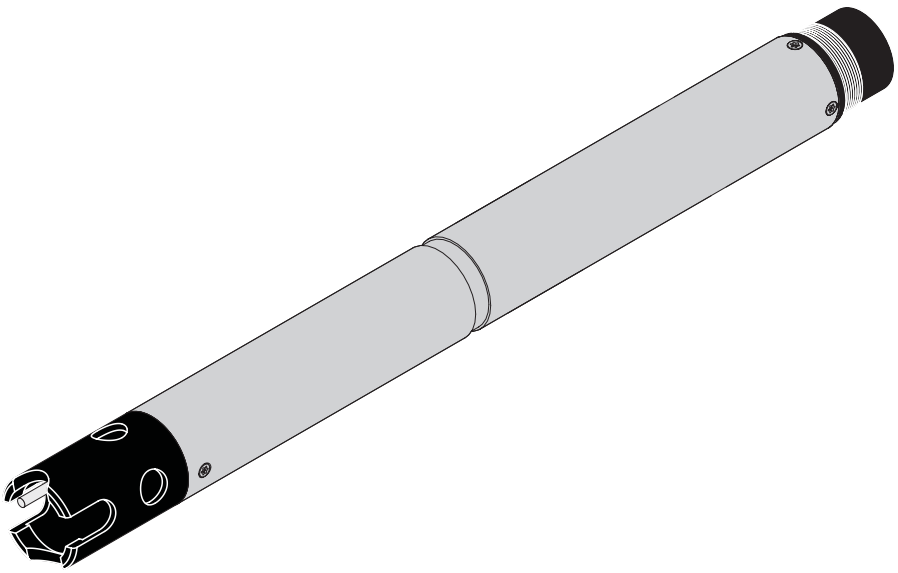
Operating manual

AmmoLyt® 700 IQ



IQ SENSOR NET ammonium sensor

ba75353e05 03/2006

Accuracy when going to press

The use of advanced technology and the high quality standard of our products are the result of continuous development.
This may result in differences between this operating manual and your sensor. Also, we cannot guarantee that there are absolutely no errors in this manual. Therefore, we are sure you will understand that we cannot accept any legal claims resulting from the data, figures or descriptions.

Note
The latest version of the present operating manual can be found on the Internet under www.WTW.com.

1 Overview

1.1 How to use this component operating manual

Structure of the IQ SENSOR NET operating manual

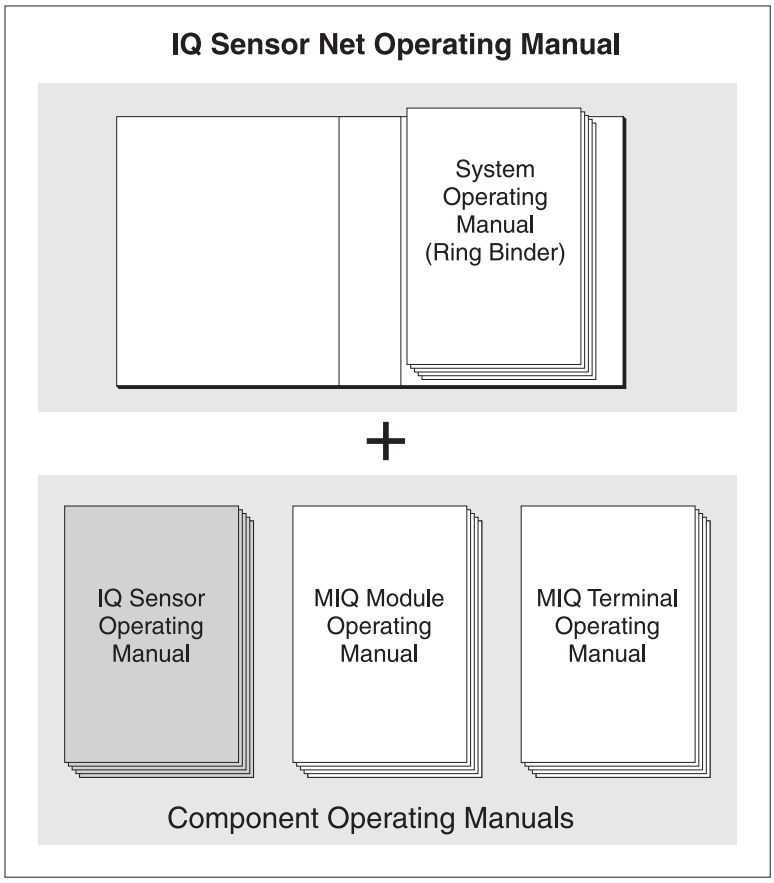


Fig. 1-1 Structure of the IQ SENSOR NET operating manual

The IQ SENSOR NET operating manual has a modular structure like the IQ SENSOR NET itself. It consists of a system operating manual and the operating manuals of all the components used.

Please file this component operating manual in the ring binder of the system operating manual.

1.2 Structure of the AmmoLyt® 700 IQ ammonium sensor

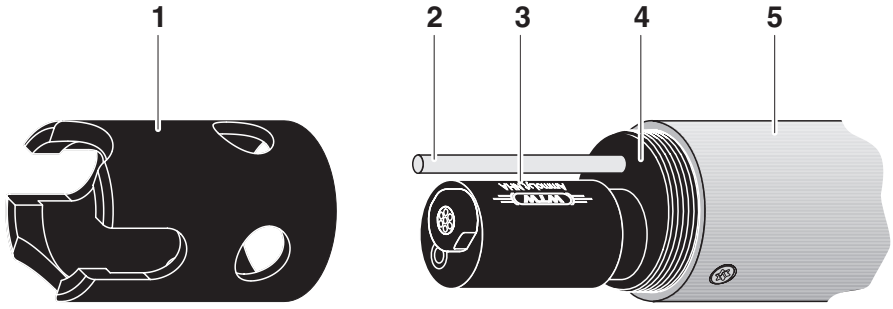


Fig. 1-2 Structure of the AmmoLyt® 700 IQ ammonium sensor

1	Protective hood
2	Temperature probe
3	AmmoLyt® combination electrode with AmmoLyt® NHA reference electrode and AmmoLyt® NHA/AT replacement electrode (electrode not contained in the scope of delivery).
4	Receptacle for the AmmoLyt® combination electrode
5	Sensor shaft

Note
The ammonium electrodes that can be used are available as accessories (see chapter 6 REPLACEMENT PARTS AND ACCESSORIES).

Screening of the ammonium sensor

The AmmoLyt® 700 IQ ammonium sensor and the AmmoLyt combination electrode together with the IQ SENSOR NET system form a measuring system that is protected to a high degree against low and high frequency interference as well as against the indirect effects of lightning strikes.

1.3 Recommended fields of application

The AmmoLyt® 700 IQ ammonium sensor forms a measuring system for the online determination of ammonium ions. It supplements the oxygen measurement in the aeration tank and enables a more efficient aeration control.

The AmmoLyt® 700 IQ ammonium sensor, in conjunction with the AmmoLyt ammonium combination electrode, is suitable for stationary ammonium measurements in water/wastewater applications.

2 Safety

This component operating manual contains special instructions that must be followed in the operation of the AmmoLyt® 700 IQ ammonium sensor. Thus, it is essential to read this component operating manual before carrying out any work using this sensor. In addition to this manual, the SAFETY chapter of the IQ SENSOR NET system operating manual must be followed.

Always keep this component operating manual together with the system operating manual and any other component operating manuals in the vicinity of the IQ SENSOR NET system.

Special user qualifications

The ammonium sensor was developed for applications in online measurement - essentially in the field of wastewater treatment. Thus, we assume that the operators are familiar with the necessary precautions to take when dealing with chemicals as a result of their professional training and experience.

General safety instructions

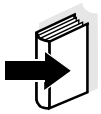
The individual chapters of this operating manual use the following safety labels to indicate different levels of danger:

Warning
indicates instructions that must be followed precisely in order to prevent serious dangers to persons.

Caution
indicates instructions that must be followed precisely in order to avoid slight injuries or damage to the instrument or the environment.

Other labels

Note
indicates notes that draw your attention to special features.



Note
indicates cross-references to other documents, e.g. operating manuals.

2.1 Authorized use

The authorized use of the AmmoLyt® 700 IQ comprises its use as an ammonium sensor together with an ammonium combination electrode in the IQ SENSOR NET.
The technical specifications according to chapter 8 TECHNICAL DATA must be observed. Only operation according to the instructions given in this operating manual is considered to be authorized.

Any other use is considered to be **unauthorized**. Unauthorized use invalidates any claims with regard to the guarantee.

Caution
Only connect and operate the sensor together with IQ SENSOR NET accessories.

2.2 General safety instructions

The sensor left the factory in a safe and secure technical condition.

Function and operational safety

The failure-free function and operational safety of the sensor is only guaranteed if the generally applicable safety measures and the special safety instructions in this operating manual are followed during its use.

The failure-free function and operational safety of the sensor is only guaranteed under the environmental conditions that are specified in chapter 8 TECHNICAL DATA.

The specified temperature (chapter 8 TECHNICAL DATA) must be maintained during the operation and transport of the sensor. Protect the sensor, particularly against frost or overheating.

Caution
The sensor may only be opened by specialists authorized by WTW.

Safe operation

If safe operation is no longer possible, the sensor must be taken out of operation and secured against inadvertent operation.

Safe operation is no longer possible if the sensor:

- has been damaged in transport
- has been stored under adverse conditions for a lengthy period of time
- is visibly damaged
- no longer operates as described in this manual.

If you are in any doubt, contact the supplier of your sensor.

Obligations of the operator

The operator of the sensor must ensure that the following rules and regulations are followed when dealing with hazardous substances:

- EEC directives for protective labor legislation
- National protective labor legislation
- Safety regulations
- Safety data sheets of the chemical manufacturer.

