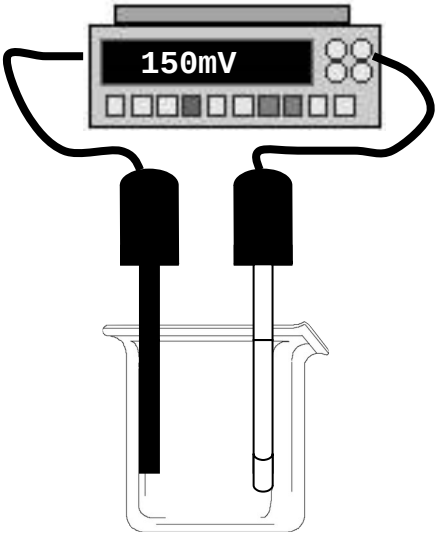
SENTEK

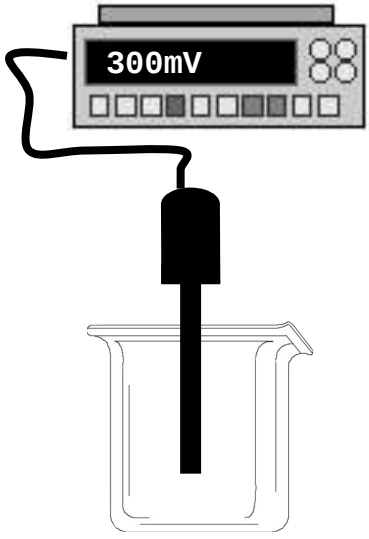
Ion Selective Electrode

OPERATING INSTRUCTIONS

THIOCYANATE



Mono/Reference



Combination

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Operating Instructions
Thiocyanate Ion Selective Electrode

This Document includes operating instructions for two types of Ion Selective Electrode. A single sensing Half Cell Thiocyanate Electrode which requires a separate Reference Electrode, and a Combination Thiocyanate Electrode which has the Reference built into the outer shaft.

For extremely low level work the Half Cell plus Reference Electrode should be used. For general applications the Combination is more convenient.

Depending on the type of ISE chosen you will need to disregard some information for instance if you have the Combination Electrode then disregard any comments about reference electrodes.

A quick guide is included with a more involved section following.

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Operating Instructions for the Thiocyanate Ion Selective Electrode

1. Characteristics

The Ion Selective Electrodes (ISE's) are "All Solid State" meaning they have a solid state membrane, an internal solid contact and contain absolutely no liquid: they have important advantages:

- Easy to handle, require only a few minutes preconditioning prior to usage.
- Stability of electrochemical potentials resulting in very low signal drift and eliminating the necessity for frequent recalibration.
- Short response time which is of importance when used in automatic analysers, titrators, process monitoring and process control.
- Function in any position; upside down for small sample voluminas.
- No leaking of liquids
- Practically no limitation of storage time.
- Can be stored and transported below 0°C (32°F)

2. Applications

ISE's are used in a wide range of applications:

- General Use in Analytical Laboratories
- Usage Out in the Field
- Continuous and Long Time Monitoring of Industrial and Environmental Parameters.
- On-line Process Control
- Automatic Analysers, Titrators, Clinical Analysers.

The Thiocyanate ISE is especially used for:

Analysis of Chemical Products, Pharmaceutical Products

3. Specifications

Mechanical:

Body	:	Diameter 12mm, Length 120mm
Total Including Cap	:	Diameter 16mm, Length 150mm
Cable Length	:	1.0m, shielded
Connector	:	BNC (if no other specified)
Electrode Weight	:	20g

Electrical:

Resistance	:	Less than 2.5 Megohm
Response Time	:	Less than 10 s (30 s)
Potential Drift	:	Less than +/- 1 mV
Re-calibration	:	Once a day

Chemical:

Preconditioning Solution	:	10^{-2} KSCN
Preconditioning Time	:	5 Minutes
Admissible pH-Range	:	pH 2 to pH 12
Admissible Temperature	:	5°C to 50°C
Optimal Temperature	:	25°C
Recommended TISAB	:	5 M KNO_3
Reference Electrode	:	Double Junction
Outer Filling Solution	:	0.1 M KNO_3

