Combined dCa ISE

6.00502.300

Sensor leaflet

8.0109.8012EN / 2020-11-25

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Table of contents

1 Overview

1.1 Combined dCa ISE – Product description

The Combined dCa ISE is a calcium-selective, combined polymer membrane electrode with shockproof membrane for titration, direct measurement and standard addition.

1.2 Combined dCa ISE – Overview

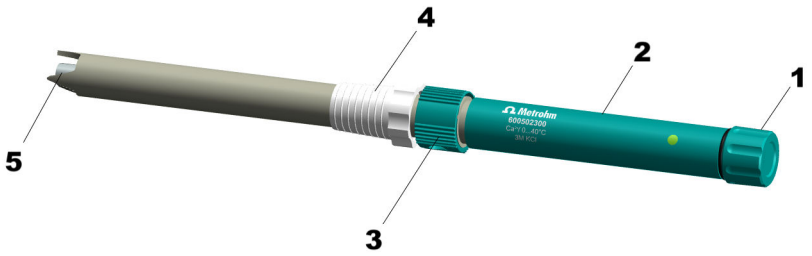


Figure 1 Combined dCa ISE

1	**Protective cap**	**2**	**Electrode head**
3	**Filler opening**	**4**	**SGJ sleeve SGJ 14/15, movable**
5	**Sensor surface**		

2 Functional description

2.1 Combined dCa ISE – Functional description

An ion-selective electrode only responds to a specific ion in the solution and, ideally, it does not show any change in potential with other ions present.

The measuring ions of the sample solution reach the membrane surface of the ion-selective electrode, after a certain amount of time an equilibrium is established. An electrochemical potential is created between the measuring solution and the membrane.

3 Transport and storage

3.1 Electrode – Checking the delivery

Immediately upon arrival of the merchandise, check the shipment to ensure absence of damage.

3.2 Electrode – Storing the packaging

The product is supplied in extremely protective special packaging. Keep this packaging, as only this ensures safe transportation of the product.

3.3 Unpacking and checking the electrode

1 Unpacking the electrode

Remove the electrode with storage vessel from the packaging.

2 Removing the storage vessel

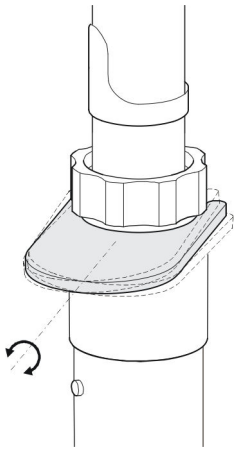


Figure 2 Releasing the electrode from the storage vessel

- Hold the electrode and storage vessel firmly in your hand so that the electrode cannot slip away.
- Position the tool between the storage vessel and SGJ sleeve.
- **Carefully** push the tool to the side to release the electrode. **Do not tip the tool forwards!**

NOTICE

Avoid applying excess pressure to the tool. Otherwise, the electrode could be released too abruptly.

3 Checking the electrode for proper function

- **Preparing the electrode:**
  Preparing the Combined dCa ISE (see chapter 4.1, page 6)
- **Checking the electrode:**
  Checking the Combined dCa ISE (see chapter 6.3, page 12)

NOTICE

Defective electrodes must be sent back for warranty processing within two months (starting from the day of delivery).

3.4 Storing the Combined dCa ISE

1 For short periods

- Screw the protective cap *(1-**1**)* onto the electrode head *(1-**2**)*.
- Store the electrode in the storage vessel. When doing so, ensure that the sensor surface *(1-**5**)* is immersed in the storage solution.

NOTICE

Use 0.01 mol/L of calcium chloride as the storage solution.

2 For longer periods

- Screw the protective cap *(1-**1**)* onto the electrode head *(1-**2**)*.
- Rinse the electrode and dry the outer shaft of the electrode.

NOTICE

We recommend maintaining some residual moisture between the inner pipe and the three protection flaps to keep the electrode ready for use.

4 Installation

4.1 Preparing the Combined dCa ISE

Ion-selective electrodes must be prepared before the first usage, after longer breaks and between precipitation titrations.

CAUTION

Incorrect handling

The electrode will only work properly if you handle it correctly. Proceed in accordance with the following instructions:

- Do not touch the sensor surface with your fingers.
- Do not leave the electrode in distilled water for prolonged periods.
- Do not rub the electrode dry after rinsing.
- Do not bring the electrode into contact with any organic solvents.