3 Commissioning

3.1 Scope of delivery

- AmmoLyt® 700 IQ
- The sensor is fitted with a protective hood and protective caps
- Operating manual.

3.2 Installation

Connection cable

The SACIQ sensor connection cable is required to connect the sensor. Information on this and other IQ SENSOR NET accessories is given in the WTW catalog and on the Internet.

Note
How to connect the SACIQ sensor connection cable to the terminal strip of an MIQ module is described in chapter 3 INSTALLATION of the IQ SENSOR NET system operating manual.

Caution
The AmmoLyt® 700 IQ ammonium sensor unit may only be immersed in conjunction with a mounted combination electrode. Moisture must be prevented from penetrating the ammonium sensor during the replacement of the electrode as, otherwise, the sensor could be destroyed.
Which electrodes can be used in conjunction with the AmmoLyt® 700 IQ ammonium sensor is given in section 6.1 SENSOR AND ELECTRODES.

Are the plug connections dry?

Before connecting the sensor and sensor connection cable, please make sure that the plug connections are dry. If moisture gets into the plug connections, first dry the plug connections (dab them dry or blow them dry using compressed air).

Note
Do not suspend the sensor on the sensor connection cable. Use an armature or electrode holder. Information on this and other IQ SENSOR NET accessories is given in the WTW catalog and on the Internet.

Connecting the sensor to the sensor connection cable

1	Take the protective caps off the plug connections of the sensor and the SACIQ sensor connection cable, and keep them safe.
2	Plug the jack of the SACIQ sensor connection cable onto the plug head connector of the sensor. At the same time, rotate the socket so that the pin in the plug head connector (1) clicks into one of the two holes in the jack.
3	Then, screw the coupling ring (2) of the sensor connection cable onto the sensor up to the stop.

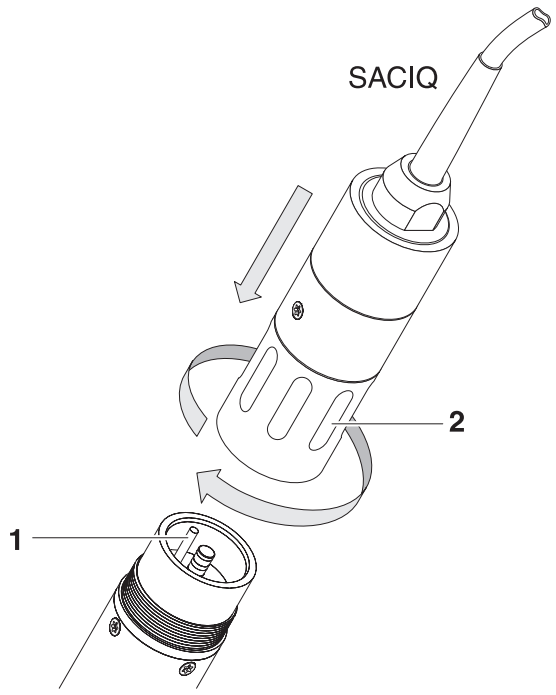
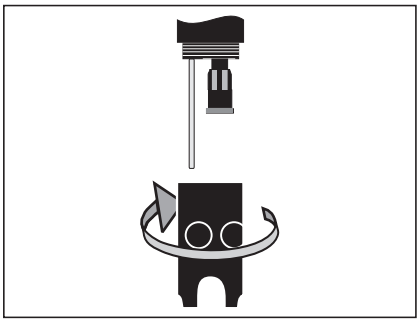


Fig. 3-1 Connecting the sensor

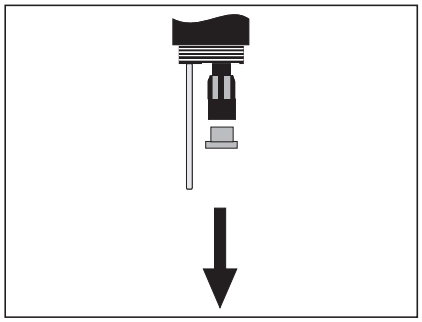
3.3 Commissioning / Getting the sensor ready for measuring

Mounting the combination electrode

1	Unscrew the protective hood from the sensor.

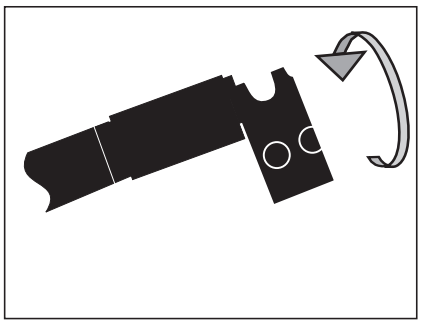


2	Pull off the blind plug from the plug head socket of the sensor.

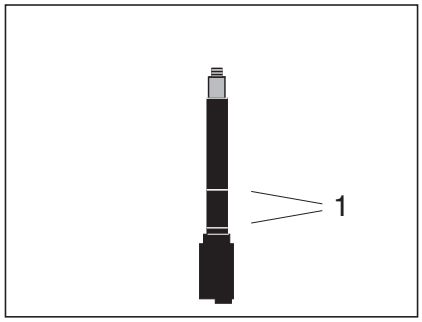


3	Prepare the combination electrode to be mounted in the sensor. To do so, screw the AmmoLyt® NHA/AT exchange electrode onto the AmmoLyt® NHA reference electrode without leaving any gap (see AmmoLyt® NHA/AT operating manual).

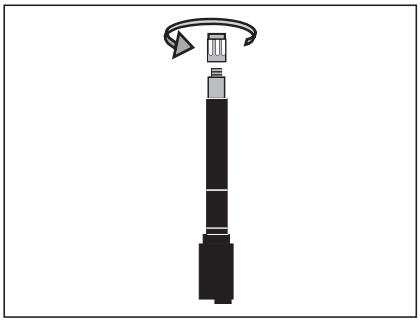
Note
The protection hood of the AmmoLyt® 700 IQ sensor can be used as a wrench.



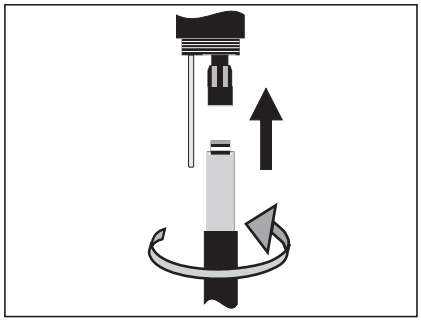
4	Grease the two sealing rings (1) of the AmmoLyt® electrode using the grease from the tube supplied.



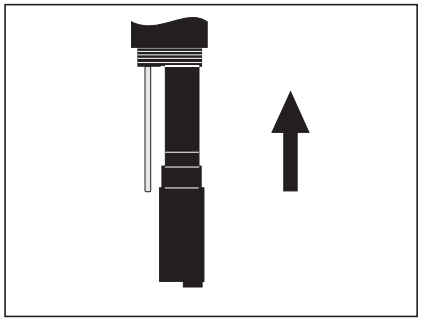
5	Unscrew the protection cap from the plug head of the reference electrode.



6	Screw the reference electrode into the plug head socket of the sensor.



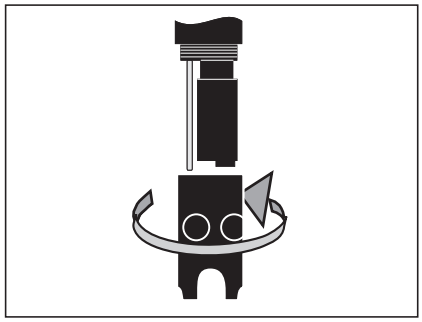
7	Push the unit into the sensor up to the stop.



Caution

Push the electrode into the sensor right up to the stop so that the connection is watertight. Leaks could lead to the destruction of the sensor.

8	Screw the protective hood onto the sensor.



9	Carry out the settings for the sensor on the terminal of the measuring system (see section 3.4).
10	In the case of initial commissioning, condition the sensor together with the mounted combination electrode in a diluted standard solution, e.g. ES/NH4_ISA-10 10 mg/l NH4-N for about 2 hours (see section 6.2).
11	Calibrate the sensor and electrode with the measuring system (see section 4.1).

3.4 Carrying out the settings for the sensor on the terminal of the IQ SENSOR NET system

The following settings can be carried out for the sensor:

Menu item	Possible settings	Explanations
Measuring mode	● *NH4* ● *NH4-N* ● *mV*	The citation form of the mass concentration or the voltage of the electrode.
Measuring range (*NH4*)	● *AutoRange* ● *1 ... 1290 mg/l* ● *0.1 ... 129.0 mg/l*	2 measuring ranges can be selected. With *AutoRange*, the instrument automatically switches to the suitable measuring range.
Measuring range (*NH4-N*)	● *AutoRange* ● *1 ... 1000 mg/l* ● *0.1 ... 100.0 mg/l*	2 measuring ranges can be selected. With *AutoRange*, the instrument automatically switches to the suitable measuring range.
Measuring range (*mV*)	● *-2000 ... 2000 mV*	Fixed range
Temperaturmodus	● *°C* ● *°F*	Unit of the measured temperature value (Celsius, Fahrenheit).