Electrode Slope (25°C)	:	54 to 59 mV/Decade
Linear Measuring Range	:	10^{-1} to 10^{-4} M $5.8x10^{3}$ to 5.8 ppm
Total Measuring Range	:	10^{-1} to $2x10^{-5}$ M $5.8x10^{3}$ to 1.2 ppm
Detection Limit	:	Less than $2x10^{-5}$ M 1.2 ppm

Selectivity Coefficients:

I^--Ion k (SCN,I)	=	20
Cl^--Ion k (SCN,Cl)	=	400

In the sample must be absent:

I^-, Cl^-, S^{2-}

4. Electrode Preparation and Maintenance

Remove protective cap and immerse the Electrode for the specified time in the recommended preconditioning solution. When soaking is complete, rinse the electrode with distilled water and dry: the Electrode is now ready for calibration.

When an Electrode shows a slow response or low slope, the membrane may be poisoned or coated with a film. Try to rejuvenate the membrane by soaking the Electrode in the preconditioning solution for 12 hours. If this procedure is not successful, polish the membrane with very fine emery paper and soak for 15 minutes in the preconditioning solution.

Avoid exposing the membrane to high concentrated solutions for long periods of time.

Avoid touching the membrane.

After measurement, rinse the Electrode with distilled water and dry. Replace the protective cap and store.

5. Measuring with ISE's

An ISE is always used with a Reference Electrode: select type as recommended and fill with the specified solution. Make sure the liquid junction is not clogged.

The electrochemical potential E between the ISE and the Reference Electrode indicates the activity a of the ion to be determined:

$$E = E^{o} + S.\log a$$

E^{o} = Constant Potential S = Slope of the Electrode

The ISE and the Reference Electrode are connected to a suitable pH Meter, Ion Meter or Computer Interface. Refer to the manual for each device.

During calibration and sample solution have the same temperature (+/- 2^{o}C)

Ensure the Electrode is rinsed and dried between measurements to avoid carry-over or contamination.

When reading the meter, wait until the value is stable.

6. Calibration

Calibration is carried out by using concentration standards. For a correct calibration, the calibration solutions must have the same ionic strength as the sample solution. This is achieved by adding a TISAB (Total Ionic Strength Adjustment Buffer) to the calibration and sample solutions. In solutions with low ionic strength (less than 10^{-4} M) like water, this is not necessary.
When the equation in Paragraph 5 is drawn on a semi-logarithmic paper (potential E linear on the vertical axis and concentration logarithmic on the horizontal axis) the graph is a straight line. Therefore, it is necessary to make a 2 point (better 3 or 4 point) calibration measurement in order to plot the calibration curve.

The concentration standard is usually diluted in powers of 10 (dilute 1 part with 9 parts of distilled water).

7. Direct Potentiometry

It may be necessary to pretreat the sample before taking a measurement : complexing interfering ions and decomplexing the ion to be determined. For accurate results, the calibration and sample solutions should have the same matrix (background), and all the reagents added to the sample should be added to the calibration solutions.

When the electrodes are immersed in the sample and the reading is stable, the measured electrochemical potential allows the concentration of the ion to be determined from the calibration curve.

8. Standard Addition Method

The concentration of the sample can be determined by adding a certain amount (usually 10% of the sample volume) of a concentrated standard and measuring the change in the electrochemical potential. The sample concentration can be calculated by the formula:

$$Cp = Cs \frac{Vs}{(Vp + Vs) \cdot A - Vp} : A = 10$$

Cp	Concentration of Sample	Cs	Concentration of Added Standard
Vp	Volume of Sample	Vs	Volume of Added Standard
E_2-E_1	Potential Difference	S	Electrode Slope

This method is simple to perform and the results are reliable. The precision is in the range of 2% to 5%. The slope of the Electrode is known from previous calibrations.