1 Rinsing the electrode

Rinse the electrode with distilled water.

NOTICE

The electrode is ready for direct use in most samples and requires no special preliminary treatment.

The electrode is shipped with 3 mol/L of potassium chloride as a reference electrolyte. If the electrode is used for an application with parallel chloride titration, the reference electrolyte should be changed to 1 mol/L of ammonium nitrate.

2 Connecting the electrode

- Unscrew the protective cap *(1-**1**)*.
- Position the cable connection on the electrode head such that the slot in the cable connection is on the guide lug of the electrode head.
- Push the socket in the cable connection into the plug inside the electrode head.

- Push the outer ring of the cable connection over the electrode head.
  Ensure that the guide lugs in the electrode head are in the grooves of the cable connection.
- Push the cable connection onto the electrode head until it snaps in place.

NOTICE

To remove the cable, first release the outer ring and then carefully pull the cable connection from the electrode head.

When doing so, be sure not to pull on the cable itself but the cable connector instead.

4.2 Mounting the electrode

The electrode must sit securely in the titration head.

NOTICE

For automatic procedures, ensure that the cables have enough room to move.

During the titration or standard addition, it is important that the solution is mixed well. The stirring rate should be high enough to form a small vor-

tex. If the stirring rate is too high, then air bubbles will be aspirated. These may result in incorrect measured values. If the stirring rate is too low, then the solution at the electrode will not be mixed correctly.

In order for the measurement to be taken in a well-mixed solution after the addition of the titrant, the titration tip should be positioned where turbulence is high. Furthermore, the distance between the addition of the titrant and the electrode should be as large as possible. Therefore, take into account the stirring direction (counterclockwise or clockwise) when positioning the electrode and titration tip.

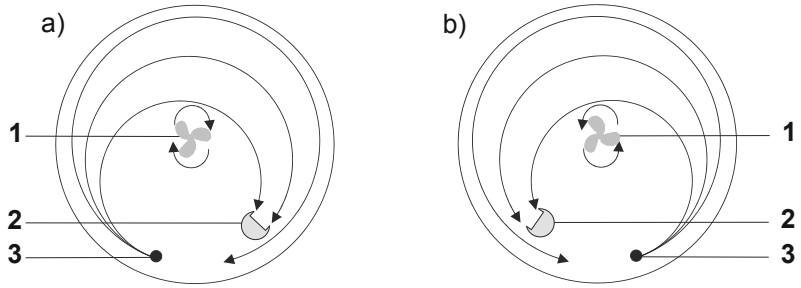


Figure 3 Diagrams showing rod stirrer, electrode and titration tip during a titration. a) clockwise stirring direction, b) counterclockwise stirring direction.

1	**Rod stirrer**	**2**	**Electrode**
3	**Titration tip**		

5 Operation and control

5.1 Combined dCa ISE – Measurement procedures

Titration

Ion-selective electrodes are well-suited for potentiometric titrations. The resulting titration curves are usually S-shaped and can be evaluated well with automatic titrators.

For application advice on working with ion-selective electrodes, please go to *www.metrohm.com*.

Direct measurement with calibration

The ion activity in the sample is interpolated by means of a calibration curve. The calibration curve is established with standard solutions. The expected ion activity in the sample should lie in the mid-concentration range of the standard solutions.

Since the concentration of an ion is usually of interest (rather than its activity), measurements are performed at a fixed ionic strength. The ionic strength is measured in an ISA (Ionic Strength Adjuster) solution or a TISAB (Total Ionic Strength Adjustment Buffer) solution. ISA/TISAB solutions have a high ionic strength so that the various contributions of the measuring ion to the ion strength can be ignored.

For calcium, it is preferable to use a 1 mol/L potassium chloride solution.

NOTICE

Measure samples and calibration standards under identical measuring conditions. The temperature of the standard solutions and the sample solutions should, as far as possible, be the same during measurements. Furthermore, the temperature should fluctuate as little as possible during the measurement.

In order to guarantee reliable results, periodically carry out a control measurement with a calibration standard (e.g. daily). A new calibration curve should be established if the deviation is deemed unacceptable.

Standard addition / standard subtraction

In the standard addition method, a defined quantity of the ion to be determined is added to a known volume of the sample (in several increments). Normally, ISA/TISAB solutions are used in this process. The unknown concentration can be calculated from the resulting potential differences between the sample and the sample with added standard solution. This calculation is performed automatically by modern ion meters.