Menu item	Possible settings	Explanations
Cal. procedure (only in the *NH4* and *NH4-N* measuring mode)	● *1 point standard (1)*	● 1-point calibration with a standard solution. The concentration of the standard solution must be entered.
	● *1 point ref. (2)*	● 1-point calibration in the test sample with independent determination of the NH_4^+ concentration by a reference measurement. The concentration of the test sample determined in a reference procedure must be entered.
	● *2 point stand. (3)*	● 2-point calibration using any two WTW standard solutions. The concentration of the standard solutions must be entered.
	● *Simple std. add. (4)*	● A known concentration of standard solution is added to the sample. The NH_4^+ concentration in the test sample is determined from the change in potential.
	● *Double std. add. (5)*	● A known quantity of a standard solution is added to the test sample in two steps. The NH_4^+ concentration in the test sample is determined from the change in potential during the first and second standard addition.
		Note: The calibration procedures are described in detail in section 4.1 CALIBRATION.
ORP offset (only in *mV* measuring mode)	*-100 mV ... +100 mV*	You can set the voltage zero point here.
Initial calibration	*On* *Off*	An *Initial calibration* is required when the sensor is calibrated for the first time or when an electrode or the entire combination electrode has been replaced. During initial calibration, the basis for the evaluation of the drift potential is determined. Here you can select whether the next calibration should be an *Initial calibration*. After the initial calibration has been carried out, the setting for *Initial calibration* automatically switches to *Off.*

Menu item	Possible settings	Explanations
Temp. adjustment	*-1.5 °C ... +1.5 °C*	The temperature compensation function enables the temperature sensor to be balanced against a reference temperature measurement (displacement of the zero point by ±1.5 °C). Notes: ● Due to the thermal capacity of the sensor, it is necessary to place it in a container with at least 2 liters of water. ● Leave the sensor in this container for at least 15 minutes while stirring occasionally, then carry out the adjustment. If the temperature difference of the water and sensor is > 10°C, leave the sensor in the container for at least one hour while stirring occasionally.
Potassium compens.	*On* *Off*	Potassium ions in the test sample interfere with the measurement and lead to increased values (see section 4.2.2). After determining the potassium content of the test sample by a reference measurement you can input the determined potassium content here. The potassium compensation corrects the measured value accordingly.
Potassium conc. (only with *Potassium compens.*: *On*)	*0 ... 100 mg/l*	
Save and quit		The system confirms the saving of the settings and the display switches to the next higher level.
Quit		The display switches to the next higher level without saving the new settings.

Carrying out settings

1	Switch to the measured value display with (M).
2	Open the *Settings* menu with (S).
3	Select and confirm the menu item *Settings of sensors and diff. sensors -> Measuring range* column with (↻) and (OK).
4	Select an entry with (↻).

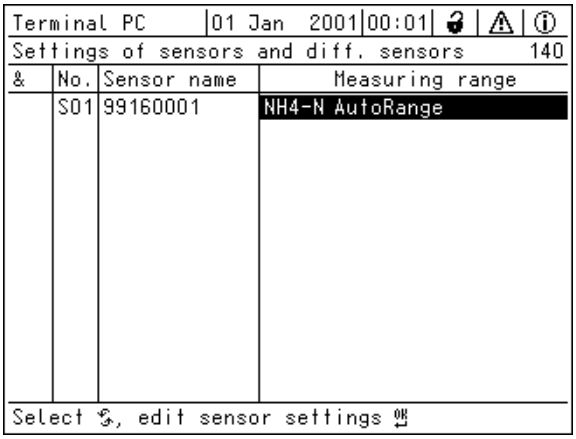


Fig. 3-2 140 - Settings of sensors and diff. sensors

5	Confirm the selection with OK. The settings of the sensor are displayed.

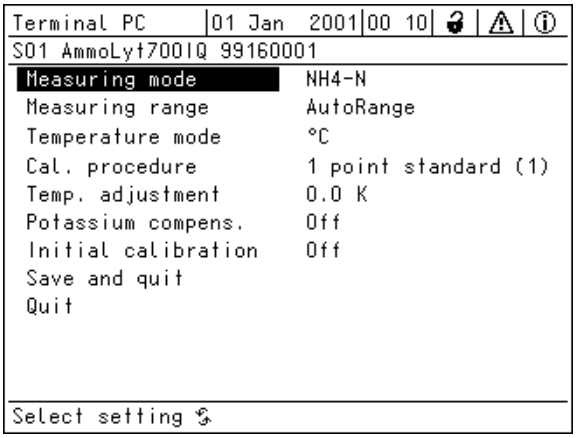


Fig. 3-3 140 - Settings of sensors and diff. sensors

6	Make the sensor settings with and confirm each of them with OK.
7	Select the *Save and quit* menu item with and confirm with OK. The new settings are stored in the sensor.

4 Calibration and measuring

4.1 Calibration

4.1.1 General information

Why calibrate?

When an ammonium electrode is operated its characteristic curve changes with the course of time. The characteristic curve is generally characterized by the slope and the axis intercept. The characteristic curve is the base for calculating the measured value from the electrode voltage.

With calibration, the current characteristic curve parameters are determined as follows:

- With all calibration procedures, i.e. 1-point and 2-point procedures, the change of the axis intercept is determined ("drift potential").
- All two-point calibration procedures additionally determine the slope.

Why calibrate?

Calibrate during the initial commissioning, after exchanging an electrode and at regular intervals (depending on the application).

Calibration log and calibration history

The calibration history contains the calibration log of the initial and last of the following calibrations. You can call up the calibration history via the *Calibration history of selected sensor* display option.

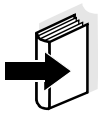
Citation form

There are two common citation forms for the specification of ammonium contents in a solution. The citation form NH4 specifies the ammonium content (NH_4^+). The citation form NH4-N specifies the amount of ammonium nitrogen only. You can select the required citation form in the settings for the sensor.

If the citation forms do not correspond, you can carry out the conversion yourself.

1 mg/l NH4 = 0.777 mg/l NH4-N.

1 mg/l NH4-N = 1.287 mg/l NH4.



Note
Ordering information on ammonium standard solutions can be found in section 6.2.

4.1.2 Overview of the calibration procedures

For ammonium measurements with the AmmoLyt® 700 IQ sensor, the following calibration procedures can be selected:

1 point standard (1) 1-point calibration in a standard solution.

1 point ref. (2) 1-point calibration in the test sample. Calibration is carried out determining the ammonium concentration by an independent reference procedure, e.g. photometry.

2 point stand. (3) 2-point calibration in two standard solutions.

Simple std. add. (4) Calibration in the test sample with a one-time addition of standard solution.

Double std. add. (5) Calibration in the test sample with a double addition of standard solution.

Determined calibration data

Depending on the calibration procedure (single-point or two-point), the following data are determined during calibrating:

Calibration procedures	Drift potential:	Slope
1 point standard (1)	✶	
1 point ref. (2)	✶	
2 point stand. (3)	✶	✶
Simple std. add. (4)	✶	
Double std. add. (5)	✶	✶

In the calibration log and calibration history (section 4.1.10), the slope and drift potential are output. The drift potential and slope inform about the age condition of the electrode.

Note
Single-point calibration procedures take over the slope of the last two-point calibration. If no valid data from a two-point calibration are available, the default setting (59.16 mV) is used. In both cases the value is marked with * in the calibration history.

4.1.3 Calibration in practice

Initial calibration

The first calibration (initial calibration) is especially important as it is the reference point for all other calibrations (following calibrations).

An initial calibration is required each time an electrode is commissioned. The initial calibration is switched on and off in the setting menu of the sensor (see section 3.4).

With the initial calibration, the zero point for the drift potential is determined. It serves as the reference value for the drift potential, which is determined and recorded in the calibration log with every following calibration. In addition to the slope, the drift potential informs about the age condition of the electrode (see section 4.1.10).

Note
An optimum initial calibration is achieved by a calibration procedure that determines the current slope of the electrode (*2 point stand. (3)* or *Double std. add. (5)*). If the slope is not determined, the default setting (59.16 mV) is taken over. A value that is taken over is marked with * in the calibration history (see section 4.1.10).

Following the initial calibration, we recommend to carry out a calibration with the *1 point ref. (2)* procedure in order to compensate for matrix effects of the real test sample. Apart from that, the potassium content of the test sample should be determined and checked for whether a potassium compensation is required (see section 4.2.2).

Following calibrations

Basically, any calibration procedure can be used for the following calibrations. The slope of the electrode should be determined at regular intervals in any case in order to be able to evaluate the aging of the electrode. If the electrode cannot be calibrated any more because the slope is too low it is blocked for measurement and has to be exchanged.

"Emergency operation" with invalid slope

After determining an invalid slope, the sensor can be further operated with a subsequent valid single-point calibration as a stopgap solution until the electrode is exchanged. The last valid slope is used in the measuring operation. With the single-point calibration, a corresponding note appears quoting the slope that is used.

