ION570
Ion Analyser

Reference Manual
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Introduction

The ION570 Ion Analyser is dedicated for routine use. It offers two distinct user levels:

- **Supervisor**
  
  Dedicated for operators who wish to edit their methods to fit their specific needs. They can also assign a password to protect the programmed data from eventual changes.

- **Routine**
  
  Dedicated for operators wishing to use the routine functions to guide them step by step through the analyses.

The ION570 can store up to 50 methods, 30 electrodes and 30 reagents. In addition 30 electrodes and 20 reagents have been pre-defined to help you save time setting up your application.

Thanks to the preprogrammed applications, the Ion Analyser is ready for use as soon as it has been installed. *Refer to "Appendix 1: Preprogrammed methods", page 215.*

The ION570 also allows you to automatically sequence and repeat measurements.

The purpose of the ION570 Reference Manual is to give detailed information on the Ion Analyser and the data displayed during operations. The information is listed in alphabetical order for quick access and cross-references are listed in italics.

In addition to this handbook, a general User’s Guide (part no. D21M069) is available giving descriptions and overviews of the workstation menus and operating concepts to guide you through programming and running of the analyses.
Read me!

An important feature of this instrument interface is that it controls the presence of different elements necessary to run the defined application for a selected method/sequence, before the method/sequence is run.

**Working in Supervisor mode**

A Supervisor has access to all the libraries for *creation* purposes.

When programming the instrument in “SUPERVISOR” mode, it is recommended to work in stages. These stages *must* be carried out in the order described below:

**A. To program method**

1. **Define your electrode(s)**
   Identify electrodes (including temperature sensors) to be used for the analysis:
   Electrodes can be created from the following lists:
   - Catalogue, see "Catalogue list", page 68.
   - Other, see "Others list", page 149.
   - Copy from, see "Copy electrode", page 79.
   When creating the electrode, define if electrode calibration is required (or not), if yes specify the “periodicity” of the calibrations and the pH, ISE or conductivity standards to be used. *Refer to “Calibrate electrodes”, page 61.*

2. **Define reagent**
   Identify reagents to be used for the analysis
   Reagents can be created from the following lists:
   - Catalogue, see "Catalogue list", page 68.
   - Other, see "Others list", page 149.
   - Copy from, see "Copy reagent", page 80.
   If a sample changer is to be used, define the sample changer in the Configuration menu before selecting a SAC sequence.
3. Create new method or Edit a pre-programmed one

Create the method to be used for the analyses. Enter the parameters required to calculate the results, see “Programming methods”, page 27.

When you have finished programming, select the method/sequence or pre-programmed application, see "Select method", page 189 or see "Select sequence", page 190.

If your methods are to be performed in a sequence, program the sample stack, see "Sample stack", page 188.

4. Check icons

The following icons indicate the exact state of your working system:

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunny icon</td>
<td>Everything is OK. Run the method or sequence.</td>
</tr>
<tr>
<td>Cloudy icon</td>
<td>Action required within 12 or 24 hours (for a calibration) and 1 week (for a reagent replacement).</td>
</tr>
<tr>
<td>Stormy icon</td>
<td>Electrode calibration date elapsed or electrode(s)/reagent(s) not installed.</td>
</tr>
<tr>
<td>Question mark</td>
<td>Programming error.</td>
</tr>
</tbody>
</table>

Refer to "Electrode icons", page 112.
Refer to "Reagent icons", page 162.

Sunny icons are needed in order to run the selected method.

If Cloudy/Stormy/Question mark icons are displayed in the Reagent/Electrode window press 1 to activate the “Check” command. The ION570 will automatically guide you through the operations required to solve the errors encountered.

B. Running methods

To run a method or sequence, see "Working in Routine mode", page 16.
Working in Routine mode

A. Access methods
A Routine operator has access to all the methods “Select method” and programmed parameters “Display method” for checking purposes.

<table>
<thead>
<tr>
<th>Station no. 1</th>
<th>08:46:30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working mode</td>
<td>Method</td>
</tr>
<tr>
<td>Run &quot;Method1&quot;</td>
<td></td>
</tr>
<tr>
<td>Sequence/Sample stack</td>
<td></td>
</tr>
<tr>
<td>Select method</td>
<td></td>
</tr>
<tr>
<td>Display method</td>
<td>4</td>
</tr>
<tr>
<td>CLP-Archives</td>
<td>5</td>
</tr>
</tbody>
</table>

B. Running methods
When working in “ROUTINE” mode, it is necessary to install your measurement system according to the selected method or sequence, prior to running a method or sequence.

