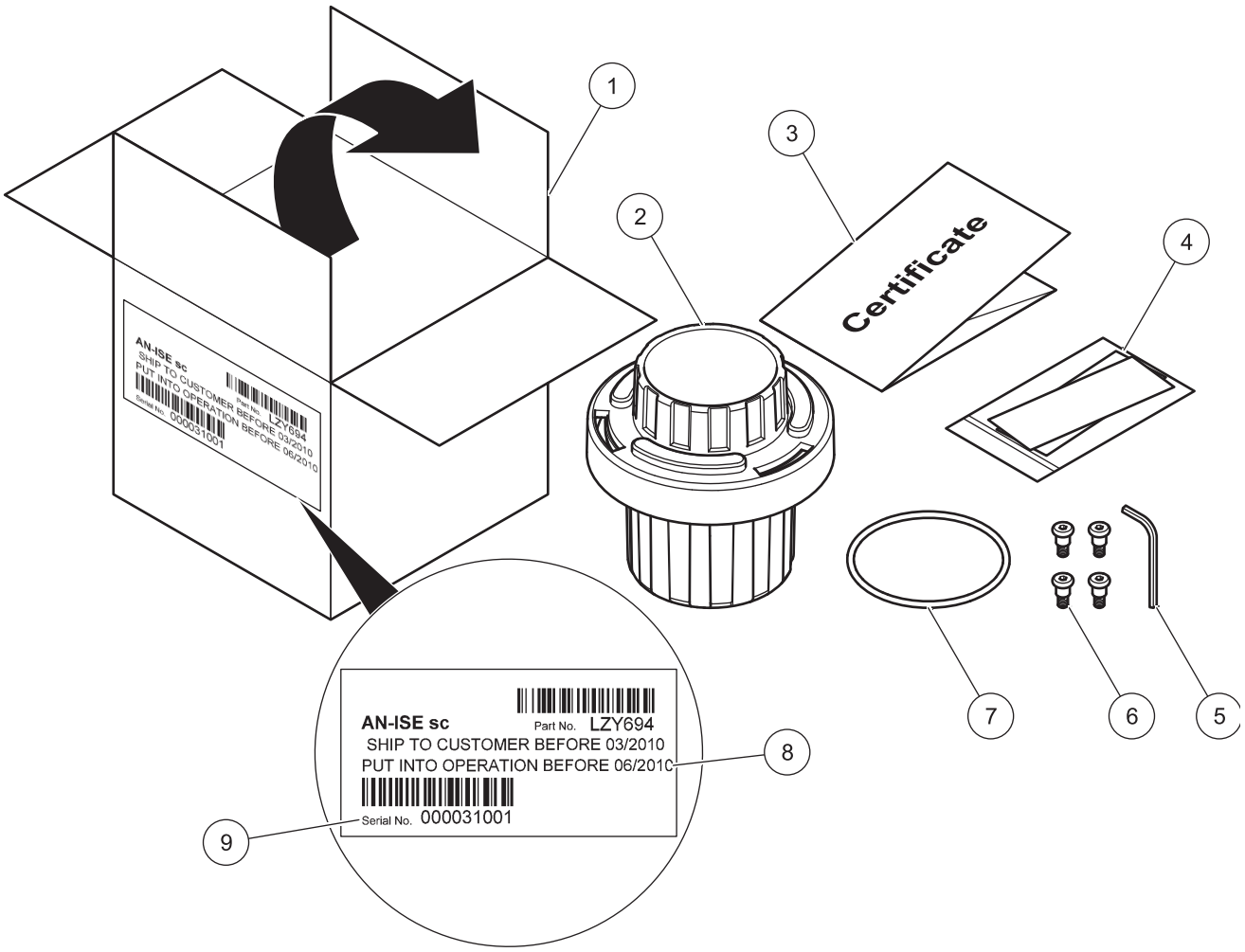

Figure 5 Storage container packaging

1	Sensor cartridge packaging	**6**	Socket head screws
2	Storage container for sensor cartridge	**7**	Black gasket
3	Test certificate for cartridge with sensor code	**8**	Latest date to put into operation
4	Polishing paper for chloride electrode	**9**	Serial Number
5	Socket head wrench		

3.2.1 Assembling the storage container including sensor cartridge

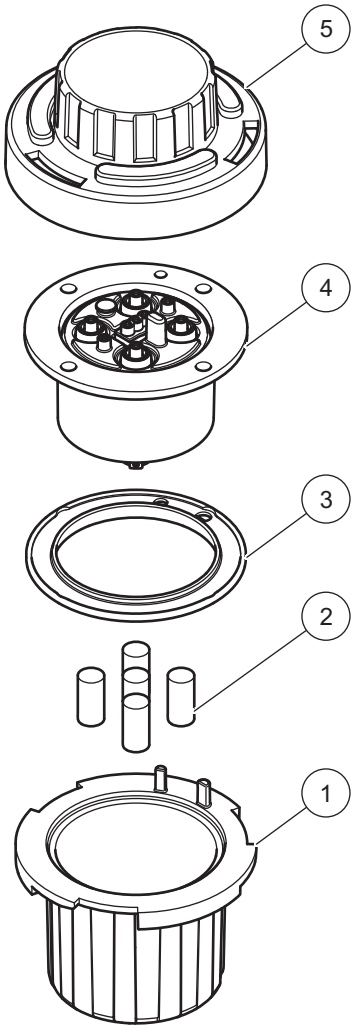

Figure 6 Storage container for sensor cartridge[1]

1	Storage container	**4**	Sensor cartridge
2	Sponges soaked in storage solution	**5**	Lid with bayonet coupling
3	Black gasket		

[1] Save items 1, 2, 3 and 5 for subsequent storage of the sensor cartridge.

3.2.2 Removing the cartridge from the transport container

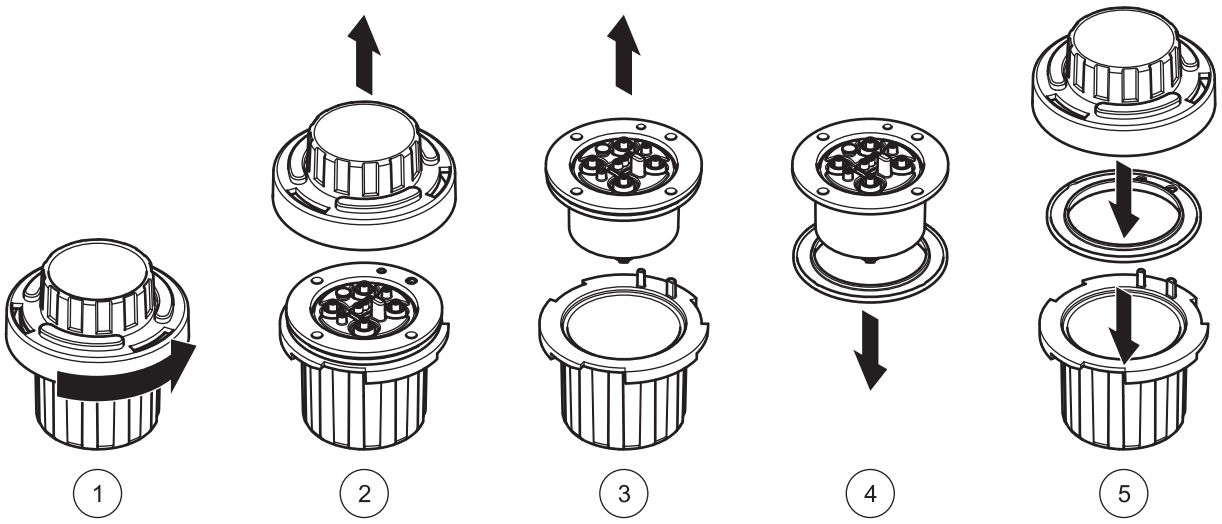

Figure 7 Opening the storage container

1	Release bayonet coupling	**4**	Remove black gasket
2	Remove lid	**5**	Insert black seal in storage container and close the lid.
3	Take out sensor cartridge		

Note: *This black gasket is not required for installation. It is advisable to keep the black gasket in the sensor cartridge storage container.*

NOTICE

The sensor cartridge must not be in contact with the air for more than 30 minutes. Make sure that the electrodes do not dry out.

Please complete the following movement when you have unpacked the cartridge in order to moisten the inside of the membranes.