Optimum calibration of an electrode

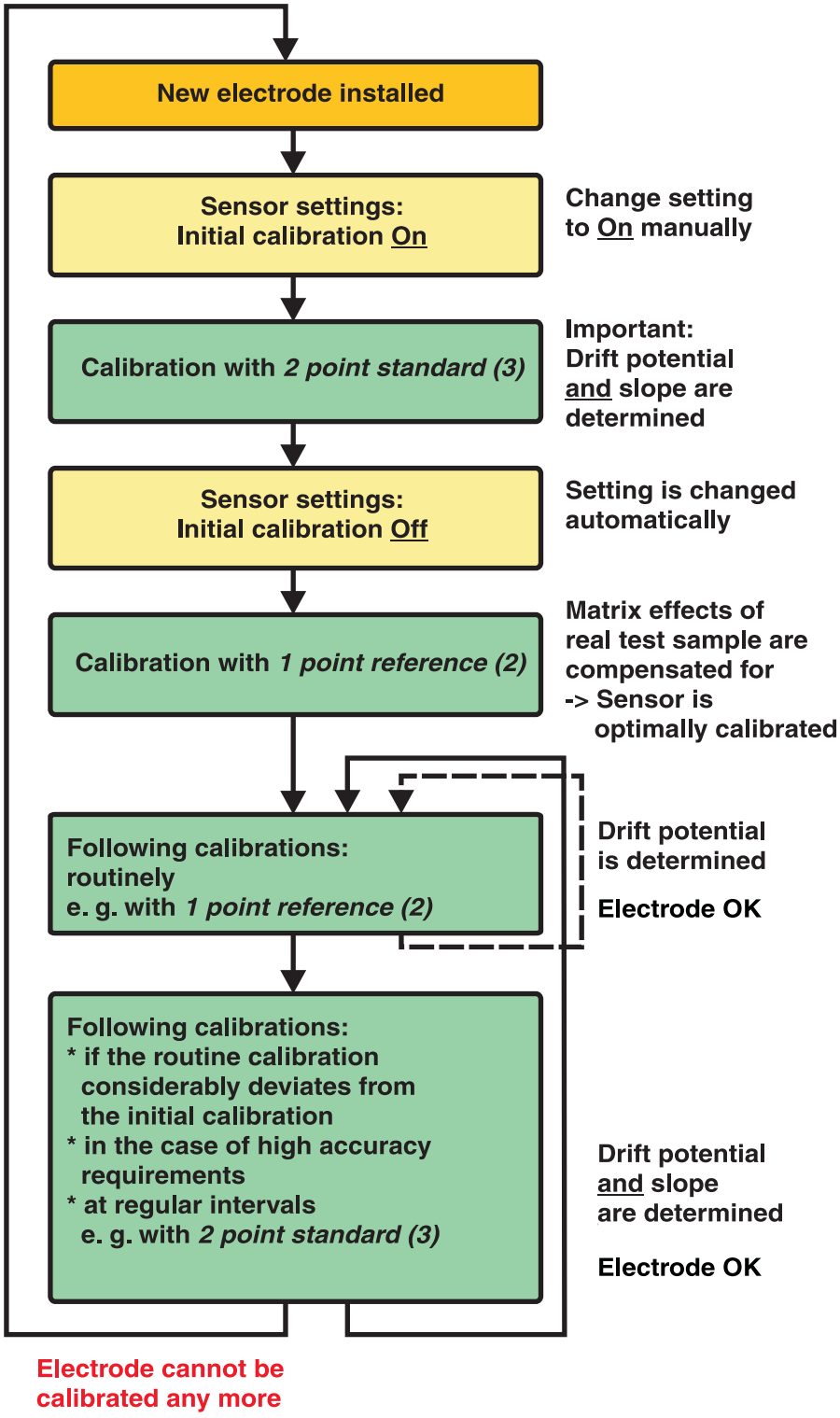


Fig. 4-1 Sequence of calibrations

4.1.4 General course of a calibration

Preparatory activities

An optimum calibration result is possible by,

- before calibrating,
  - conditioning the sensor in the ES/NH4_ISA-10 standard solution with 10 mg/l NH4-N for approx. 10 minutes
  - setting the required calibration procedure (see section 3.4).
- providing a similar temperature of standard solution and test sample for calibration

Note
When exchanging an electrode or the entire combination electrode an initial calibration (see section 4.1.3) always has to be carried out.

Course

1	Switch to the measured value display with Ⓜ.
2	Select the measured value display of the required sensor with ⟳.
3	Call up the calibration with Ⓒ. The *Maintenance condition: Linked outputs are frozen.* window appears.

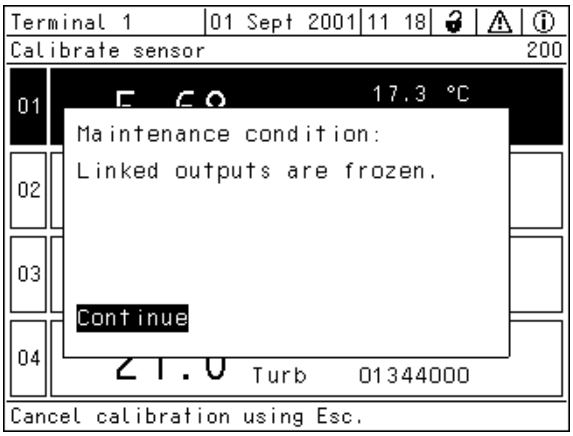


Fig. 4-2 Maintenance condition

Note
When the maintenance condition is activated, linked outputs remain in their current condition. In the measured value display, the measured value or the condition indicator of the sensor flashes.

Starting the calibration

4	Confirm with OK. The display appears with a note that an initial calibration may be necessary.

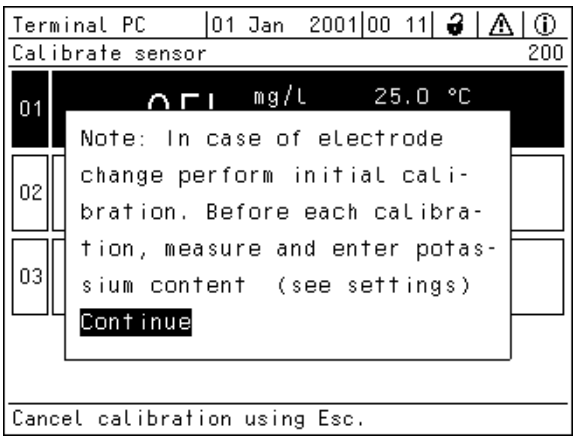


Fig. 4-3 200 - Calibrate sensor

5	Confirm with (OK). The following display (or similar, depending on the selected calibration procedure) appears:

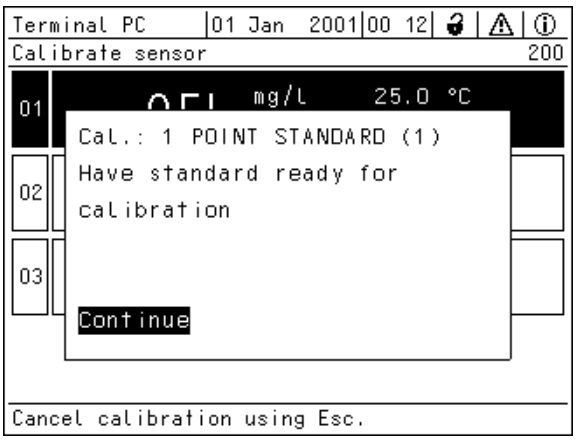


Fig. 4-4 200 - Calibrate sensor

6	The further course depends on the respective calibration procedure. The individual operating steps are given in the sections 4.1.5 to 4.1.9.

Note
You can break off the calibration procedure at any time with the (ESC) key. The system continues to work with the old calibration data. However, you have to switch off the maintenance condition in any case.

Note
The sensor determines a stable measured value with each measurement during the course of a calibration. The display shows a continuation display and the current electrode voltage in mV.

After calibrating, the following display appears:

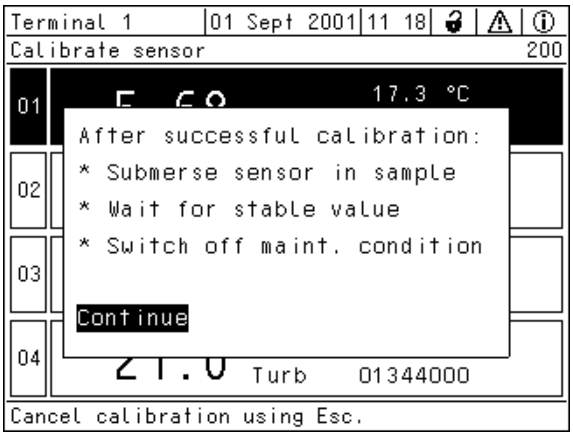


Fig. 4-5 After calibrating

Completing the calibration

7	Confirm with (OK). The measured value display appears again (the measured value flashes because the sensor is still in the maintenance condition).
8	If the calibration was successful, immerse the sensor in the sample.
9	Wait for a stable measured value.
10	Switch off the maintenance condition (press (OK) and, in the *Display/Options* menu, make the setting).
11	Switch to the measured value display with (M). The measured value no longer flashes.

Note
If the calibration was not successful, "----" appears on the display and a corresponding entry with instructions appears in the log book. Follow the instructions and repeat the calibration.

4.1.5 Calibration procedure, *1 point standard (1)*

The *1 point standard (1)* 1-point calibration is carried out using one standard solution.

Note
Determine the potassium content of the sample (see section 4.2.2). Activate the *Potassium compens.* function and adjust the potassium content (see section 3.4).
The potassium content of the sample does not effect calibration but the measurement following.

Operating steps during calibration

Display	Explanation
Cal.: 1 POINT STANDARD (1) *Have standard ready for calibration*	You can use any standard solution for this. The ammonium value should be as close to the value expected for the test sample as possible. Confirm with OK.
Select standard concentration (1 / 10 / 100) mg/l *NH4-N*	If necessary select a standard with ↻. Confirm with OK.
** Rinse electrode*	Follow the instructions on the display. Confirm with OK.
** Immerse electrode in standard.* ** Wait for a stable measured value.*	Confirm with OK. As soon as a stable measured value is reached, the next display appears.
Calibration successful *Conc. (NH4-N)* x mg/l *Slope* y mV* *Drift voltage* z mV *End of 1 POINT STAND. (1) cal.*	The values for *Conc. (NH4-N)*, *Slope* and *Drift voltage* are displayed. The slope is taken over from the last calibration that determined the slope. The calibration is complete. Confirm with OK. The display returns to the measured value display.

4.1.6 Calibration procedure, *1 point ref. (2)*

The *1 point ref. (2)* 1-point calibration is carried out with the sample and in two main steps, each of which is started with ©.

Note
Determine the calibration value and take the sample before the start of the aeration in the aeration tank. The ammonium concentration is highest before the aeration. After the aeration the ammonium content can decrease to a value that lies within the range of the detection limit. It does not make sense to calibrate in this range.

Note
Determine the potassium content together with the reference value for the ammonium content in this calibration procedure.