1. Select the method or sequence
Refer to “Select method”, page 189.
Refer to “Select sequence”, page 190.

2. Check icons
Refer to “Check icons”, page 15.
Depending on the icons displayed, the ION570 will automatically guide you through the steps necessary to run the analysis, see below:

   a. Connect the electrode(s)
      Connect/install electrodes and temperature sensors, Refer to “Electrode connection”, page 110.

   b. Install regents(s)
      Check that the burette is installed, if not, see “Install burette”, page 126. Now, install the reagent, see “Install reagent”, page 127.

   c. Calibrate electrode(s)
      Now, run the calibration.
      Refer to “Calibrate electrodes”, page 61.

   d. Enter reagent titre (only for an ISE standard addition method)
      Now, enter the reagent titre.
      Refer to “Enter titre”, page 116.

   e. Run the method or the sequence
      Refer to “Running a method”, page 179.
      Refer to “Running a SAC sequence”, page 180.
      Refer to “Running an ION sequence”, page 181.
Practical examples
Programming electrodes

**pH electrodes**

2. Press 1.
3. Select function and ID.
4. Select ID from Catalogue or Others list. Press 1 to confirm.
5. Press 1 to confirm the creation of the new electrode.
6. For a combined or a simple or reference electrode, enter the potential (in mV) of the reference versus the Standard Hydrogen Electrode (SHE).
   For a combined or a simple electrode if you have selected the Others list, enter the internal pH of the electrode.
   Enter the electrode address.
   If you want a message to be displayed once a week concerning this electrode, select Maintenance = Yes and enter the message.
   Select Fixed or Free if a calibration is required, go to step 7.
   Select No, for no calibration, press Esc to leave the menu.
   Programming is completed.
Calibration request = Fixed
Calibration with automatic recognition of the buffer among a list of predefined values. The buffer values are entered during method edition.

Calibration request = Free
The buffer values are entered freely by the user. Use this option to calibrate pH electrode with buffers that do not belong to the predefined list.

7. Enter the calibration parameters.


9. Enter the electrode calibration parameters.
   For a Fixed calibration, press Esc then 2. Go to step 10.
   For a Free calibration, press Esc then 3. Skip to step 11.

10. Fixed calibration only.
    Select the buffer solutions used. Press Esc then 3.

11. Enter the results parameters.
    Press Esc then 4.

12. Enter the printouts parameters.
    Press Esc twice. Electrode programming is completed.
**ISE electrodes**

1. **Press 4.**

2. **Press 1.**

3. **Select function and ID.**

4. **Select ID from Catalogue or Others list.**
   **Press 1 to confirm.**

5. **Press 1 to confirm the creation of the new electrode.**

6. **For a combined or a simple or reference electrode, enter the potential (in mV) of the reference versus the Standard Hydrogen Electrode (SHE).**
   **If you have selected the Others list, select the valency and enter the molar weight of the ion under study.**
   **Enter the electrode address.**
   **If you want a message to be displayed once a week concerning this electrode, select Maintenance = Yes and enter the message.**
   **Press the Left or Down arrow key.**
   **Select Manual or Automatic if a calibration is required then go to step 7.**
   **Select No, for no calibration, press Esc to leave the menu.**

Programming is completed.
Calibration = Manual
Calibration using 1 to 9 standards of known concentration. The standard concentrations are entered during method edition. This method requires 1 to 9 calibration beakers.

Calibration = Automatic
1 to 4-point calibration method where the standards are automatically prepared by the Ion Analyser using an automatic addition method. The standard concentrations and an initial volume of standard are entered during method edition. This simple to use method requires only one calibration beaker.

7. Enter the calibration parameters.
8. Screen obtained in the case of a Manual calibration.
   Press 1.
Enter the electrode calibration parameters.
Press Esc then 2.

10. Screen obtained in the case of a Manual calibration.
Enter the standard solution ID and standard concentrations.
Press Esc then 3.
11. Screen obtained in the case of a Manual calibration.
Enter the results parameters.
Press Esc then 4.
12. Enter the printouts parameters.
Press Esc twice. Electrode programming is completed.
Conductivity cells


4. Select ID from Catalogue or Others list. Press 1 to confirm.

2. Press 1.

5. Press 1 to confirm the creation of the new electrode.

3. Select function and ID.

6. If you have selected the Others list, enter the cable resistance and capacitance.

Calibration request = Free
Use the Free calibration mode when you use a standard that does not belong to the Catalogue list and you know the conductance of this standard at a given temperature. During a Free calibration run and after stabilisation of the measurement, you will adjust the cell constant in order to display the correct conductance value.