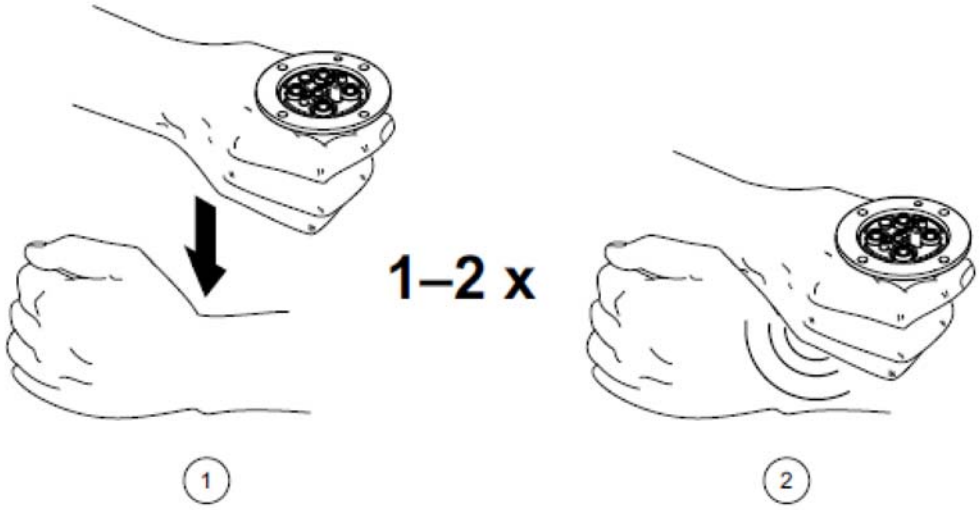

Figure 8 Knocking the air out of the sensor cartridge

1	Hold the sensor cartridge in one hand with the membranes facing downward.	**2**	Now hit sharply downward over your other hand.

3.3 Probe assembly

NOTICE

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

1. Place the black gasket Figure 10, Page 17 in the recess on the sensor body.
2. Make sure that the black gasket is correctly positioned.

NOTICE

The black gasket prevents sensor damage caused by moisture penetration.

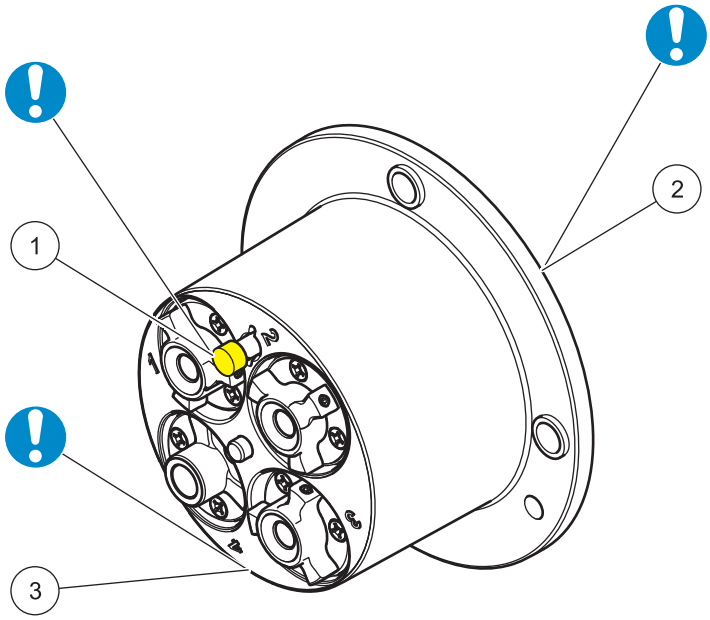

Figure 9 Sensor cartridge

1	Reference system cap	**3**	Front side with membranes
2	Rear side with contacts		

NOTICE

The sensor cartridge must not be in contact with the air for more than 30 minutes.

The contacts in the sensor cartridge must be dry and must not become contaminated.

3. Align the marker hole on the sensor cartridge with the marker hole on the probe adapter (refer to Figure 10, Page 17)
4. Place the 4 socket head screws in the corresponding screw holes and tighten gently with the long side of the wrench. Then cross-tighten the screws by hand with the short side of the wrench. Only use the screws supplied.

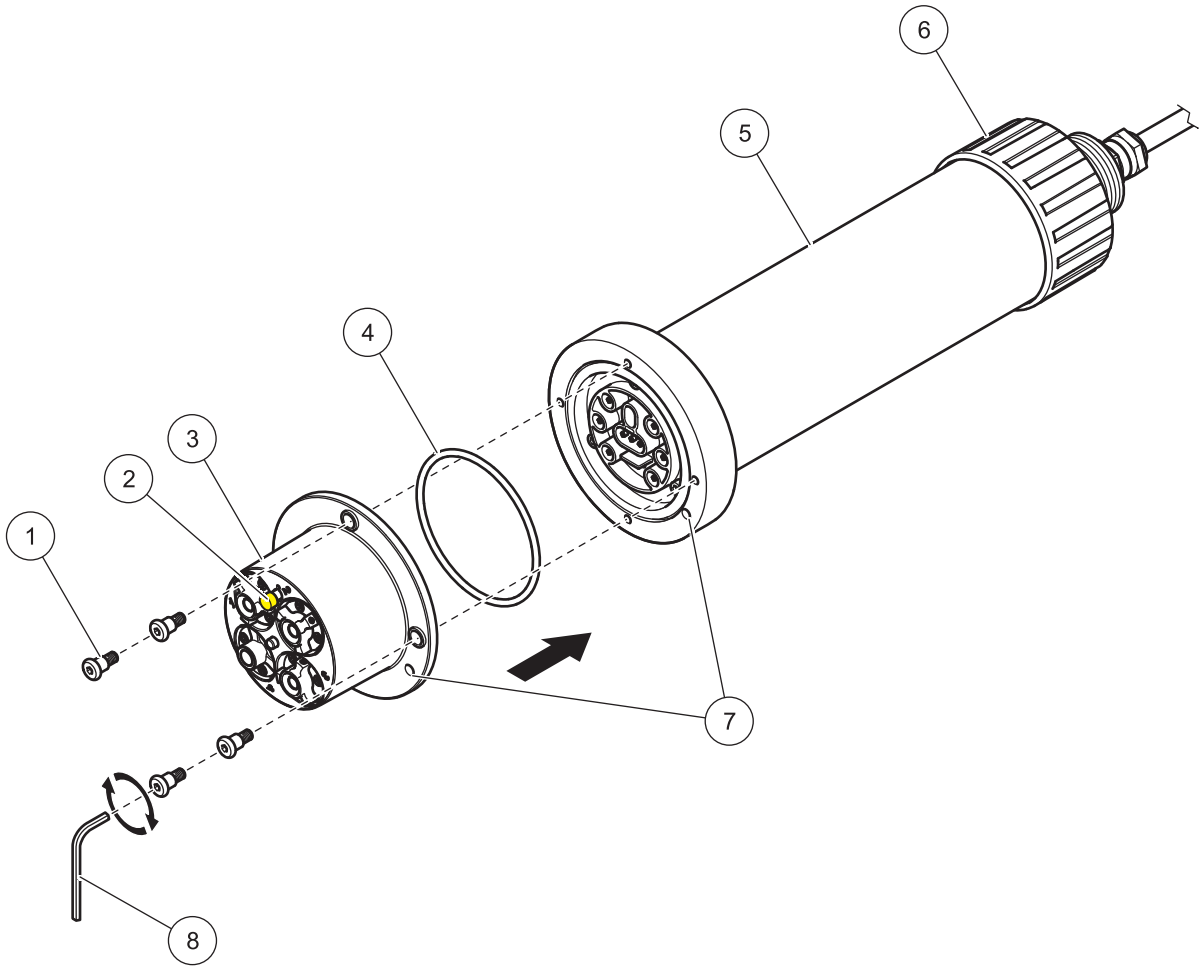

Figure 10 Probe assembly

1	Socket head screw	**5**	Probe housing
2	Reference system cap	**6**	Union nut
3	Sensor cartridge	**7**	Marker hole
4	Black gasket	**8**	Socket head wrench

3.4 Installation of the cleaning unit (optional)

Please refer to the installation instructions for the cleaning unit for information on how to install this on the probe.

Use the relay control on the sc controller to set the cleaning interval.
Select RTC (Real Time Clock) as the signal source. For details on more advanced relay configuration, please refer to the User Manual for the relevant sc controller.

3.5 Installation of the probe in the sample flow

NOTICE

Please handle the sensor cartridge carefully and avoid contact with the membranes when installing the sensor.

There are mounts with separate installation instructions available for installation of the probe, with or without a cleaning unit, to suit a number of different requirements.

Always observe the following prior to installation:

- The probe must be aligned with the bracket, as described in section 3.5.1, page 19.
- Position the probe at a distance of at least 200 mm (7.87 in.) from the tank wall.
- When the probe is attached with a chain mount, make sure that the probe cannot strike the tank wall.
- Immerse the probe at an angle of approx. 45° ± 15°.
- Make sure that the probe is fully immersed.
- When using the cleaning unit refer to the supplied Instruction Sheet.