Operating steps during step 1

Display	Explanation
Cal.: 1 POINT REFERENCE (2) *Step 1: Determining the reference voltage*	Confirm with (OK).
** Rinse electrode.* ** Immerse electrode in sample.* ** Observe conditioning time of 15 minutes.*	Before starting the calibration the sensor should be immersed in the test sample for conditioning for at least 15 min. Start the measurement with (OK). This step determines and stores the reference voltage. As soon as a stable measured value is recognized, the next display appears.
Step 1 finished. Switch to the measured value display with 2x 'OK'. After det. the reference concentration, start calib. step 2 with 'C'.	Step 1 of the calibration is finished. Press (OK) twice to switch to the measured value display. The sensor is in the maintenance condition.

Note
During the subsequent determination of the reference concentration in the laboratory you can use the sensor for measuring again by simply abolishing the maintenance condition.
The sensor continues to use the old calibration data. The reference voltage determined in step 1 of the calibration is not lost. It remains stored until step 2 of the calibration is completed. It does not have to be noted and entered again.

Sampling and determining the reference concentration

You have to be in the measured value display to continue the calibration. Continue with sampling and determining the reference concentration as follows.

1	Take a sample.

Note
The ammonium content has to be determined immediately after taking the sample as the ammonium content changes very quickly due to the micro organisms that are present. It is best to take the sample using a syringe filter for transport to the laboratory or to stabilize it otherwise. When adding stabilizing solutions, the dilution factor has to be taken into account.

2	Determine the concentration of ammonium and potassium in the laboratory. With this procedure, the potassium content of the sample affects calibration as well as measurement.
3	In the *Settings of sensors and diff. sensors* menu (see section 3.4) – Switch on the *Potassium compens.* function and – enter the potassium content.
4	Continue the calibration as follows with Ⓒ.

Operating steps during step 2

Display	Explanation
Cal.: 1 POINT REFERENCE (2) *Step 2: Enter reference concentration* *Reference voltage already determined*	Confirm with Ⓞⓚ.
Continue with ... *...Input ref. conc.* *...New calibration*	Here you can select whether you want to repeat step 1 of the calibration (*...New calibration*), or enter the reference concentration (*...Input ref. conc.*). If necessary select the step with Ⓢ. Confirm with Ⓞⓚ.
Input reference concentration *Citation form/Value range*	Confirm with Ⓞⓚ.

Citation form of ref. conc. *NH4(0.1..129.0mg/l)* *NH4(1..1290mg/l)* *NH4N(0.1..100.0mg/l)* *NH4N(1..1000mg/l)*	If necessary select the citation form with ⟳. Confirm with OK.
Input reference concentration *Value determined*	Confirm with OK.
Value of ref. concentration *x mg/l NH4-N*	If necessary set the reference concentration determined with ⟳. Confirm with OK.
Calibration successful *Conc. (NH4-N)* x mg/l *Slope* y mV* *Drift voltage* z mV *End of 1 POINT REF. (2) cal.*	The values for *Conc. (NH4-N)*, *Slope* and *Drift voltage* are displayed. The slope is taken over from the last calibration that determined the slope. The calibration is complete. Confirm with OK. The display returns to the measured value display.

4.1.7 Calibration procedure, *2 point stand. (3)*

The *2 point stand. (3)* two-point calibration is carried out with two standard solutions of different concentrations. The procedure includes two conditioning processes. Each conditioning process takes 15 min and is important so the temperatures of standard solution and electrode can adjust to each other and a stable concentration can be reached at the electrode membrane. During the conditioning process the remaining time is displayed on the screen. The process cannot be shortened. By pressing ESC or M you cancel the entire calibration and the old calibration data is still used. The time required for the entire calibration is approx. 40 min.

Note
Determine the potassium content of the sample (see section 4.2.2). Activate the *Potassium compens.* function and adjust the potassium content (see section 3.4).
The potassium content of the sample does not effect calibration but the measurement following.
If you carry out a *1 point ref. (2)* calibration directly after the *2 point stand. (3)* calibration it is sufficient to determine and adjust the potassium content during the *1 point ref. (2)* calibration (matrix alignment) (see section 4.1.6).

Operating steps during calibration

Displays	Explanation
Unscrew protective hood. *Clean and rinse sensor incl. electrode and protective hood, then reassemble them.*	Prepare the sensor as described. After completing the operating steps confirm with (OK).
Cal.: 2 POINT STANDARD (3) *Have standard 1 ready for calibration*	Confirm with (OK).
Immerse sensor in standard 1. *Observe minimum immersion depth (70mm).*	Confirm with (OK).
Select standard concentration (1 / 10 / 100) mg/l *NH4-N*	If necessary select another concentration of the standard with (↻). Confirm with (OK). Subsequently wait for the conditioning time of 15 minutes to expire. The remaining time is shown on the display.
Discard used standard. Immerse sensor in new standard with similar concentration. *Start calibration.*	Confirm with (OK).
Cal.: 2 POINT STANDARD (3) *Calibration values for standard 1 determined* *Have standard 2 ready*	Confirm with (OK).
Rinse sensor with standard 2. *Immerse sensor in standard 2.* *Observe minimum immersion depth (70mm).*	Confirm with (OK).
Select standard concentration (1 / 10 / 100) mg/l *NH4-N*	If necessary select the concentration of the standard with (↻). Confirm with (OK). Subsequently wait for the conditioning time of 15 minutes to expire. The remaining time is shown on the display.
Discard used standard. Immerse sensor in new standard with similar concentration. *Start calibration.*	Confirm with (OK).

Displays	Explanation
Cal.: 2 POINT STANDARD (3) *Calibration values for standard 2 determined*	Confirm with (OK).
Calibration successful *Conc. (NH4-N)* x mg/l *Slope* y mV *Drift voltage* z mV *End of 2 POINT STAND. (3) cal.*	The values for *Conc. (NH4-N)*, *Slope* and *Drift voltage* are displayed. The calibration is complete. Confirm with (OK). The display returns to the measured value display.

4.1.8 Calibration procedure, *Simple std. add. (4)*

This calibration with a simple standard addition is carried out in the test sample while adding standard. The volumes of the test sample and standard have to be dosed exactly.

The following appliances are suitable for dosing:

- Measuring cylinder to determine the volume of the sample
- Pipette (microliter pipette as necessary) for accurate dosing of the standard. The higher the concentration of the standard, the more important it is to measure the amount of calibration standard very carefully.

Note
Before calibrating, determine the potassium content of the sample (see section 4.2.2).
Before calibrating, activate the *Potassium compens.* function and adjust the potassium content (see section 3.4).
The potassium content of the test sample affects the calibration result.

Conditions and calibration range for simple standard addition

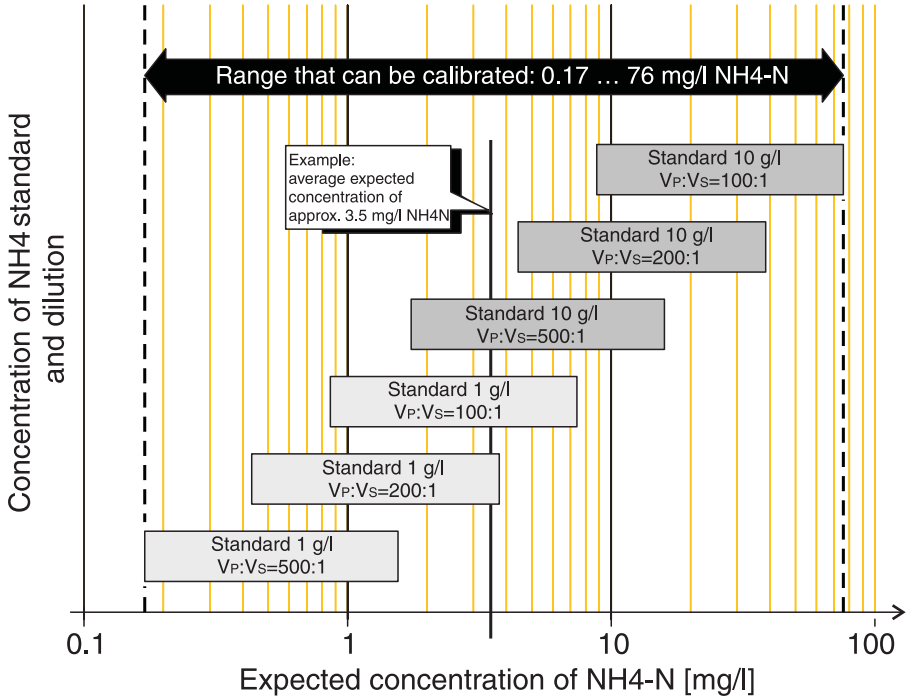
Observe the following points for the simple standard addition:

- The volume of the standard added to the test sample changes the test sample. Therefore, the volume of the standard should not be more than approx. 1 % of the volume of the sample.
  Example: With 100 ml sample volume, the added volume should not be more than 1 ml.
- Through the addition of standard solution, the ammonium content of the test sample should be increased at least twofold but not more than tenfold.

Based on these conditions, the range that can be calibrated is from 0.17 to 76 mg/l NH4-N (or 0.22 to 99 mg/l NH4). If the expected measured values are outside this range, a different calibration procedure has to be selected.

Concentration and quantity of standard solution

The concentration and quantity of the standard solution to be added depend on the measuring range expected. They can be determined by means of the following diagram. The requirements for the simple standard addition are automatically met while doing so.



V_P:V_S is the volume ratio between the test sample and standard to be added. If several combinations for concentration/volume ratio (bars) are possible for the determination, select the bar where the expected NH4-N concentration is more in the center.