Calibration request = Fixed
With the Fixed mode when you use a standard that belongs to the Catalogue list, the cell constant is determined as the ratio of the conductivity (known by the instrument) divided by the measured conductance.
7. Enter the calibration parameters.


9. Enter the electrode calibration parameters. For a Fixed calibration, press Esc then 2. Go to step 10. For a Free calibration, press Esc then 3. Skip to step 11.

10. Fixed calibration only.

11. Enter the results parameters. Press Esc then 4.

12. Enter the printouts parameters. Press Esc twice. Electrode programming is completed.
Programming reagents


2. Press 1.


4. Select ID from Catalogue list or Others list.
Enter the target titre and unit.
Press 1 to confirm.

5. Confirm the creation of the new reagent.

6. Enter the burette address.
Press Esc twice to leave the menu.
Programming is completed.
Programming methods

Creating and editing a method


2. Press 1.

3. Enter ID.
Press 1 to confirm.

4. Enter method parameters.
Specify the Mode, see "Mode", page 143.

5. Press 1.

6. Press ✓ and select the electrode(s) and temperature sensor from the lists.
Enter the other method parameters.
For an ISE standard addition method (as shown in our example), press Esc then 2 and go to the next step.
For all other methods, press Esc then 3 and skip to step 8.
7. Enter the Sample parameters. Press Esc then 3.

8. Enter the results parameters. Press Esc then 4.

9. Enter the printouts parameters. If a QC sample has been defined in step 4, press Esc then 5.

10. Enter the QC data. Press Esc twice. Method programming is completed.
For a Coupled method


4. Select Mode = Coupled.
Enter the method to be linked.
Press Esc twice.
Method programming is completed.

2. Press 1.

3. Enter the Method ID and press 1 to confirm.
Programming ION sequences

An ION sequence is a sequence of methods with manual change of the beakers. No sample changer is used.

1. Select Sequence.
2. Press 2.
3. Enter a name for the sequence.
4. Press 3.
5. Press 1 to add a method.
6. Select the type of method.
7. Select a method in the list of available methods.

8. Press 1 to add the method to the sequence.

9. If Sample has been selected in step 6, enter the number of samples (number of times you wish to repeat the method in the sequence).

10. Press 1 to add a second method to the sequence. Repeat steps 6 to 9. Up to 10 methods can be chained in a sequence. After having added the last method, press Esc twice. Sequence programming is completed.
A SAC sequence is a sequence of methods with automatic change of the beakers. A sample changer (SAC80, SAC90, SAC850 or SAC950) is used.

1. Press **Stop** for 3 seconds to enter the Setup menu.

2. Press **1**.

3. Select a Sample Changer (SAC80, SAC90, SAC850 or SAC950). Enter the parameters of the sample changer selected (number of rinses, rinse time, etc.). Press **Esc** then **5** (Exit) to quit the Setup menu.

4. Select **SAC Sequence**.

5. Press **2**.

6. Enter a name for the sequence.
7. Press 3.

8. Press 1 to add a method.

9. Select the type of method.

10. Select a method in the list of available methods.

11. Press 1 to add the method to the sequence.

12. If Sample has been selected in step 9, enter the number of samples (number of times you wish to repeat the method in the sequence).

   If a SAC850 or SAC950 has been selected in step 3, enter the sample preparation number.
13.

Press 1 to add a second method to the sequence. Repeat steps 9 to 12. Up to 10 methods can be chained in a sequence. After having added the last method, press Esc twice. Sequence programming is completed.
Programming tips

- Do not forget to declare electrode(s) and reagent(s) when programming your method parameters.
- If a Sample Changer is used, do not forget to declare one in the Configuration menu.
- If a printer is used, do not forget to declare one in the Configuration menu.

**If no sun icons appear after the method has been selected, check the following points:**

1. Install electrode(s) for selected method, see "Check electrodes", page 72.
2. Install reagent(s) for selected method, see "Install reagent", page 127.
3. If required, calibrate electrode. Refer to "Calibrate electrodes", page 61.
4. For an ISE standard addition method only, enter standard reagent titre, see "Enter titre", page 116.