3.5.1 Position of the probe on the mount

The probe must be attached in a specific position on the mount:

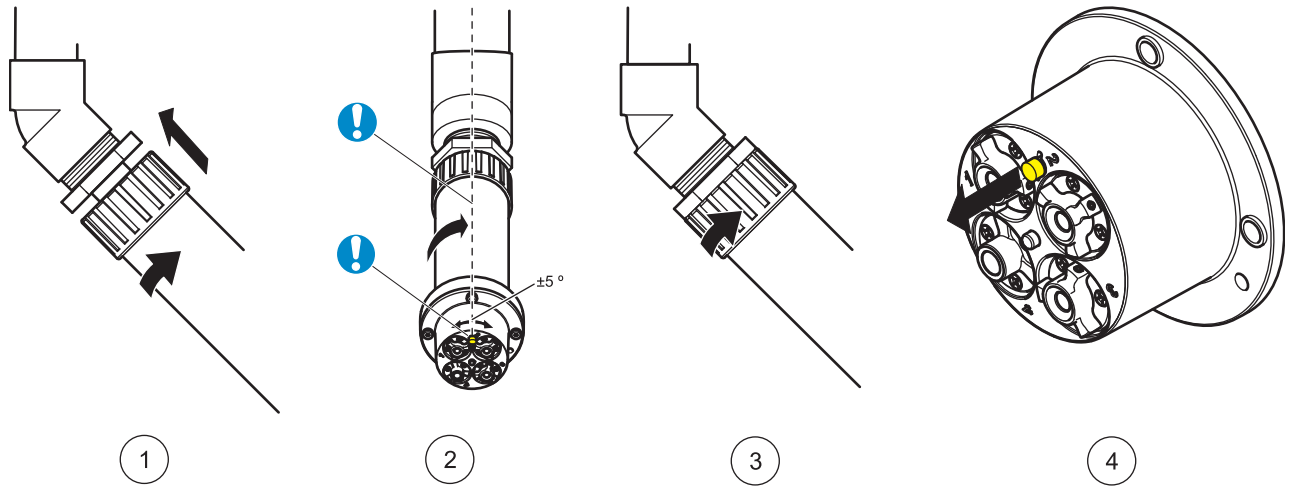

Figure 11 Installing the probe

1	Installation of the AN-ISE sc in the bracket. 45° adapter and transition piece should be preassembled.	**3**	Attaching the aligned probe to the bracket using the union nut
2	Aligning the probe using the colored reference system cap. The salt bridge should be oriented upward (12 o' clock, +/- 5°).	**4**	Removing the reference system cap

3.5.2 Probe installation example

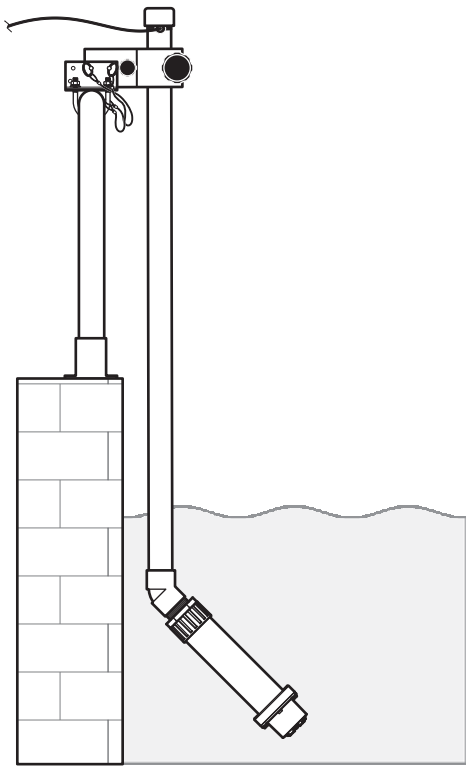

Figure 12 Example of probe installation with rail mount

3.6 Connect the probe to the sc controller (non-hazardous location) with screw fittings

The probe cable is supplied with a screw fitting with reverse polarity protection (refer to Figure 13, Page 20). Retain the connector cap to seal the connector opening in case the probe ever needs to be removed. Additional extension cables are available to increase the probe cable length.

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

Note: *The middle connection on the sc1000 controller must not be used for probes as this is reserved for the display module.*

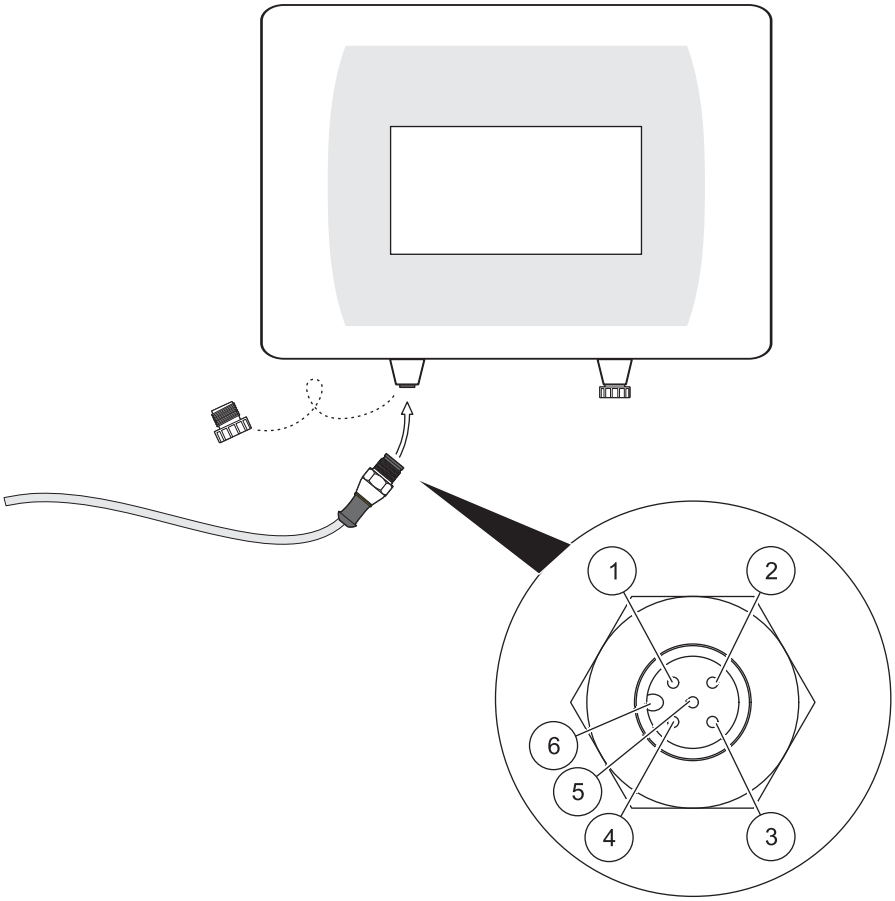

Figure 13 Connecting the probe to the sc controller with the screw fitting

Number	Description	Cable color
1	+12 VDC	Brown
2	Ground	Black
3	Data (+)	blue
4	Data (–)	White
5	Shield	Shield (gray)
6	Guide	

Section 4 Operation

4.1 How to use an sc controller

The probe can be used with all sc controllers. Become familiarized with the controller's functions before using the probe.

4.2 Sensor setup

When the sensor is connected for the first time, the sensor serial number is displayed as the name of the sensor. To change the sensor name.

1. Open the MAIN MENU.
2. Select SENSOR SETUP and confirm.
3. Select the corresponding sensor and confirm.
4. Select CONFIGURE and confirm.
5. Select EDIT and confirm.
6. Edit the name and confirm to return to the CONFIGURE menu.
7. Check the sensor configuration and adjust as needed to meet requirements.
8. Go back to the MAIN MENU or the Measurement mode display.

4.3 Sensor data logger

Every sc-sensor provides a data memory and event memory within the sc controller. The data memory is used to store measurement data at preset intervals; the event memory stores events such as configuration changes, alarms and warning conditions. Both memories can be read in CSV format (refer to the operating instructions for the sc controller).

4.4 Sensor diagnostics menu

AN-ISE sc	
ERROR LIST	Displays all actual error codes.
WARNING LIST	Displays all actual warnings.