Example:
The expected average concentration is approx. 3.5 mg/l NH4-N. The vertical line in the diagram crosses three ranges:

– Concentration 1 g/l and volume ratio 200:1

– Concentration 1 g/l and volume ratio 100:1

– Concentration 10 g/l and volume ratio 500:1

Selection of the range: Basically, all of the three ranges are suitable. The lower bar is crossed by the line on the right edge only. Therefore, the other two ranges are better suited. For further selection, decide which bar covers the expected measuring range better, i.e. whether the expected values are rather lower or higher than the average value. Besides, the decision can be made according to practical points of view (availability of standard solution and suitable dosing equipment).

Entry of volumes

The volume of standard to be added in this calibration procedure has to be entered on the terminal of the IQ SENSOR NET with an accuracy of 1/10 ml. Therefore, the volume has to be rounded up or down accordingly.

Note
Make sure the citation form is correct for all specifications of the concentration.

Operating steps during calibration

Display	Explanation
Cal.: SIMPLE STD. ADD. (4) *Have test sample ready for calibration*	Confirm with (OK).
Input sample volume *(100 ... 1000) ml*	If necessary select the volume of the sample with (↻). Confirm with (OK).
** Wait for a stable measured value.*	Confirm with (OK).
Cal.: SIMPLE STD. ADD. (4) *Reference voltage of test sample determined* *Have standard ready*	Confirm with (OK). The measurement of the test sample begins.
Select standard concentration *(1 / 10) g/l NH4*	If necessary select the concentration of the standard with (↻). Confirm with (OK).
Input standard volume *(0.1 ... 20.) ml*	If necessary select the volume of the standard with (↻). Confirm with (OK).
Cal.: SIMPLE STD. ADD. (4) *Add standard to test sample*	Add the quantity of standard that was entered to the test sample. Subsequently confirm with (OK).
** Wait for a stable measured value.*	Confirm with (OK).
Cal.: SIMPLE STD. ADD. (4) *Reference voltage determined after standard addition*	Confirm with (OK).
Calibration successful *Conc. (NH4-N)* x mg/l *Slope* y mV* *Drift voltage* z mV *End of SIMPLE STD ADD (4) cal.*	The values for *Conc. (NH4-N)*, *Slope* and *Drift voltage* are displayed. The calibration is complete. Confirm with (OK). The display returns to the measured value display.

4.1.9 Calibration procedure, *Double std. add. (5)*

This calibration with double standard addition is carried out in the test sample while adding standard with a certain concentration in two steps. The volumes of test sample and standard have to be dosed exactly.

The following appliances are suitable for dosing:

- Measuring cylinder to determine the volume of the sample
- Pipette to exactly dose the standard

Note
Before calibrating, determine the potassium content of the sample (see section 4.2.2).
Before calibrating, activate the *Potassium compens.* function and adjust the potassium content (see section 3.4).
The potassium content of the test sample affects the calibration result.

Concentration and quantity of standard solution

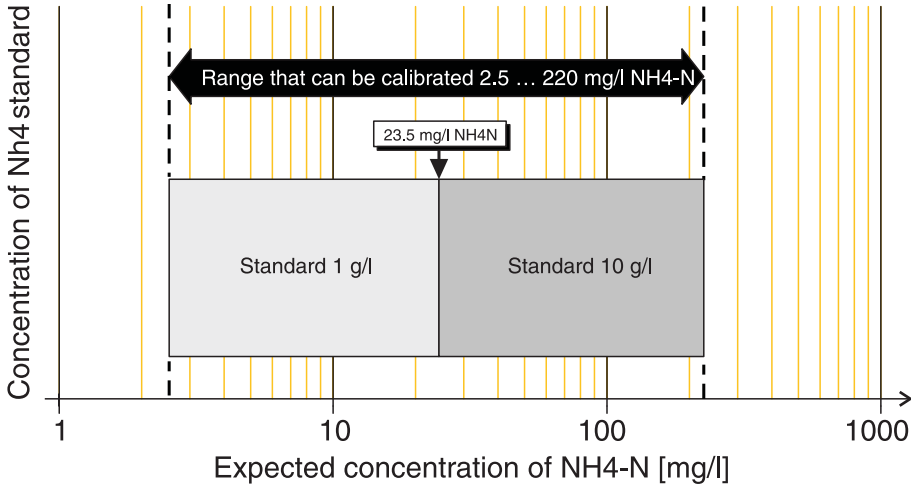
The quantity of standard solution to be added is permanently fixed for the double standard addition:

- First addition: 1 % of the sample volume
- Second addition: 2 % of the (original) sample volume

After both additions, the original ammonium content of the test sample should be increased at least twofold but not more than tenfold.

Based on these conditions, the range that can be calibrated is from 2.5 to 220 mg/l NH4-N (or 3.2 to 283 mg/l NH4). If the expected measured values are outside this range, a different calibration procedure has to be selected.

The concentration of the standard solution to be added depends on the measuring range expected. It can be determined by means of the following diagram. The requirements for the double standard addition are automatically met while doing so.



Note
Make sure the citation form is correct for all specifications of the concentration.

Operating steps during calibration

Display	Explanation
Cal.: DOUBLE STD. ADD. (5) *Have test sample ready for calibration*	Confirm with OK.
Input sample volume (100 ... 1000) ml	If necessary select the volume of the sample with ↻. Confirm with OK.
** Rinse electrode.* ** Immerse electrode in test sample.* ** Wait for a stable measured value.*	Confirm with OK. The measurement of the test sample begins.
Cal.: DOUBLE STD. ADD. (5) *Reference voltage of test sample determined* *Have standard ready*	Confirm with OK.
Select standard concentration (1 / 10) g/l *NH4*	If necessary select the concentration of the standard with ↻. Confirm with OK.
Add standard to sample	Confirm with OK.
** Wait for a stable measured value.*	Confirm with OK. The measurement begins.

Display	Explanation
Cal.: DOUBLE STD. ADD. (5) *Reference voltage determined after first standard addition*	Confirm with (OK).
Add standard to sample	Confirm with (OK).
** Wait for a stable measured value.*	Confirm with (OK). The measurement begins.
Cal.: DOUBLE STD. ADD. (5) *Reference voltage determined after second standard addition*	Confirm with (OK).
Calibration successful *Conc. (NH4-N)* x mg/l *Slope* y mV *Drift voltage* z mV *End of DOUBLE STD ADD (5) cal.*	The values for *Conc. (NH4-N)*, *Slope* and *Drift voltage* are displayed. The calibration is complete. Confirm with (OK). The display returns to the measured value display.

4.1.10 Calibration result

Calibration evaluation

After calibrating the system automatically evaluates the calibration data and current state of the sensor. The drift potential and slope are evaluated separately. For a valid calibration, the values have to be within the following ranges:

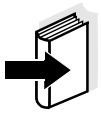
Slope: +50 ... +70 mV

Drift potential: -45 ... +45 mV

A calibration can have the following results:

Possible results of the calibration

Display after the calibration	Log book entries (meaning/actions)
Measured value display	Sensor was successfully calibrated. Slope and drift potential are within the valid range. For calibration data, see calibration history.
"----"	Sensor could not be calibrated. Slope and/or drift potential are outside the valid range. Sensor blocked for measurement. – Service the sensor immediately (see chapter 5). – View the calibration history. – Check the calibration conditions and calibration standard. Note: After determining an invalid slope, the sensor can be further operated with a subsequent valid single-point calibration as a stopgap solution until the electrode is exchanged. The last valid slope is used in the measuring operation. With the single-point calibration, a corresponding note appears quoting the slope that is used.



Note
Information on the contents and structure of the log book and how you can call it up is given in the LOG BOOK chapter of the IQ SENSOR NET system operating manual.

Viewing the calibration data

The calibration data can be viewed as follows via the *Calibration history* display option.

1	Select the relevant sensor in the measured value display on the terminal.
2	Press the (OK) key. The *Display/Options* menu appears.
3	Select the *Calibration history of selected sensor* menu item. The data of the last calibrations of the sensor appear on the display.

Calibration history

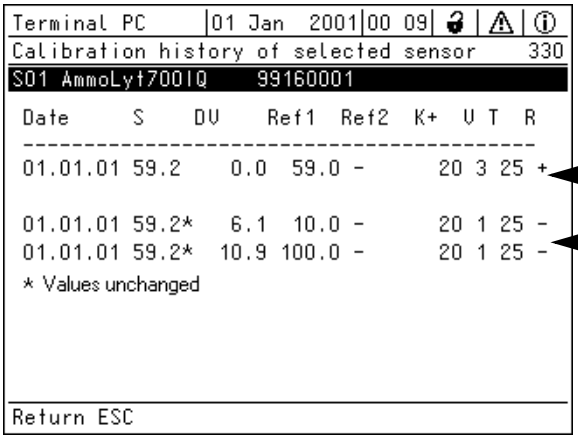


Fig. 4-6 330 - Calibration history of selected sensor

The calibration history contains the following information:

Date	Date of the calibration
S(*)	Slope [mV] of the electrode The value is marked by ** Values unchanged* if it is not possible to determine the slope. Instead, the last determined value is taken over for the slope. This applies to all 1 point calibration procedures, *1 point standard (1)*, *1 point ref. (2)* and *Simple std. add. (4)*.
DV	Drift potential [mV]
Ref1/Ref2	Concentration [mg/l NH4-N] ● of the standard with *1 point standard (1)* ● of the test sample (reference measurement) with *1 point ref. (2)* ● of the two standards with *2 point stand. (3)* ● of the test sample (calculated) with *Simple std. add. (4)* [Ref1/-] ● of the test sample (calculated) with *Double std. add. (5)* [Ref1/Ref2]
K+	Potassium content [mg/l]
P	Calibration procedure, number 1 ... 5
T	Temperature [°C]
R	Result of the calibration **+** : Calibration successful **-** : Calibration unsuccessful

Note
Only calibration data produced by the same calibration procedure can be compared.