**If the Sunny icons appears:**
Everything is OK. A sunny icon is required to run the selected method.

**If the Cloudy icon appears:**
An electrode calibration should be performed within 24 hours. The expiry date of one of the reagents in the system will expire in less than one week. This is a simple warning, it will not stop you from running the analysis.

**If the Stormy icon appears:**
Reagent and/or electrode required in the selected method is/are not installed. Electrode required in the selected method has not been calibrated.

**If the Question mark icon appears:**
It is a programming error, reagent and/or electrode is/are not defined in the selected method. Revise the method programming.

*When a Stormy or a Question mark icon appears, press 1 "Check". The ION570 will automatically guide you through the operations necessary to solve the errors encountered.*
ABU1/ABU2

ABU1 means an ABU52 connected to the Local socket of the ION570. ABU2 means an ABU52 connected to the Slave socket of a second ABU52 itself connected to the Local socket of the ION570.

Two ABU52 Biburettes can be connected to one ION570.

Accept a result Refer to "Result accepted (Yes/No)", page 170.
Acceptance criteria

Acceptance criteria = Yes

Enables the user to enter preset minimum and maximum values for measurement results. If the result lies outside these values an alarm message appears and the results are rejected by the instrument. The Supervisor is the only person allowed to accept a result that has been rejected by the instrument, see "Result accepted (Yes/No)", page 170.

Therefore, acceptance limits can be set on:

- the conductivity cell constant, see "Min. cell cst - Max. cell cst", page 140.
- the result value such as a pH, a potential, a concentration, see "Minimum value - Maximum value", page 142.
- the response slope of a pH or an ISE electrode, see "Min. sensitivity - Max. sensitivity", page 141.
- the pH0 of a pH electrode, see "Min. pH0(25) - Max. pH0(25)", page 141.

Acceptance criteria = No

The Supervisor or Routine user is free to accept/reject the results.

Enter in:
Edit method > Results
Edit method > QC data
Edit electrode > Results

Irrespective of the Yes or No option selected for the Acceptance criteria parameter:

- Acceptance limits must be set for the sample or the standard measured temperature, see "Min. Temp. - Max. Temp.", page 141, see "°C minimum/maximum value", page 203.
- A minimum limit is set by the instrument for the concentration measured by an ISE Direct measurement method. This limit is the C0 concentration, see "Minimum value - Maximum value", page 142.
- A maximum limit is set by the instrument for the concentration measured by an ISE Direct or Standard addition method. This limit is set to 10^{30}, see "Minimum value - Maximum value", page 142.
Acceptation

Result acceptance time limit.
When the time entered for the Acceptation has elapsed the measurement will be accepted whether stable or not.

For the signal to be accepted once the Acceptation has elapsed, the Max. Stab. time must be greater than the Acceptation time.

Enter in:
Edit method > Parameters menu
Edit electrode > Calibration parameters menu

Range available:
0 to 59:59 min:s

Access routine mode

Press Stop for 3 seconds from the Main window then press 2.
These rules can be set by the Supervisor to allow the routine user access to certain operations.

Enter in:
Setup menu > Access routine mode

Active electrode unknown in "method ID"

The method in use, has at least one electrode which has not been defined. Press ✓ and declare the electrode in the Electrode ID field of the Method parameters screen.
Add method menu

Use this menu to set the ID and type of method to be added to a sequence.

In the title bar, x/y (eg. 1/1) indicates the position "x" of the method in the sequence and "y" the total number of methods in the sequence.

When a sequence is created <1/1> is displayed.

To access:
Press 1 in the Edit sequence menu.

Addition

Select Yes to carry out a reagent addition at the start of an ISE standard addition method.

The reagent is added using a second burette controlled by the ION570. This second burette is installed on an ABU52 connected to the ION570, see "ABU1/ABU2", page 41.

Edit an Addition method when you want to perform 2 or 3 reagent additions successively or simultaneously. Refer to "Addition method - definition", page 46.

Enter in:
Edit method > Parameters
Addition delay  

Parameter of an Addition method, see "Addition method - definition", page 46.

For a 1-addition method or a multi-addition method with the Simultaneous additions = Yes option selected, the Addition delay is counted down at the end of the reagent addition(s).

For a multi-addition method with the Simultaneous additions = No option selected, an Addition delay is to be set for each addition. An Addition delay is counted down at the end of an addition and before the next addition is initiated.

While an addition method is running, you can carry on regardless this delay by pressing key Del.

Enter in:
Edit method (Addition method).