4.5 Sensor setup menu

SENSOR SETUP	
AN-ISE sc	
CALIBRATE	
MATRIX CORR	Matrix correction options. The most recently used menu is displayed. The currently active corrections are shown in Information.
NONE	No MATRIX CORR. is activated
MATRIX 1	1 point matrix correction
NH4 + NO3	1 point matrix correction for ammonium and nitrate
NH4	1 point matrix correction for ammonium
NO3	1 point matrix correction for nitrate
NH4 + K	1 point matrix correction for ammonium and potassium
NO3 + CL	1 point matrix correction for nitrate and chloride
NH4+K NO3+CL	1 point matrix correction for ammonium, potassium, nitrate and chloride
TAKE SAMPLE IMMEDIATELY AND ANALYSE IN LABORATORY	Information window: When this window appears, the sample must be taken immediately and then analyzed in the laboratory.
VALUE CORR. 1	Perform 1 point value correction. The most recently used menu is displayed. The currently active corrections are shown in Information.
NH4–N	Select parameter for the 1 point value correction
NO3–N	
VALUE POINT	Enter the values for the 1 point value correction (below for the example of NH_4)
AN-ISE SC NH4–N	Enter the displayed ammonium value
AN-ISE SC K	Enter the displayed potassium value
LAB NH4–N	Enter the laboratory ammonium value
ENTRY COMPLETE	Confirm the values entered
CORR-RESULT	Display the correction results
VALUE CORR. 2	Perform 2 point value correction
NH4–N	Select parameter for the 2 point value correction
NO3–N	
VALUE POINT 1	Enter the values for the 2 point value correction (first point) (below for the example of NH_4)
AN-ISE SC NH4–N	Enter the displayed ammonium value
AN-ISE SC K	Enter the displayed potassium value
LAB NH4–N	Enter the laboratory ammonium value
ENTRY COMPLETE	Confirm the values entered
VALUE POINT 2	Enter the values for the 2 point value correction (second point) (below for the example of NH_4)
AN-ISE SC NH4–N	Enter the displayed ammonium value
AN-ISE SC K	Enter the displayed potassium value
LAB NH4–N	Enter the laboratory ammonium value
ENTRY COMPLETE	Confirm the values entered
CORR-RESULT	Display the correction results

4.5 Sensor setup menu (Continued)

SENSOR SETUP	
FURTHER CORR.	Other matrix correction options
None	No **FURTHER CORR.** is activated
MATRIX 2	A 2 point matrix correction can be performed here
NH4	Parameter selection for the MATRIX2 correction.
NO3	
MEAS CONC 1	Saves the currently measured measurement for the first point
DATE	Displays the date of the current correction of the first point
CONC. LABVALUE 1	Entry and display of reference value for the first point
MEAS CONC 2	Saves the currently measured measurement for the second point
DATE	Displays the date of the current correction of the second point
CONC. LABVALUE 2	Entry and display of the reference value for the second point
HIST. CORR.	Selection of one of the last corrections performed
SENSOR CODE	The sensor code can be activated or entered here
INPUT	Entry of the sensor code
ACTIVATION	Activates the sensor code for the individual channels
NH4 + K	Activate the sensor code for ammonium and potassium
NO3 + CL	Activate the sensor code for nitrate and chloride
NH4+K NO3+CL	Activate the sensor code for ammonium, potassium, nitrate and chloride
FACTORY CALIBRATION	Activates factory calibration
ENTER CORR.	The laboratory values of the last matrix correction can be changed
ENTER LABVALUE (displayed when MATRIX 1 or MATRIX 2 is performed)	Enter the laboratory values if MATRIX 1 or MATRIX 2 has been selected
AMMONIUM	Enter the labatory value for ammonium
NITRATE	Enter the laboratory value for nitrate
POTASSIUM	Enter the laboratory value for potassium
CHLORIDE	Enter the laboratory value for chloride
ENTRY COMPLETE	Confirm the values entered
CORR-RESULT	Display the correction results
NH4–N	Displays whether or not the ammonium correction was successful
NO3–N	Displays whether or not the nitrate correction was successful
K+	Displays whether or not the potassium correction was successful
CL	Displays whether or not the chloride correction was successful
INFORMATION	Information on the matrix correction used per parameter
NH4–N	Matrix correction used for ammonium
NO3–N	Matrix correction used for nitrate
K+	Matrix correction used for potassium
CL	Matrix correction used for chloride

4.5 Sensor setup menu (Continued)

SENSOR SETUP		
CONFIGURE		
	EDIT NAME	Enter or edit the name. Up to 10 alphanumeric characters
	MEAS UNITS	Select either mg/L or ppm as the measurement unit
	PARAMETERS	Select NH_4–N/NO_3–N or NH_4/NO_3
	TEMP UNITS	Selection of °C or °F as temperature unit
	TEMP OFFSET	Enter a temperature offset
	RESPONSE TIME	Entry of the response time (30 sec to 300 sec)
	DATALOG INTRVL	Select the data log interval (OFF, 30 sec, 1 min, 2 min, 5 min, 10 min, 15 min and 30 min), 5 min is the factory setting
	K+ COMPENSATE	Select automatic potassium compensation: **On** **Off** 0 = compensation OFF 0.1–2000 mg/L K^+ = Fixed compensation value
	SET K+ CONC	Only shown when K^+ COMPENSATE is **OFF**
	CL COMPNSATE	Select automatic chloride compensation: **On** **Off** 0 = compensation OFF 0.1–2000 mg/L CL = Fixed compensation value
	SET CL CONC	Only shown when CL COMPNSATE is **OFF**
	FACTORY CONFIG	Resets the configuration on the factory setting
DIAG/TEST		
	SENSOR INFO	Information on the connected sensor
	SENSOR NAME	Name of the connected sensor
	EDIT NAME	Serial number or name of the measurement location
	SERIAL NUMBER	Serial number of the connected sensor
	SENSOR TYPE	Instrument designation of the connected sensor
	CODE VERS	Software version
	CAL DATA	Data of the selected MATRIX correction and information about slope and offset of the individual channels, for example
	NH4–N	Matrix correction selected for ammonium
	NO3–N	Matrix correction selected for nitrate
	K+	Matrix correction selected for potassium
	CL	Matrix correction selected for chloride
	SIGNALS	Signals and measurements of the individual measurement channels
	AMMONIUM	Display the signals and measurement results for ammonium
	NITRATE	Display the signals and measurement results for nitrate
	POTASSIUM	Display the signals and measurement results for potassium
	CHLORIDE	Display the signals and measurement results for chloride
	REF. ELECTRODE	Displays the signals and measurement results for the reference system
	MV RAW	Display the signals and measurement results for MV RAW
	IMPED STATUS	Display the signals and measurement results for impedance

4.5 Sensor setup menu (Continued)

SENSOR SETUP	
TEMP	Display the signals and measurement results for temperature
HUMIDITY	Display the signals and measurement results for humidity
RFID	Display the signals and measurement results for RFID
CAL DAYS	Display the age of the last matrix correction for ammonium and nitrate
AMMONIUM	Display the age of the last matrix correction for ammonium
NITRATE	Display the age of the last matrix correction for nitrate
SERVICE	
TEST CARTRIDGE	Perform a sensor check with the test cartridge
TEST CARTRIDGE FERTIG? DRÜCKE ENTER	
TEST CARTRIDGE	Display whether the individual sensor channels are OK or not
DIAG/TEST	Displays whether or not DIAG/TEST is OK
GNDROD	Displays whether or not GNDROD is OK
REF	Displays whether or not REF channel is OK
NO3	Displays whether or not NO3 channel is OK
NH4	Displays whether or not NH4 channel is OK
ORP	Displays whether or not ORP channel is OK
CL	Displays whether or not CL channel is OK
K^+	Displays whether or not K channel is OK
TEMP	Displays whether or not temperature channel is OK
CHANGE CARTR.	Follow the menu process
CLEANING	Follow the menu process

4.6 Calibration/Matrix correction

The four electrodes with the reference system of the compact sensor cartridge were calibrated with one another at the factory using special standard solutions (CARTICAL™). However, the membranes on the ion-selective electrodes are not 100% selective due to other substances that may affect the measurement. Perform a matrix correction (refer to 4.6.4 on page 27) to compensate for other ions present on the ISE electrodes.

Potassium has the largest interference effect on the ammonium membrane, while chloride has the largest effect on the nitrate membrane. The AN-ISE sc sensor compensates for this with the aid of a built-in potassium/chloride electrode.

Cross sensitivities between ammonium, potassium/nitrate and chloride are automatically eliminated. Solids do not interfere with the measurement. Due to matrix effects, correction and validation cannot be performed with standard solutions. A matrix correction can be carried out quickly and easily at any time.

NOTICE

A matrix correction may only be performed if the sensor has been immersed in the corresponding wastewater matrix for over 12 hours. This is the minimum time required to adapt the ISE membranes to the wastewater matrix.

4.6.1 Sensor code calibration

The sensor code is a calibration code and is delivered with the sensor cartridge certificate. It contains the factory calibration described in section 4.6 on page 25 for the sensor cartridge.

Instruments with automatic sensor code recognition (LXG440.99.0000x) read this automatically and assume the Cartrical calibration.

Instruments without automatic sensor code recognition (LXG440.99.0001x) require the sensor code to be entered during the initial setup and whenever a new sensor cartridge is activated. If the sensor code certificate has been lost, please carry out factory calibration (under the sensor code menu) as a temporary solution.