4.2 Measuring

1	Submerse the sensor with the mounted combination electrode in the sample.
2	Read the measured value on the terminal of the IQ SENSOR NET system.

Note
Please pay attention to:

- the minimum immersion depth of the sensor (> 70 mm)
- the measuring range of the electrode used (see operating manual of the electrode).

Note
To keep the sensor clean, we strongly recommend to use the CH cleaning head (see chapter 6 REPLACEMENT PARTS AND ACCESSORIES).

4.2.1 Influence of the pH value

pH value > 7

The pH value of the test sample affects the chemical balance between NH_4^+ and NH_3. From a pH value of 7, the NH_4^+ part of the test sample decreases and the NH_3 part increases with a rising pH value. NH_3 is not measured by the AmmoLyt®.

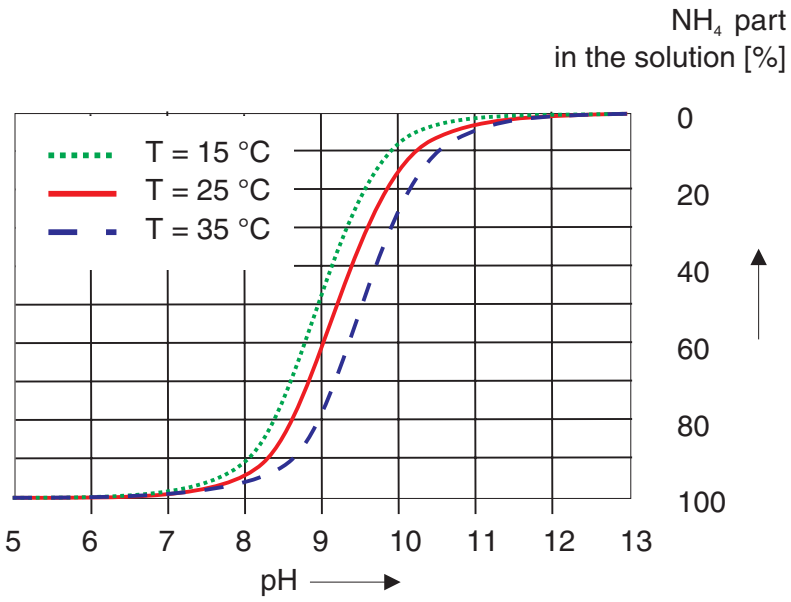
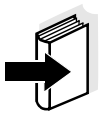


Fig. 4-7 Influence of pH value and temperature (T) on the NH_4^+ part in the test sample

For measurements in test samples with a pH value > 7, a compensation for the influence of the pH value may be necessary. The compensation can, e. g. be performed using the superior process control engineering.



Note
For details, please refer to WTW GmbH.

4.2.2 Potassium compensation

Measuring ammonium in the presence of potassium leads to increased ammonium values:

Potassium contents	Ammonium value increased by approx.
10 mg/l K^+	0.7 mg/l
50 mg/l K^+	3.4 mg/l

Higher measured values caused by potassium can be compensated for by switching on the *Potassium compens.* function and entering the potassium content in the *Settings of sensors and diff. sensors* menu (see section 3.4).

Potassium compensation for calibration

The presence of potassium affects the calibration results of the following calibration procedures:

- *1 point ref. (2)*
- *Simple std. add. (4)*)
- *Double std. add. (5)*

For these calibration procedures, the current potassium content must always be determined and entered before or during calibration. The entered potassium compensation has an effect on the calibration result and thus on the subsequent measurements.

The calibration procedures, *1 point standard (1)* and *2 point stand. (3)* are carried out in standard solutions. Potassium does not interfere here. An incorrectly set potassium compensation affects the following measurement.

Potassium compensation for measurements

The function, *Potassium compens.*, should always be used if the concentration of the interfering ion causes the measurement signal to leave the range of the required accuracy. To avoid calibration and measuring errors, we recommend to

- routinely determine the potassium contents
- switch on the *Potassium compens.* function
- enter the potassium content.

The more the actual potassium content deviates from the value entered for the potassium compensation, the more the displayed measured value deviates from the current ammonium content.

Fig. 4-8 shows the interrelationship of real and displayed NH4-N value for different potassium contents. The characteristic curve with the optimum potassium compensation corresponds to the characteristic curve without any potassium content.

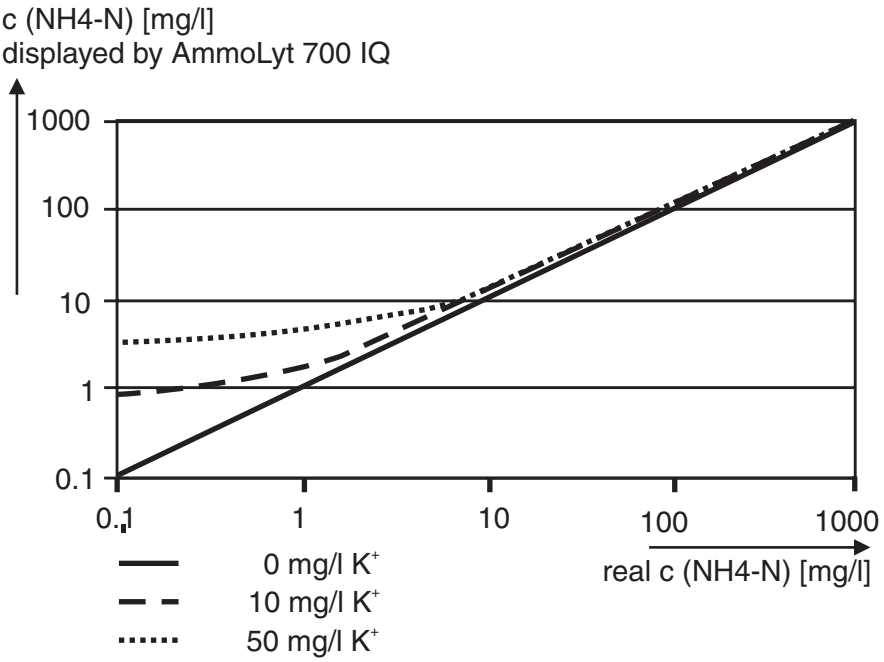


Fig. 4-8 Influence of potassium on the measured ammonium value

4.2.3 Further influences on the measured value

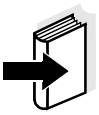
Greases, oils, certain tensides and similar substances can shorten the operational lifetime of the AmmoLyt® NHA/AT exchange electrode. Therefore, they should not be present in the test sample.

5 Maintenance and changing the electrode

The AmmoLyt® 700 IQ ammonium sensor is maintenance-free.

Warning
Contact with the sample can be dangerous for the user! Depending on the type of sample, suitable protective measures must be taken (protective clothing, protective goggles, etc.).

Note
To keep the sensor clean, we strongly recommend to use the CH cleaning head (see chapter 6 REPLACEMENT PARTS AND ACCESSORIES).



Note
Please read the maintenance of the combination electrode in the relevant operating manual of the electrode.

5.1 Exchanging the electrode

Note
We do not recommend unscrewing the measuring electrode from the sensor connection cable when changing the electrode. Otherwise, moisture and/or dirt can get into the plug connection where it can cause contact problems.

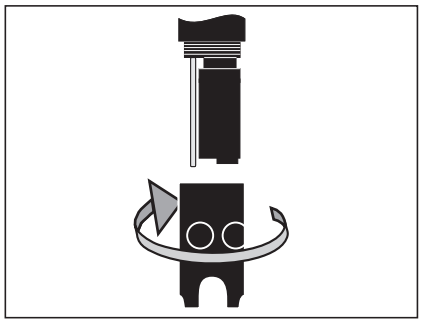
If you need to disconnect the sensor from the sensor connection cable, please note the following points:

- Before disconnecting the sensor from the SACIQ sensor connection cable, remove any larger pieces of contamination from the sensor, particularly in the area of the plug connection (brush it off in a bucket of tap water, wash it off with a hose or wipe it off with a cloth).
- Unscrew the sensor from the SACIQ sensor connection cable.
- Always place a protective cap on the plug head of the sensor and on the SACIQ sensor connection cable so that no moisture or dirt can get into the contacting surfaces.

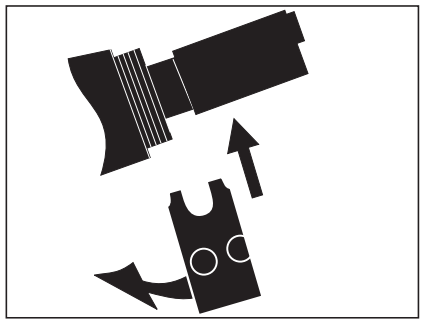
Replacing the electrode

If it is necessary to replace an electrode, proceed as follows:

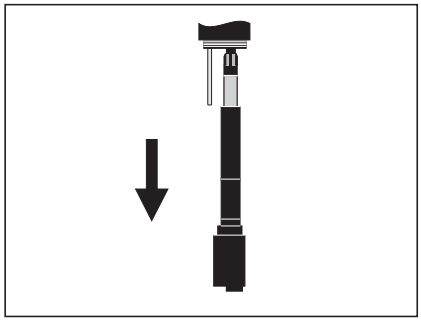
1	Unscrew the protective hood from the sensor.



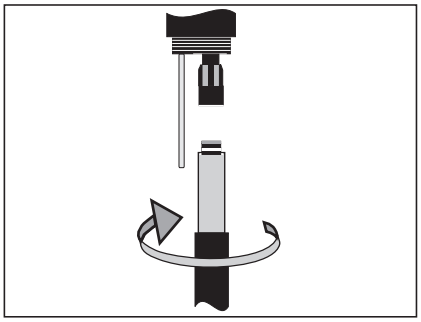
2	Use the protective hood as a tool to lever out the electrode.