Range available:
00:00 to 99:59 min:s
Addition method - definition

An Addition method performs 1 to 3 reagent additions. These additions can be runned simultaneously or one after the other with or without a delay between 2 additions. No measurements are performed. An example of use is to place an Addition method in a Coupled method before a Measurement method.

Programming an Addition method

1. In the Edit method menu, select Mode = Addition.
2. On the next line, enter the number of additions to be done (1 to 3).

For a 1-addition method

<table>
<thead>
<tr>
<th>Edit method</th>
<th>My method</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID:</td>
<td>My method</td>
</tr>
<tr>
<td>Mode:</td>
<td>Addition</td>
</tr>
<tr>
<td>Number of additions:</td>
<td>1</td>
</tr>
<tr>
<td>Addition no.1</td>
<td></td>
</tr>
<tr>
<td>ID:</td>
<td></td>
</tr>
<tr>
<td>Addition volume:</td>
<td>0.10000ml</td>
</tr>
<tr>
<td>Addition delay:</td>
<td>00min20s</td>
</tr>
<tr>
<td>Auxiliary output:</td>
<td>No</td>
</tr>
</tbody>
</table>

Select the addition reagent name. Enter the reagent volume to be added (1 µl to 999 ml). Enter the delay to wait at the end of the addition (00:00 to 99:59 min:s).

For a 2 or 3-addition method

Refer to "Addition method - programmation", page 47.
Addition method - programmation

For a 1-addition method

Refer to "Addition method - definition", page 46.

For a 2 or 3-addition method

At the Simultaneous additions, select whether you want to perform the additions simultaneously or one after the other.

- In the case of simultaneous additions:

  ![Simultaneous Additions Example](image1)

  Enter the delay to wait at the end of the 2 or 3 additions (00:00 to 99:59 min:s). Enter for each addition, the reagent name and the volume to be added (1 µl to 999 ml).

- In the case of additions performed one after the other:

  ![Sequential Additions Example](image2)

  Enter for each addition, the reagent name, the volume of reagent to be added (1 µl to 999 ml) and the delay to wait at the end of the addition (00:00 to 99:59 min:s).

For the Auxiliary output parameter, see "Auxiliary output", page 54.

In an Addition method, it is not possible to run 2 additions of the same reagent.

In an ISE standard addition method, it is also possible to run one reagent addition before the measurement starts, see "Addition", page 44.
Addition volume

Refer to "Reagent addition volume", page 162.

Address

The position where the electrode and burette are placed during operation:

Electrode

The electrode address is defined using the format “xxx/y” where “xxx” corresponds to the instrument (ION, ABU1 or ABU2) where the electrode is connected and “y” corresponds to the socket. For example ION/E1, indicates that the electrode is connected to E1 socket on the ION570.

It is always recommended to connect an indicating electrode and its associated reference to the same instrument (ION, ABU1 or ABU2).

Refer to "Electrode connection", page 110.

Burette

The burette address is defined using the format “xxx/y” where “xxx” corresponds to the instrument (ION, ABU1 or ABU2) where the burette is placed and “y” corresponds to the position. For example ION/1 indicates that the burette is placed on the ION570 in position 1.

Refer to "ABU1/ABU2", page 41.

Alarm: Locked

The user cannot bypass an electrode and/or QC sample analysis if the last result obtained lies outside the acceptance range.

Enter in:
Set up menu > Access routine mode
**Alarm:**
**Unlocked**

Enables the user to bypass an electrode and/or QC sample analysis when the last result obtained lies outside the acceptance range.

**Enter in:**
Setup menu > Access routine mode

**Aliquot**

Amount that is taken from the diluted sample. This amount is used for analysis.

![Diagram]

1. Sample amount
2. Dilution under stirring with a solvent to obtain a final amount of x ml (or g)
3. Analysis

The quantity of species present in the sample is calculated using the result obtained at the end of the analysis.

\[
\text{Quantity of species in sample} = \text{Result} \times \frac{x}{y}
\]

\(x = \text{Final dil. amount}\)
\(y = \text{Aliquot}\)

**Figure 3: What is an aliquot?**

**Enter in:**
Edit method > Sample

**Range available:**
0.001 to 100000 (unit = Sample unit)
The following alphanumeric characters can be obtained using the ION570s Keypad:

<table>
<thead>
<tr>
<th>Keys</th>
<th>Characters</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>7, A, B, C, a, b, c, @</td>
</tr>
<tr>
<td>8</td>
<td>8, D, E, F, d, e, f</td>
</tr>
<tr>
<td>9</td>
<td>9, G, H, I, g, h, i</td>
</tr>
<tr>
<td>4</td>
<td>4, J, K, L, j, k, l</td>
</tr>
<tr>
<td>5</td>
<td>5, M, N, O, m, n, o, µ</td>
</tr>
<tr>
<td>6</td>
<td>6, P, Q, R, p, q, r</td>
</tr>
<tr>
<td>1</td>
<td>1, S, T, U, s, t, u</td>
</tr>
<tr>
<td>2</td>
<td>2, V, W, v, w</td>
</tr>
<tr>
<td>3</td>
<td>3, X, Y, Z, x, y, z</td>
</tr>
<tr>
<td>0</td>
<td>0, -, +, *, ^, =, #, &lt;, &gt;, ., space, /, (, ), [, ], l, ?, l, %, °</td>
</tr>
</tbody>
</table>

Table 1: Entering alphanumeric characters

**Applied signal (AC/DC)**

Specifies the current type (alternative AC or direct DC) to be sent to the Pt-Pt socket on the Ion Analyser. The AC signal frequency is 1.67 Hz. This option is available if mV (i > 0) has been selected for Measurement in the Edit method menu.

**Enter in:**
Method parameters menu

**Archives data lost - Cal. Data lost - Methods kept**

Instrument internal failure. Only the method parameters have been kept.
Archiving

Archiving = Yes (default setting)
All measurements (sample, electrode calibrations and reagent titre entries) are saved in the archives. You can view these measurements as follows:

- Sample results: enter Main window and press 5
- Reagent titre entries: enter Reagent window and press 6
- Electrode calibration results: enter Electrode window and press 6

Refer to "GLP-Archives menu", page 122.

Archiving = No
No measurements are saved in the archives. The instrument saves only the last electrode calibration.

When you set Archiving from No to Yes, you must recalibrate your electrodes and re-enter your reagent titre!

Enter in:
Setup menu > Configuration menu

Assistant function

Embedded instructions on the ION570 display to guide the user step-by-step through electrode and reagent installations. These instructions appear at the start of a run method if the working system has not been correctly installed.

By default this option is set to Yes. It is recommended to use the default setting at all times!

If the setting is set to No, the ION570 considers that the working system is correctly installed at the start of a run method. However, this may not be the case, the user must know the status of the working system at all times!

Enter in:
Setup menu > Configuration menu

Automatic (calibration mode)

Refer to "Electrode calibration (ISE)", page 104.
**Autochaining**

This option is valid for a Coupled method which is not part of a sequence.

**Autochaining = No**

At the end of each method run, you must confirm the result in order to perform the next method. If a Notification message has been selected, a message is displayed between each method of the Coupled method.

**Autochaining = Yes**

At the end of each method run, The methods are chained automatically in the Coupled method. If a Notification message has been selected, a message is displayed upon starting the first method (no message is displayed after).

*Refer to “Notification message”, page 145.*

**Enter in:**

Edit method menu (for a Coupled method)
**Auxiliary input**

The auxiliary input socket can be connected to an external device unit used to send an analysis start command to the ION570. The analysis is a sequence of methods with manual change of the sample beakers (Working mode = Sequence, see "Working mode", page 211).

The external device unit is to be connected to the red and black IN banana sockets of the ION570. The red banana socket receives the TTL 0 ± 5 V auxiliary signal and the black banana socket is connected to the instrument electrical zero.

Proceed as follows to trigger a sequence of methods by an auxiliary signal input:

- In the Configuration menu, select **Controlled by TTL IN = Yes**.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Printer</th>
<th>No</th>
<th>Beep</th>
<th>No</th>
<th>Sample changer</th>
<th>No</th>
<th>ION cell external Gnd</th>
<th>No</th>
<th>Controlled by TTL IN</th>
<th>Yes</th>
</tr>
</thead>
</table>

- Connect the auxiliary control unit to red and black IN banana sockets of the ION570.
- Run the sequence. The ION570 displays a waiting for auxiliary signal message. The sequence is started as soon as the auxiliary signal is received.

**Specifications of the auxiliary input signal**

*Refer to "TTL IN (sockets)", page 208.*
**Auxiliary output**
The auxiliary outputs are used to control external equipment such as valves or pumps during analyses. This signal is sent between the red and black banana sockets *5V OUT* or *12V OUT* of the ION570.

**Auxiliary output (5 V, 12 V, No)**
Activate to 5 V or 12 V or disable the auxiliary signal.
Specifications of the auxiliary output signal:
see "TTL 5 V OUT/TTL 12 V OUT (sockets)", page 207.