After activating the code, the sensor is fully calibrated but not yet adapted to the specific matrix of the relevant application on a wastewater treatment plant. At least 12 hours must elapse before a matrix correction is performed to allow the cartridge to adapt to the specific matrix.

To change the sensor code:

1. Select **SENSOR MENU>AN-ISE SC>CALIBRATE>FURTHER CORR.>SENSOR CODE>ENTER**
2. Enter the sensor code.
3. Press **ENTER** to confirm and activate the sensor code. The day meter for the cartridge is set to zero.

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.

4.6.2 Matrix correction via LINK2SC

The LINK2SC procedure offers a secure method of data exchange between process probes and LINK2SC-compatible photometers using an SD memory card or via a local area network (LAN). There are two different options are available:

a. The pure laboratory control measurement

b. A matrix correction that involves the measurement data generated in the laboratory being used to correct the probe

During a pure control measurement, the measurement data is transferred from the prove to the photometer where it is then archived together with the photometric reference data that has been recorded.
During a matrix correction, the reference data generated in the laboratory is transferred to the probe where is used for the correction.
The matrix correction process requires operating steps to be completed on the sc controller and on a LINK2SC-compatible photometer.
Please refer to the LINK2SC user manual for a detailed description of the LINK2SC procedure.
When using the LINK2SC software, sections 4.6.3 and 4.6.4 are not relevant.

4.6.3 Matrix correction overview

The AN-ISE sc sensor offers different options
(refer to Table 1) for correcting the sensor value with laboratory values (as a reference value).

The laboratory value of the water sample is entered as nitrate-nitrogen (NO_3–N) or as ammonium-nitrogen (NH_4–N). This laboratory value replaces the prior value measured by the sensor.

Table 1 AN-ISE sc sensor correction options

Correction Option	Application
MATRIX 1	A MATRIX 1 is the **most commonly used correction option** and performs a 1 point matrix correction for ammonium and/or nitrate (4.6.4.1 on page 27). It is advisable to perform a MATRIX1 as **the first correction**. The Matrix1 correction can be performed both with and without correction of the compensation electrodes (potassium or chloride); in most cases, it is sufficient to perform it without correction of the compensation electrodes. A correction featuring potassium and chloride is only necessary if a high level of accuracy is required. With a MATRIX1, a sample must be taken when the correction is triggered and analyzed in the laboratory. The MATRIX1 is activated when the laboratory value is entered.
VALUE CORR. 1	Value correction 1 (correction at one concentration point) corresponds to a **MATRIX1 correction with an alternative entry format**. Comparison values between AN-ISE sc and the laboratory can be collected over a period of around a week with this correction. The correction can be performed at a later stage.
VALUE CORR. 2	Value correction 2 (correction at 2 different concentration points) should be performed if dynamic **concentration fluctuations are present over at least half a decade**[1] **and a MATRIX1 or VALUE CORR. 1 does not achieve a sufficiently accurate result**. Comparison values between AN-ISE sc and the laboratory can be collected over a period of around a week with this correction. The correction can be performed at a later stage.
MATRIX 2	The **MATRIX 2 correction corresponds to a VALUE CORR.2, but uses an alternative entry format** and is recommended if there is a dynamic process with a large nitrate/ammonium fluctuation over at least half a decade[1]. With a MATRIX2, a sample must be taken for both points when the correction is triggered and analyzed in the laboratory. The MATRIX2 is activated when the laboratory value is entered.
HIST. CORR.	Return to one of the last matrix and value corrections performed **if a correction has not produced a successful result**.

[1] Examples of half a decade: The concentration of nitrogen nitrate shifts between 1 and 5 mg NO_3–N or between 5 and 25 mg/L NO_3–N. (conc2 = (conc1 x 10)/2)

4.6.4 Performing the matrix correction

Note: *Take laboratory value measurements or reference values promptly or, alternatively, take these from the stabilized sample. This will prevent changes in sample concentration, as time is a factor in comparative tests.*

Refer to 7.3 Validation accessories, page 39 for recommended laboratory measurement tests.

4.6.4.1 MATRIX 1 correction (1 point matrix correction)

Proceed as follows to perform MATRIX 1:

CALIBRATE
MATRIX CORR
FURTHER CORR.
INFORMATION

1. Select **SENSOR MENU>AN-ISE SC>CALIBRATE>MATRIX CORR**.
2. Select **MATRIX 1** from the selection window and press **ENTER**.
3. Select the parameters you wish to correct and confirm by pressing **ENTER**. Selection options:
   NH_4 + NO_3; NH_4; NO_3; NH_4 + K;
   NO_3 + Cl; NH_4 + K NO_3 + Cl.

MATRIX 1
TAKE SAMPLE
IMMEDIATELY
AND ANALYSE
IN LABORATORY

The sensor saves the current values of the selected parameters at this point.

4. Take a water sample immediately from the closest point possible to the sensor. Filter the sample as quickly as possible and carry out a **prompt** laboratory analysis of the selected parameters, as the measurement value can change quickly.

When the laboratory value has been determined, proceed as follows:

CALIBRATE
MATRIX CORR
FURTHER CORR.
ENTER LABVALUE
INFORMATION

5. Select **SENSOR MENU>AN-ISE SC>CALIBRATE>ENTER LABVALUE**
6. The laboratory values for the parameters can only be entered if the MATRIX1 correction has been selected beforehand. Once the laboratory values have been entered, select **ENTRY COMPLETE** to confirm.

When the entered laboratory value is confirmed, the matrix correction is activated.

7. Once the correction is activated, the result **CORR-RESULT** is shown.

Note: *This process must always be carried out in full to make sure the matrix correction is completed successfully.*
If a correction does not produce a successful result, calculations are made with the previous correction.

4.6.4.2 Value correction 1

The one-point value correction **VALUE CORR. 1** offers the option of retrospectively performing a matrix correction at one point (**MATRIX1**).

CALIBRATE
MATRIX CORR
FURTHER CORR.
INFORMATION

1. Take several samples with different concentrations on various days, preferably within one week. Analyze the samples in the laboratory. During the time the samples are being taken, the sample temperature should be around a maximum of 5 °C, as temperature changes are not taken into account in the value correction.
2. Make a note of the two values measured in the samples and displayed for the parameters to be corrected (ammonium and potassium values, or nitrate and chloride values)
3. Also note the laboratory values measured for ammonium or nitrate.

These three values form the correction point.

4. From the values taken, select a correction point that lies in the middle of the expected concentration range.
5. Go to the sensor menu and select **CALIBRATE>MATRIX CORR>VALUE CORR. 1** and confirm by pressing **ENTER**.
6. Select the parameter (NH_4–N or NO_3–N) that requires correction.

VALUE POINT
AN–ISE SC NH4–N
AN–ISE SC K
LAB NH4–N
ENTRY COMPLETE

7. Enter the three values for the sought correction point and confirm with **ENTRY COMPLETE** to activate the correction.

Correction result **CORR-RESULT** is shown.

Note: *If a correction does not produce a successful result, calculations are made with the previous correction.*
After successful completion of value correction, the corrected value is shown as the display value for ammonium or nitrate the next time the menu is opened.

4.6.4.3 Value correction 2

The two-point value correction **VALUE CORR. 2** makes it possible to perform a subsequent 2-point correction (**MATRIX2**) to achieve higher accuracy for a larger concentration range.

CALIBRATE
MATRIX CORR
FURTHER CORR.
INFORMATION

Note: *Value correction 2 and MATRIX 2 are comparable from a calculation perspective.*

1. Take several samples on various days with different concentrations, preferably within a week, and perform an analysis of the samples in the laboratory. During the time the samples are being taken, the sample temperature should be around a maximum of 5 °C, as temperature changes are not taken into account in the value correction.

Note: *The **VALUE CORR. 2** concentrations should be within a range of over half a decade. The following formula can assist in the calculation of the half decade:*

$$\text{Conc2} \quad >= \quad \frac{\text{Conc1} \times 10}{2}$$

2. Make a note of the two values measured with the sensor in the samples and displayed for the parameters to be corrected (ammonium and potassium values, or nitrate and chloride values).
3. Also note the laboratory value measured for ammonium or nitrate.

All three values form one of the two correction points.

4. Look for two correction points where the laboratory values are at least half a decade apart and display typical operating conditions for the installation.
5. Go to the sensor menu and select **CALIBRATE>MATRIX CORR>VALUE CORR. 2** then confirm with **ENTER**.
6. Select the parameter (NH_4–N or NO_3–N) that requires correction.

Note: *Only one parameter can be corrected at a time. If both need to be corrected, the procedure must be performed again.*

VALUE POINT 1
AN–ISE SC NH4–N
AN–ISE SC K
LAB NH4–N
ENTRY COMPLETE

7. Enter the three values for the first correction point and confirm with **ENTRY COMPLETE**.

VALUE POINT 2
AN–ISE SC NH4–N
AN–ISE SC K
LAB NH4–N
ENTRY COMPLETE

8. To activate the correction, enter the three values for the second correction point and confirm with **ENTRY COMPLETE**.