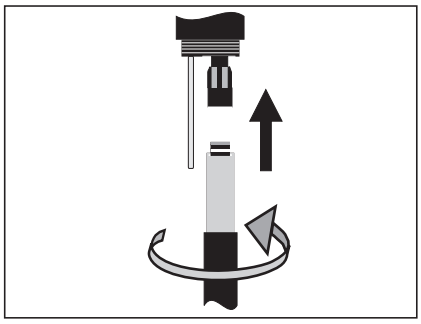
3	Carefully pull out the electrode until the plug head screwed fitting can be seen.



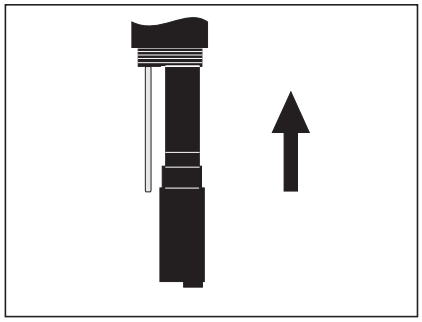
4	Unscrew the electrode from the plug head socket (for disposal, see section 5.2).



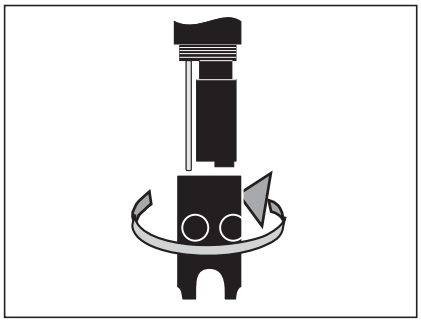
5	Screw in a new electrode.



6	Push the unit into the sensor up to the stop.



7	Screw the protective hood onto the sensor.



8	Calibrate the sensor and the electrode with the measuring system (see section 4.1 CALIBRATION).

5.2 Disposal

Sensor We recommend disposing of the sensor as electronic refuse.

Electrodes If no official regulations apply to the contrary, used and defective electrodes can be treated as household waste.

6 Replacement parts and accessories

6.1 Sensor and electrodes

Ammonium sensor

Model	Order no.
AmmoLyt® 700 IQ	107002

Ammonium electrodes

Model	Order no.
Reference electrode AmmoLyt® NHA	107004
Exchange electrode AmmoLyt® NHA/AT	107006

6.2 General accessories

Protective hood

Designation	Order no.
AmmoLyt® 700 IQ-SK	107016

Standard solutions for ammonium calibration

For the calibration procedures, *1 point standard (1)* and *2 point stand. (3)*:

Designation		Order no.
ES/NH4_ISA-1	1 mg/l NH4-N; 1000 ml	107010
ES/NH4_ISA-10	10 mg/l NH4-N; 1000 ml	107012
ES/NH4_ISA-100	100 mg/l NH4-N; 1000 ml	107014

For the calibration procedures, *Simple std. add. (4)* and *Double std. add. (5)*:

Designation		Order no.
SL NH4 19812	1000 mg/l NH4; 500 ml	250461
ES/NH4	1000 ml; 10 g/L NH4	120240

Cleaning system

Model	Order no.
CH Cleaning Head	900107
MIQ/CHV Valve Module	900109

Note
Information on other IQ SENSOR NET accessories is given in the WTW catalog and on the Internet.

7 What to do if...

No measured value

Cause	Remedy
– Sensor not connected	– Connecting the sensor
– Unknown	– Look in the log book

Measurement does not function

Cause	Remedy
– Electrode not connected	– Connect electrode
– Liquid has penetrated the sensor	– Sensor defective, send it back
– Sensor not connected	– Connecting the sensor
– Instrument setting incorrect	– Correct instrument setting

Measurement provides implausible measured values

Cause	Remedy
– No calibration performed	– Calibrate
– Electrode not connected or defective	– Check electrode and electrode connection
– Electrode contaminated	– Clean electrode
– Liquid has penetrated the sensor	– Sensor defective, send it back
– Instrument setting incorrect	– Correct the instrument setting (*Measuring mode* mg/l or mV)
– Potassium compensation is switched off – Potassium compensation with unsuitable value for potassium content	– Switch on potassium compensation – Determine and enter potassium content – Recalibrate (see also section 4.2.2)

System cannot be calibrated

Cause	Remedy
– Slope of the electrode not within tolerance (see section 4.1.10)	– Condition the electrode – If the slope is still outside the tolerance: Replace the electrode
– Drift of the electrode too high	– Replace the electrode

8 Technical data

8.1 Measuring properties

Measuring principle

Potentiometric measurement with an ammonium-selective combination electrode;
Integrated microprocessor electronics, shielded 2-wire connection for power and data transmission.

Measuring ranges and resolutions

Measuring mode	Measuring range	Resolution
NH_4^+	*0.1 ... 129.0 mg/l* *1 ... 1290 mg/l*	0.1 mg/l 1 mg/l
NH4-N	*0.1 ... 100.0 mg/l* *1 ... 1000 mg/l*	0.1 mg/l 1 mg/l
Voltage	*-2000 ... 2000 mV*	1 mV

Temperature measurement

Probe type	integrated NTC
Measuring range	- 5 °C ... + 40 °C (23 ... 104 °F)
Accuracy	± 0.5 K
Resolution	0.1 K
Response time t_{99}	< 15 s

Temperature compensation

in the range of 0 °C ... + 40 °C (32 ... 104 °F)

8.2 Operating characteristics

Allowed temperature range

Measuring medium	0 °C ... + 40 °C (32 ... 104 °F)
Storage/transport	With electrodes mounted: 0 °C ... + 40 °C (32 ... 104 °F) With electrodes removed: -5 ... + 65 °C (23 ... 149 °F)

Allowed pH range of the measuring medium

4 ... 12 (pH range for measurement: 4 ... 8.5)

Pressure resistance

Sensor with electrode and SACIQ sensor connection cable connected:

Max. allowed overpressure	2×10^5 Pa (0.2 bar)

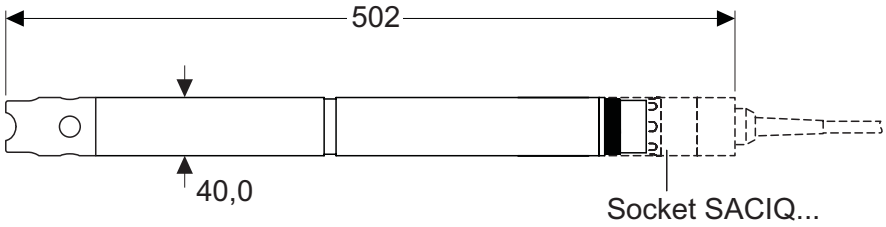
Depth of immersion min. 70 mm; max. 2 m depth

Operating position pendulous to horizontal

Field of application Controlling / monitoring in the aeration tank of waste water treatment plants, water and waste water monitoring

8.3 General features

Dimensions



Weight (without electrode and sensor connection cable) 970 g

Integrable electrodes AmmoLyt® NHA reference electrode and AmmoLyt® NHA/AT exchange electrode

Connection technique Connection via SACIQ sensor connection cable

Material

Protective hood	PVC
Electrode receptacle	POM
Temperature sensor	V4A stainless steel 1.4571
Plug head connector housing	POM
Plug, 3-pole	ETFE (blue) Tefzel®
Shaft	V4A stainless steel 1.4571

Instrument safety

Applicable norms	– EN 61010-1 – UL 3111-1 – CAN/CSA C22.2 No. 1010.1

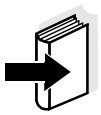
8.4 Electrical data

Nominal voltage	Max. 24 VDC via the IQ SENSOR NET (for more details, see TECHNICAL DATA chapter of the IQ SENSOR NET system operating manual)
Power consumption	0.2 W
Protective class	III

9 Indexes

9.1 Explanation of the messages

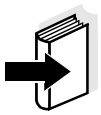
This chapter contains a list of all the message codes and related message texts that can occur in the log book of the IQ SENSOR NET system for the AmmoLyt® 700 IQ sensor.



Note
Information on

- the contents and structure of the log book and
- the structure of the message code

is given in the LOG BOOK chapter of the IQ SENSOR NET system operating manual.



Note
All message codes of the AmmoLyt® 700 IQ end with the number "351".

9.1.1 Error messages

Message code	Message text
EA1351	*Meas. range exceeded or undercut* ** Check process* ** Select other meas. range*
EA2351	*Sensor temperature too high!* ** Check process and application*
EA3351	*Sensor temperature too low!* ** Check process and application*
EC1351	*Sensor could not be calibrated,* *Sensor blocked for measurement* ** Check calibration conditions and calibration standard* ** View calibration history* ** Service sensor immediately* *(see operating manual)*
ES1351	*Component hardware defective* ** Contact WTW*

9.1.2 Info messages

Message code	Message text
IC1351	*Sensor has been successfully calibrated* ** For calibration data, see calibration history*

9.2 Status info

The status info is a coded piece of information on the current status of a sensor. Each sensor sends this status info to the controller. The status info of sensors consists of 32 bits, each of which can have the value 0 or 1.

Status info, general structure

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	(general)
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	(internal
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	

The bits 0 - 15 are reserved for general information.
The bits 16 - 21 are reserved for internal service information.

You obtain the status info:

- by a manual query in the *Settings*/*Service*/*List of all components* menu (see system operating manual)
- by an automated query
  - of a superordinate process control (e. g. when connected to the Profibus)
  - of the IQ Data Server (see IQ SENSOR NET Software Pack operating manual)

Note
The evaluation of the status info, e.g. in the case of an automated query, has to be made individually for each bit.

Status info AmmoLyt® 700 IQ

Status bit	Explanation
Bit 0	*Component hardware defective*
Bit 1-31	-