The volume of the added standard solutions should not exceed 25% of the sample volume, and the concentration of the standard solutions should be as high as possible (in order to be able to rule out errors due to dilution). The potential differences between the increments should be roughly constant and amount to at least 10 mV. Temperature differences between the standard solution and the sample solution should be avoided. In addition, at least three additions should be carried out.

In the standard subtraction method, a solution that eliminates the ion to be determined is added (complexation or precipitation). Apart from that, the same conditions apply as for standard addition. However, this method is rarely used.

6 Maintenance

6.1 Combined dCa ISE – Changing/refilling the electrolyte

1. Open the filler opening *(1-**3**)* by turning it.
2. Use a plastic pipette to empty the electrode.
3. Rinse the inside of the electrode with the new electrolyte.
4. Fill the electrode with electrolyte up to the filler opening.
5. Close the filler opening *(1-**3**)*.

6.2 Cleaning the Combined dCa ISE

1. Rinse the electrode with distilled water after each measurement or titration.

NOTICE

The surface must be kept clean at all times before the measurement.

NOTICE

Do not treat the electrode in ultrasonic baths! The electrode could become damaged.

6.3 Checking the Combined dCa ISE

1. Measure c(Ca^{2+}) = 10^{-4} mol/L standard solution and write down the potential.

2. Measure c(Ca^{2+}) = 10^{-3} mol/L standard solution and write down the potential.

3. Calculate the change of potentials with the 2 previously measured potentials:

   The value has to be at least 23.7 mV (at 25 °C) (80% of the theoretical slope).

NOTICE

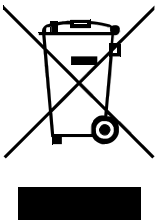
If the value cannot be reached, the electrode needs to be replaced.

7 Combined dCa ISE – Troubleshooting

If additional or other types of faults occur, ensure that the following points have been fulfilled:

- Is the electrode cable screwed on and plugged in correctly?
- Is the electrode cable functional?
- Is the sensor surface clean and intact?
- Is the electrode new?
  If the electrode is too old, the membrane may be depleted.

8 Electrode – Disposal



This product is covered by European Directive, WEEE – Waste Electrical and Electronic Equipment.

The correct disposal of your old instrument will help to prevent negative effects on the environment and public health.

Proceed as follows to dispose of the electrode:

1 Draining the electrolyte

Use a plastic pipette to remove the electrolyte from the electrode.

2 Disposing of the electrolyte

Dispose of the electrolyte in accordance with the legal provisions.

3 Disposing of the electrode

Put the electrode in electronic waste recycling.

More details about the disposal of your old product can be obtained from your local authorities, from waste disposal companies or from your local dealer.

9 Technical specifications

9.1 Ambient conditions

Nominal function range	+5 to +45 °C	at max. 80% relative humidity, non-condensing
Storage	+5 to +45 °C	

9.2 Combined dCa ISE – Dimensions

Measurements

Shaft diameter	12 mm
Maximum installation length	113 mm

9.3 Combined dCa ISE – Housing

Materials

Shaft material	PMMA	poly(methyl methacrylate)
	PP	polypropylene
Inner pipe	PMMA	poly(methyl methacrylate)

9.4 Combined dCa ISE – Connectors specifications

Connector	Metrohm plug-in head Q

9.5 Combined dCa ISE – Display specifications

Status display	LED	green - red

9.6 Combined dCa ISE – Measurement specifications

pH range	0 - 12
Temperature range	0 - 40 °C
Measuring range	
Ion concentration	$5*10^{-7}$ - 1 mol/L
Minimum immersion depth	10 mm

10 Additional information

ISA/TISAB solutions

Table 1 ISA/TISAB solutions

Measuring ion	ISA/TISAB	For 100 mL of solution	Remarks
Ca^{2+}	KCl 1 mol/L	7.46 g	

Interfering ions

The concentrations in mol/L of the interfering ions, which generate an analysis error of approximately 10%, are specified in the following table.

Table 2 Interfering ions

Measuring ion	Interferences
Ca^{2+}	$c(Na^{+}) < 0.24; c(K^{+}) < 0.4; c(Mg^{2+}) < 18; c(H^{+}) < 0.12; c(OH^{-}) < 0.11;$ $c(Cu^{2+}) < 8 \cdot 10^{-2}; c(Pb^{2+}) < 3.5 \cdot 10^{-2}; c(Zn^{2+}) < 0.22; c(Fe^{2+}) < 0.45$