Correction result **CORR-RESULT** is shown.

Note: *If a correction does not produce a successful result, calculations are made with the previous correction. After successful completion of value correction, the corrected value is shown as the display value for ammonium or nitrate the next time the menu is opened.*

4.6.4.4 MATRIX 2 correction (2 point matrix correction)

Proceed as follows to perform MATRIX 2:

AMMONIUM
CONC MEAS1
DATE
CONC. LABVALUE.1
MEAS CONC 2
DATE
CONC. LABVALUE 2

1. Select **SENSOR MENU>AN-ISE SC>CALIBRATE>FURTHER CORR.**.
2. Select **MATRIX 2** from the selection window and press **ENTER**.
3. Select the parameters requiring a two point matrix correction.
4. Select the point to be corrected first.
5. **SELECT MEAS CONC 1** or **MEAS CONC 2**
6. Take a water sample from the closest point possible to the sensor. Filter this sample promptly and perform an immediate laboratory analysis of the selected parameters. The measurement value can change very quickly:

When the laboratory value has been determined, proceed as follows:

7. Select **SENSOR MENU>ANISE SC>CALIBRATE>FURTHER CORR.>MATRIX 2**
8. Select the parameters to be corrected with the laboratory value entry:
9. Enter the laboratory reference value and confirm.

The **MATRIX2 CORR.** is activated when the entry is confirmed for both points.

Section 5 Maintenance

NOTICE

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

5.1 Maintenance schedule

Maintenance task	30 days[1]	12 months
Clean the probe[2]	x	
Replace the sensor cartridge[3, 4]		x
Check probe for damage	x	
Compare the measured value with a reference laboratory analysis and correct the values as required via a matrix correction[3]	x	

[1] Recommended: Weekly during the first month of operation

[2] The frequency of cleaning depends on the application. Some applications may require cleaning to take place more or less frequently.

[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 test the sensor with the usual NH_4-N or NO_3-N standard solutions as the ion strength of normal solutions is not high enough.*

5.2 Clean the sensor

NOTICE

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 probe body (not the sensor cartridge) with a sponge or brush.
3. Rinse the sensor with clean, lukewarm water.

5.2.1 Polish the chloride electrode

Polish the chloride electrode if it looks heavily coated/contaminated.
After polishing, a new nitrate + chloride MATRIX1 correction should be performed after 12 hours.

NOTICE

Only use the LZY671 polishing paper supplied.

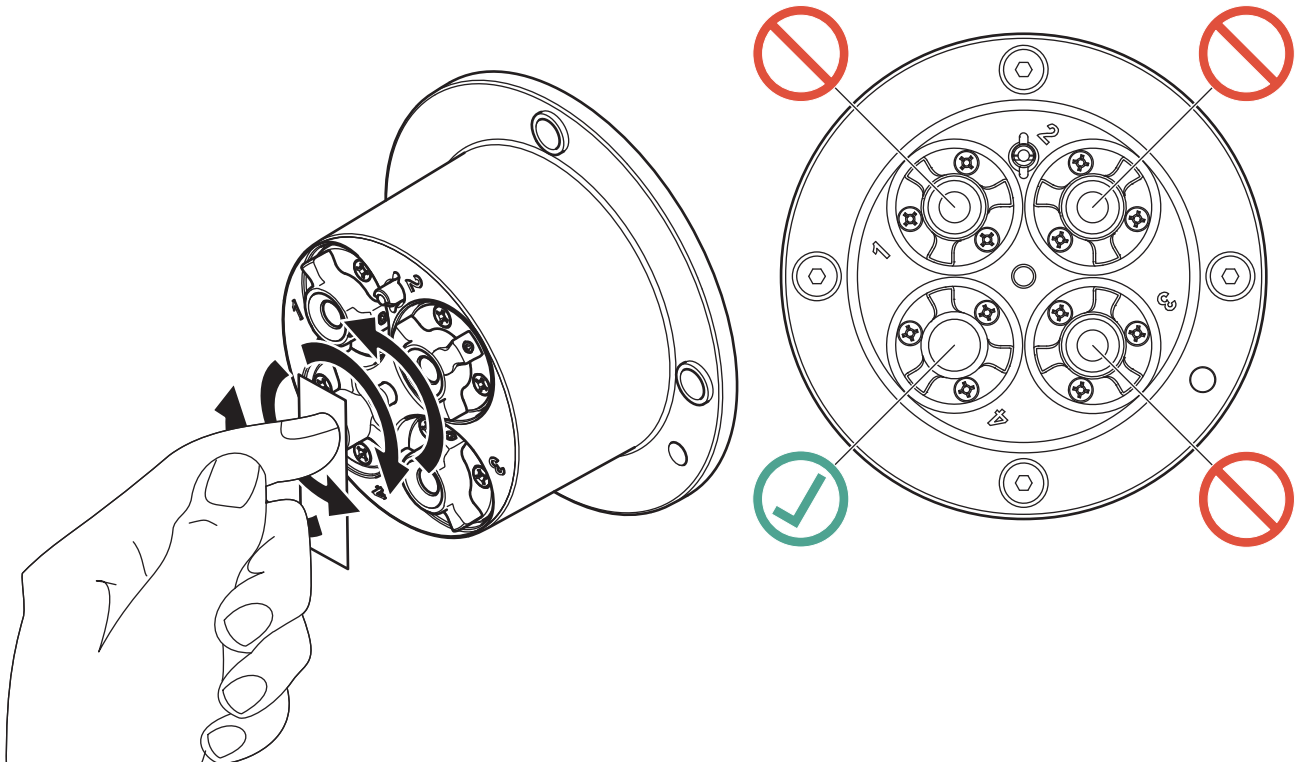

Figure 14 Chloride electrode

5.3 Replace the sensor cartridge

The sensor cartridge is replaced as described below and in Figure 15, Page 33.

1. Replace the cartridge using menu point **ANISE SC>DIAG/TEST>SERVICE>CHANGE CARTR.**.
2. Clean the probe and thoroughly dry the sensor cartridge and probe adapter.
3. Loosen the 4 socket head screws.

NOTICE

The sensor cartridge must point downward such that no water can run into the probe adapter. Pay attention to the contacts between the probe and the sensor cartridge. The contacts have to remain dry.

4. Pull the sensor cartridge out of the probe adapter and dispose of the old sensor cartridge as per the applicable regulations.
5. Make sure that a new black gasket is installed every time the sensor cartridge is replaced. Before the gasket is installed, clean the surface that faces the cartridge and the groove for the gasket.
6. Insert the new sensor cartridge into the probe adapter. Observe the marker hole on the sensor cartridge flange and the probe adapter.
7. Secure the sensor cartridge with the 4 socket head screws.
8. The sensor code (calibration data) is automatically read for instruments with automatic recognition (LXG440.99.0000x). For instruments with non-automatic recognition (LXG440.99.0001x), enter the new sensor code manually (refer to certificate).