**Aux. on for**
Time during which the auxiliary signal is set to 5 V or 12 V.

**Enter in:**  
Method parameters menu

**Range available:**
Aux. on for: 0 to 99:59 min:s

An auxiliary output can be activated:
- *at the measurement start or before the first reagent addition (duration set by Aux. on for)*
- *or during the whole measurement including measurement stabilisation delay or during all the reagent addition(s). In this case, select a 5 V or 12 V auxiliary output and set Aux. on for = 0.*

**Aux. on for**  
Refer to "Auxiliary output", page 54.

**Bar code reader connection**  
Connect a bar code reader to the ION570 via the 6-pin mini DIN port situated on the right hand side of the instrument.

**Batch number**  
Up to 16 alphanumeric characters can be entered when installing or replacing a reagent. It is the reagent identification number given on the reagent bottle.
**Beaker menu**

Use this menu to prepare a sample or calibration stack. This menu defines individual data for all the samples or standards used in the sequence.

![Beaker menu](image)

*Figure 4: Beaker menu (for a sample stack)*

**To access (for a sample stack):**

1. Select Working mode = Sequence or SAC Sequence in the Main window.
2. Press 2 Sequence/Sample stack.
3. Press 1 Sample stack.

   *The sequence must have been edited in the Edit sequence menu beforehand. Refer to "Edit sequence menu", page 101.*

**To access (for an electrode calibration stack):**

1. Select Working mode = SAC Sequence in the Main window.
2. In the Electrode window, press 1 Calibrate electrodes.
3. Press 2 Calibration sequence.

   *The electrode calibration method must have been edited beforehand. Refer to "Edit electrode menu", page 98.*

Refer to "Sample stack", page 188.
Refer to "Electrode calibration stack", page 109.
Beaker detection

On a SAC850 or SAC950, a Beaker detection module (ultrasonic transducer) makes it possible to detect beakers containing liquid sample with a height higher than the minimum detection limit (10 mm), see "Beaker detection minimum height", page 57.

In all other cases, the beaker positions are not detected, that is to say:

a. empty positions (positions not occupied by beakers),
b. empty beakers or beakers considered as empty (i.e. beakers with heights of liquid less than the minimum detection limit),
c. beakers containing solid or powder samples.

In case of a position not detected, you can ask the ION570 to jump the position (analysis not performed on that position): tick both options Beaker detection and Skip empty position. Refer to "Skip empty position", page 194.

Case of a SAC950 sample changer with the Beaker cover module already installed

On a SAC950 with the Beaker cover module installed, the Beaker detection module is also able to detect all beakers covered by appropriate metal lids (the sample changer User’s Guide, chapter 7 “Accessories” gives a list of the metal lids part numbers). By this way, you can detect beakers with heights of liquid less than the minimum detection limit) or beakers containing solid or powder samples. You have just to tick the option Beaker detection.

The option Beaker detection

If you tick the option Beaker detection, then you can ask the ION570 to jump or not the positions which will be not detected (depending on your selection for the option Skip empty position).

If you clear the Beaker detection option, the ultrasonic transducer is disabled. All the positions between the first and the last beaker of the sample stack (including the static rinse and park beakers) will be regarded as occupied by a beaker. Thus, place beakers on all these positions. In this case, the Skip empty position option is not available (option is greyed).

Enter in:
Setup menu > Configuration
If Sample changer = SAC850 or SAC950
Beaker detection minimum height

The table below reports the minimum height of liquid that must be present in the beaker in order to detect the beaker as not empty, see also "Beaker detection", page 56.