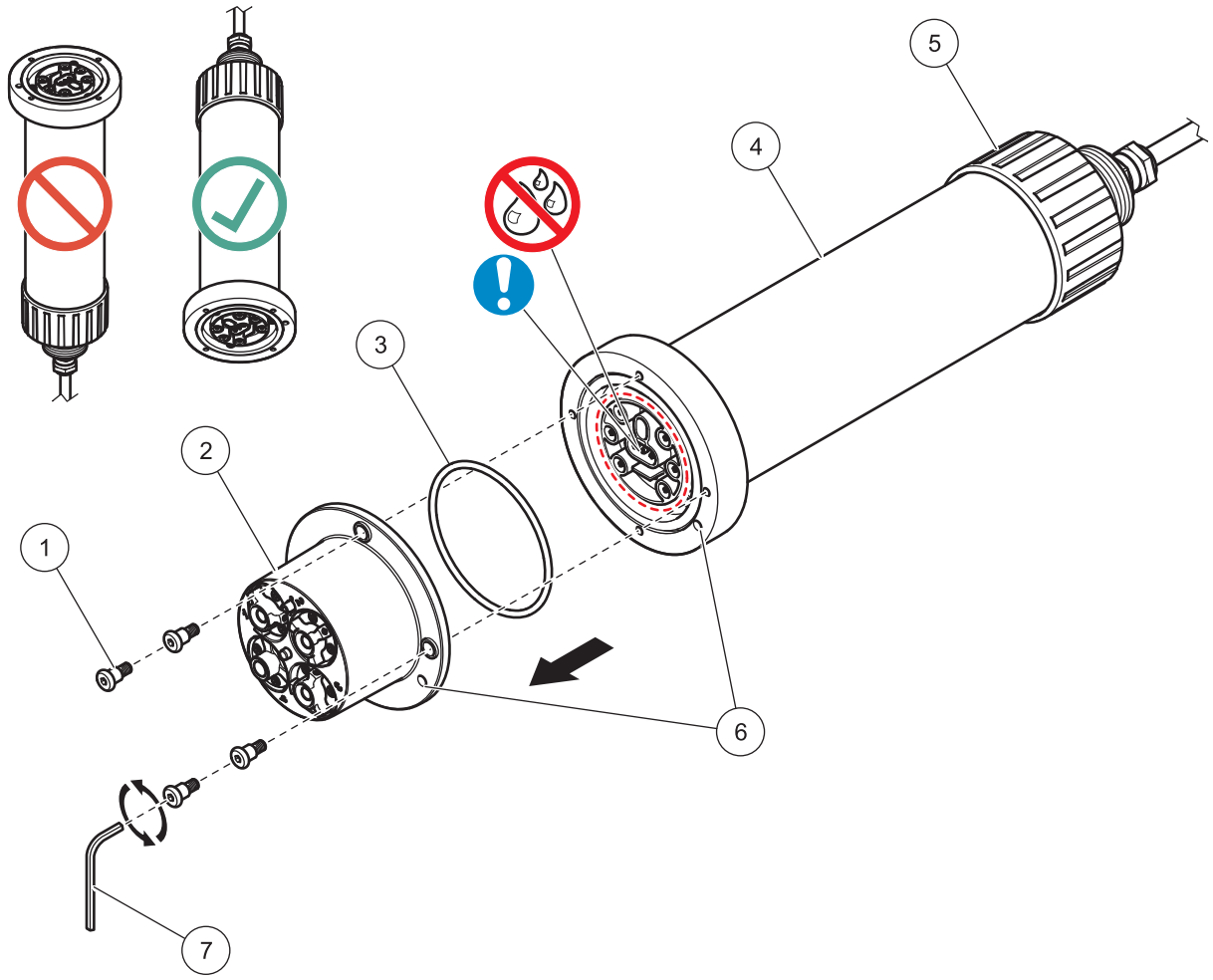

Figure 15 Replace the sensor cartridge

1	Socket head screw	**5**	Union nut
2	Sensor cartridge	**6**	Marker hole
3	Gasket	**7**	Socket head wrench
4	Sensor		

5.4 Storage

Take the probe out of the sample flow and clean thoroughly.

Short term storage
Keep the membranes and the reference system wet (DO NOT USE DISTILLED OR DEMINERALIZED WATER). Drinking water is advised.

This will help avoid long response times when the probe is placed back in the sample flow. Otherwise, the correct operation of the probe is no longer guaranteed.

Long term storage

NOTICE

Detach the cartridge and use the supplied storage container in the event of long-term storage. Moisten the little sponge in the storage container with drinking water (DO NOT USE DISTILLED OR DEMINERALIZED WATER) and make sure that the ISE membranes of the sensor cartridge remain wet. Attach the reference system cap.

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, Page 5* *for storage temperatures.*

Probe and sensor cartridge

NOTICE

Pay attention to the contacts between the probe and the sensor cartridge. The contacts must be dry.

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 messages

Displayed errors	Definition	Resolution
NH4 mV RANGE!	Ammonium mV value is out of measuring range	See 6.3.1 Troubleshooting during operation, Page 37.
K+ mV RANGE!	Potassium mV value is out of measuring range	
NO3 mV RANGE!	Nitrate mV value is out of measurement range	
CL mV RANGE!	Chloride mV value is out of measurement range	
REF1 mV RANGE!	REF1 reference value is out of measuring range	
REF2 mV RANGE!	ORP electrode mV value is out of measuring range	
TEMP RANGE	Temperature value out of measurement range	
NO CARTRIDGE	No sensor cartridge connected	Connect sensor cartridge, see section 3.3, page 15.
SENSOR CODE	Sensor code calibration failed	See 6.3.2 Troubleshooting during calibration, Page 38
HUMIDITY	Humidity in the probe	Inform service engineer
NH4-N CONC HIGH	Ammonium concentration value exceeds measuring range	See 6.3.1 Troubleshooting during operation, Page 37.
NH4-N CONC LOW	Ammonium concentration value is below measuring range	
NO3-N CONC HIGH	Nitrate concentration value exceeds measuring range	
NO3-N CONC LOW	Nitrate concentration value is below measuring range	
K+ CONC HIGH	Potassium concentration value exceeds measuring range	
K+ CONC LOW	Potassium concentration value is below measuring range	
CL CONC HIGH	Chloride concentration value exceeds measuring range	
CL CONC LOW	Chloride concentration value is below measuring range	

6.2 Warnings

In the event of a sensor warning, all menus, relays and outputs continue to function as normal but a warning symbol lights up.

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 Warnings

Displayed warnings	Definition	Resolution
RFID DATA	Cartridge faulty, read process failed	Replace cartridge, check probe with test cartridge
NH4 mV RANGE!	Ammonium mV value is close to measuring range limit	See 6.3.1 Troubleshooting during operation, Page 37.
K+ mV RANGE!	Potassium mV value is close to measuring range limit	
NO3 mV RANGE!	Nitrate mV value is close to measurement range limit	
CL mV RANGE!	Chloride mV value is close to measurement range limit	
REF1 mV RANGE!	1st reference value is close to limit	
REF2 mV RANGE!	2nd reference value is close to limit	
TEMPERATURE	Temperature is close to limit	
CARTRIDGE OLD	Sensor cartridge more than 1 year old	Replace the sensor cartridge
NH4-N CONC HIGH	Ammonium concentration value exceeds measuring range	See 6.3.1 Troubleshooting during operation, Page 37.
NH4-N CONC LOW	Ammonium concentration value is below measuring range	
NO3-N CONC HIGH	Nitrate concentration value exceeds measuring range	
NO3-N CONC LOW	Nitrate concentration value is below measuring range	
K+ CONC HIGH	Potassium concentration value exceeds measuring range	
K+ CONC LOW	Potassium concentration value is below measuring range	
CL CONC HIGH	Chloride concentration value exceeds measuring range	
CL CONC LOW	Chloride concentration value is below measuring range	
AMMONIUM		See 6.3.2 Troubleshooting during calibration, Page 38.
OFFSET	Ammonium offset is out of measuring range	
SLOPE	Ammonium slope is out of measuring range	
POTASSIUM		
OFFSET	Potassium offset is out of measuring range	
SLOPE	Potassium slope is out of measuring range	
NITRATE		
OFFSET	Nitrate offset is out of measurement range	
SLOPE	Nitrate slope is out of measurement range	
CHLORIDE		
OFFSET	Chloride offset is out of measurement range	
SLOPE	Chloride slope is out of measurement range	

6.3 Troubleshooting

6.3.1 Troubleshooting during operation

Symptom	Possible cause	Corrective actions
Incorrect measurement values	Calibration too old; calibration was not suitable for the particular case; big change in the wastewater matrix	Perform a suitable calibration. See 4.6 Calibration/Matrix correction, Page 25
	Strongly contaminated membranes and/or reference electrode	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. Clean all components (membranes/reference electrode/temperature sensor).
		Install the cleaning unit
		Increase the cleaning interval
	Sensor membrane damaged	Check the sensor installation/ replace the sensor cartridge
	Reference element damaged	
	NO3 mV RANGE! (Nitrate mV value is out of measurement range)	Replace the sensor cartridge
	CL mV RANGE! (Chloride value is out of measurement range)	
	REF1 RANGE! (measuring range exceeded on 1st reference value)	
	REF2 RANGE! (measuring range exceeded on 2nd reference value)	
	TEMPERATURE (Temperature value is out of measurement range)	Replace the sensor cartridge/check the wastewater temperature
	CARTRIDGE OLD (sensor cartridge more than 1 year old)	Replace the sensor cartridge
	Dampness at the contacts of the sensor cartridge	Dry the contact with a cloth or paper Check the black gasket for damage and make sure it is in the correct position. Screw the 4 socket head screws tight.
Incorrect measurement values	Dampness inside the measuring probe/faulty sensor electronics Check the sensor electronics by using the test cartridge (section 7.2, page 39). **1** Select SENSOR MENU>DIAG/TEST> SERVICE>TEST CARTRIDGE> Test Cartridge ready? Press ENTER **2** If all channels are confirmed with OK, the sensor electronics are operational: Test cartridge OK ENTER	If the test cartridge data are not within this range or if the test cartridge check is not successful, contact our service department.
	Potassium concentrations too high (e.g.: >700 mg/L with small ammonium concentrations) or chloride concentrations too high (e.g.: >1000 mg/L with small nitrate concentrations)	Switch off potassium/chloride compensation (in the configuration menu - then potentially enter a fixed value for potassium/chloride)

6.3.1 Troubleshooting during operation (Continued)

Symptom	Possible cause	Corrective actions
Unstable measurement values	Air bubbles, depth of immersion	Check the sensor installation Check the cleaning unit configuration
	Dampness at the contacts of the sensor cartridge	Dry the contacts with a cloth or paper. Check the black gasket for damage and make sure it is in the correct position. Screw the 4 socket head screws tight
	Sensor membrane damaged	Check the sensor installation/ replace the sensor cartridge
	Reference element damaged	

6.3.2 Troubleshooting during calibration

Symptom	Possible cause	Corrective actions
SENSOR CODE	Sensor code entered incorrectly	Using the certificate, check whether the sensor code was entered correctly.
AMMONIUM		
OFFSET	Error during the last ammonium correction, sensor cartridge too old, contaminated, faulty	Repeat the correction. Use the previous correction. Clean or replace the sensor cartridge.
SLOPE		
POTASSIUM		
OFFSET	Error during the last potassium correction, sensor cartridge too old, contaminated, faulty	Repeat the correction. Use the previous correction. Clean or replace the sensor cartridge.
SLOPE		
NITRATE		
OFFSET	Error during the last nitrate correction, sensor cartridge too old, contaminated, faulty	Repeat the correction. Use the previous correction. Clean or replace the sensor cartridge.
SLOPE		
CHLORIDE		
OFFSET	Error during the last chloride correction, sensor cartridge too old, contaminated, faulty	Repeat the correction. Use the previous correction. Clean or replace the sensor cartridge.
SLOPE		

Section 7 Replacement parts and accessories

7.1 Replacement Parts

Description	Catalog Number
AN-ISE sc (probe with built-in 10-m cable and a pre-calibrated sensor cartridge)	LXV440.99.000x1
AN-ISE sensor cartridge, calibrated[1]	LZY694
Cleaning brush	LZY589
Black gasket	LZY713
Cartridge screw set (4 screws and socket head wrench)	LZY715
Protective cap for reference system	LZY588
Cable clip for AN-ISE sc	LZY717

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

7.2 Accessories

Description	Catalog Number
Cleaning Unit	LZY706
Rail Mount Kit	6184900
Chain Mount Kit	LZX914.99.12400
Stainless Steel Basin Edge Mounting	LZX414.00.80000
High Output Air Blast compressor 115 V/50 Hz	6860003.99.0001
High Output Air Blast compressor 230 V/50 Hz	6860103.99.0001
Test cartridge	LZY720
Polishing paper for chloride electrode	LZY671

7.3 Validation accessories

Description	Catalog Number
Nitrate cuvette test (measurement range: 0.23–13.5 mg/L NO_3–N/1–60 mg/L NO_3)	LCK 339
Nitrate cuvette test (measurement range: 5–35 mg/L NO_3–N/22–155 mg/L NO_3)	LCK 340
Chloride cuvette test (measurement range: 1–1000 mg/L Cl)	LCK 311
Chloride test strips (measurement range: 30–600 mg/L Cl)	27449-40
Ammonium cuvette test (measurement range: 2–47 mg/L NH_4–N/2.5–60.0 mg/L NH_4)	LCK 303
Ammonium cuvette test (measurement range 1–12 mg/L NH_4-N/1.3–15.0 mg/L NH_4)	LCK 305
Potassium cuvette test (measurement range: 5–50 mg/L K)	LCK 228

7.4 Corresponding documentation

Description	Catalog Number
Instruction sheet Cleaning Unit	DOC273.99.90203
Instruction sheet Rail Mounting	DOC273.99.90201
Instruction sheet Chain Mounting	DOC273.99.90322
Compressor operating instructions ("HOAB")	DOC023.53.00811
sc100 operating instructions	DOC023.53.00032
sc1000 operating instructions	DOC023.53.03260

Section 8 Contact

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Section 9 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 10 Certification

10.1 Certification

FCC ID: YCB – LXG440

IC ID: 5879A – LXG440

This device complies with Part of the FCC and Industry Canada license exempt RSS standard(s).

Operation is subject to the following two conditions:

1. this device may not cause interference, and
2. this device must accept any interference, including interference that may cause undesired operation of the device."

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. l'appareil nedoit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement."

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at their expense. The following techniques can be used to reduce interference problems:

1. Disconnect the equipment from its power source to verify that it is or is not the source of the interference.
2. If the equipment is connected to the same outlet as the device experiencing interference, connect the equipment to a different outlet.
3. Move the equipment away from the device receiving the interference.
4. Reposition the receiving antenna for the device receiving the interference.
5. Try combinations of the above.

Appendix A Modbus Register

Tag Name	Register #	Data Type	Length	R/W	Discrete Range	Min/Max Range	Description
AMMONIUM NH4-N	40001	Float	2	R		0/1500	AMMONIUM as NH4-N [mg/l]
AMMONIUM NH4	40003	Float	2	R		0/1932	AMMONIUM as NH4 [mg/l]
Nitrate NO3-N	40005	Float	2	R		0/1500	Nitrate as NO3-N [mg/l]
Nitrate NO3	40007	Float	2	R		0/6643	Nitrate as NO3 [mg/l]
Potassium	40009	Float	2	R		0/1500	Potassium [mg/l]
Chloride	40011	Float	2	R		0/1500	Chloride [mg/l]
TEMPERATURE [C]	40013	Float	2	R		0/60	TEMPERATURE [C]
TEMPERATURE [F]	40015	Float	2	R		-54/180	TEMPERATURE [F]
Location	40025	String	8	R/W			Location
MEAS UNITS	40033	Unsigned Integer	1	R/W	U0/2		MEAS UNITS mg/l;ppm
SET PARAMETER	40034	Unsigned Integer	1	R/W	0/1		NH4-N&NO3-N; NH4&NO3
TEMP UNITS	40035	Unsigned Integer	1	R/W	U25/26		°C; °F
TEMP ADJUST [C]	40036	Float	2	R/W		-1.5/1.5	TEMP ADJUST [C]
TEMP ADJUST [F]	40038	Float	2	R/W		-2.7/2.7	TEMP ADJUST [F]
Response Interval	40040	Unsigned Integer	1	R/W		10/1800	Response Interval
Logger Interval	40041	Unsigned Integer	1	R/W	0/1/2/3/4/5/6/7		Logger Interval
K+ compensation	40042	Unsigned Integer	1	R/W	0/1		K+ compensation on/off
K+ subsitute value	40043	Float	2	R/W		0/1500	K+ subsitute value if compensation is off
Chlorine compensation	40045	Unsigned Integer	1	R/W	0/1		Chlorine compensation on/off
Cl subsitute value	40046	Float	2	R/W		0/1500	Cl subsitute value if compensation is off
SERIAL NUMBER	40049	String	6	R/W			SERIAL NUMBER
AC Code Version	40055	Float	2	R		0/3.402823 47E+38	AC Code Version
BC Code Version	40057	Float	2	R		0/3.402823 47E+38	BC Code Version
Structure DD	40059	Unsigned Integer	1	R		0/255	Structure DD
Content DD	40060	Unsigned Integer	1	R		0/255	Content DD
Firmware DD	40061	Unsigned Integer	1	R		0/255	Firmware DD
Moist [%]	40062	Unsigned Integer	1	R		0/100	Moist [%] moisture in probe, OK<5%
Ammonium mV	40063	Float	2	R		-2000/2000	Ammonium mV

Modbus Register

Tag Name	Register #	Data Type	Length	R/W	Discrete Range	Min/Max Range	Description
Ammonium Drift	40065	Float	2	R		-2000/2000	Ammonium Drift
Ammonium Noise	40067	Float	2	R		-2000/2000	Ammonium Noise
Nitrate mV	40069	Float	2	R		-2000/2000	Nitrate mV
Nitrate Drift	40071	Float	2	R		-2000/2000	Nitrate Drift
Nitrate Noise	40073	Float	2	R		-2000/2000	Nitrate Noise
Potassium mV	40075	Float	2	R		-2000/2000	Potassium mV
Potassium Drift	40077	Float	2	R		-2000/2000	Potassium Drift
Potassium Noise	40079	Float	2	R		-2000/2000	Potassium Noise
Chloride mV	40081	Float	2	R		-2000/2000	Chloride mV
Chloride Drift	40083	Float	2	R		-2000/2000	Chloride Drift
Chloride Noise	40085	Float	2	R		-2000/2000	Chloride Noise
Reference mV	40087	Float	2	R		-2000/2000	Reference mV
Reference Drift	40089	Float	2	R		-2000/2000	Reference Drift
Reference Noise	40091	Float	2	R		-2000/2000	Reference Noise
Reference 2 [mV]	40093	Float	2	R		-2000/2000	Reference 2 [mV]
CART. NO.	40102	Unsigned Integer	2	R		0/4294967 295	CART. NO.
SENSORCODE	40104	String	8	R/W			SENSORCODE

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