<table>
<thead>
<tr>
<th>Beaker type diameter x height (mm)</th>
<th>Detection minimum height</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 ml tall form 70 x 131</td>
<td>10 mm (40 ml)</td>
<td></td>
</tr>
<tr>
<td>250 ml low form 70 x 95</td>
<td>10 mm (40 ml)</td>
<td></td>
</tr>
<tr>
<td>250 ml tall form 60 x 120</td>
<td>10 mm (30 ml)</td>
<td></td>
</tr>
<tr>
<td>125 ml, Gosselin, PP, 54 x 73</td>
<td>10 mm (25 ml)</td>
<td>X31T087 (pack of 50)</td>
</tr>
<tr>
<td>180 ml, Gosselin, PP, 54 x 103</td>
<td>10 mm (25 ml)</td>
<td>X31V005 (pack of 50)</td>
</tr>
<tr>
<td>150 ml tall form 60 x 80</td>
<td>10 mm (30 ml)</td>
<td></td>
</tr>
<tr>
<td>150 ml low form 62 x 81</td>
<td>10 mm (30 ml)</td>
<td></td>
</tr>
<tr>
<td>40-100 ml, PP 60 x 80</td>
<td>10 mm (30 ml)</td>
<td>904-490 (pack of 50)</td>
</tr>
<tr>
<td>100 ml tall form 48 x 80</td>
<td>10 mm (20 ml)</td>
<td></td>
</tr>
<tr>
<td>50 ml low form 42 x 60</td>
<td>10 mm (15 ml)</td>
<td>904-489 (pack of 50)</td>
</tr>
<tr>
<td>22-45 ml, PP 44 x 70</td>
<td>10 mm (15 ml)</td>
<td>904-489 (pack of 50)</td>
</tr>
<tr>
<td>8-25 ml, PP 44 x 70</td>
<td>10 mm (15 ml)</td>
<td>904-488 (pack of 50)</td>
</tr>
</tbody>
</table>

Beakers: [F;L]  
The beakers information is displayed in the Edit sequence menu of a sequence.  
It indicates the First and Last positions occupied by the beakers in the sequence.

Beep  
If Yes has been selected, three beeps will sound when a result is obtained.

Enter in:  
Setup menu > Configuration
**Burette functions menu**

These functions can be activated during the preparation of the burette, before installing the reagent.

To access, press 7 in the Reagents window. To run a burette function, select the burette in the Address field, then press 1 to 6 corresponding to the required procedure. The title bar shows the volume of the burette in use. You can replace (key 5) or remove this burette (key 6).

![Figure 5: Burette functions menu (burette installed/not installed).](image)

**Burette speed**

The maximum burette speed (in ml/min) is three times the nominal value of the burette per minute. However, for the 50 ml burette the maximum burette speed is 1.5 times the nominal value, i.e. 75 ml/min.

**Burette volume**

The burette volume is entered while installing or replacing the burette. This volume is indicated on the burette.

**Enter in:**

Install burette or Replace burette menu.

**Range available:**

1 ml, 5 ml, 10 ml, 25 ml or 50 ml.

**C₀ (Detection limit)**

Refer to "Direct ISE measurement method - definition", page 89.
Cable capacity

A cable of a given length has a given capacity. When the measured conductance is low (below 4 µS), the cable capacity is not negligible and must be taken into account.

Enter the cable capacity when:

- measuring low conductances (below 4 µS),
- the cable capacity of the conductivity cell is greater than 350 pF.

The cable capacity is normally specified by the manufacturer. Cable capacities of a few Radiometer Analytical conductivity cells are given below:

<table>
<thead>
<tr>
<th>Conductivity cell</th>
<th>Cable capacity (pF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC511T</td>
<td>500</td>
</tr>
<tr>
<td>CDC861T</td>
<td>500</td>
</tr>
<tr>
<td>CDC565</td>
<td>440</td>
</tr>
<tr>
<td>CDC749</td>
<td>170</td>
</tr>
<tr>
<td>CDC267-9 with cable A94L136</td>
<td>70</td>
</tr>
<tr>
<td>CDC267-9 with cable A94L336</td>
<td>200</td>
</tr>
<tr>
<td>CDC241-9 with cable A94L136</td>
<td>70</td>
</tr>
<tr>
<td>CDC241-9 with cable A94L336</td>
<td>200</td>
</tr>
<tr>
<td>XE100 with cable A94L136</td>
<td>70</td>
</tr>
<tr>
<td>XE100 with cable A94L336</td>
<td>200</td>
</tr>
</tbody>
</table>

Figure 6: Cable capacities of Radiometer Analytical conductivity cells

If you create a conductivity cell from the Catalogue list, the cable capacity is automatically assigned to the conductivity cell created (and cannot be modified).

Enter in:

When creating an electrode with the Conductivity function and the option From = Other. Refer to "Create electrode", page 82.

Available limits:
0 to 1999 pF
A cable has a given length, therefore a given resistance. When the measured resistance is low (below 50 Ω), the cable resistance is not negligible and must be taken into account.

Enter the cable resistance when:

- measuring low resistances (below 50 Ω) or high conductances (above 20 mS).
- using a 2 or 3-pole conductivity cell.

The cable resistance is normally specified by the manufacturer. Cable resistances of a few Radiometer Analytical conductivity cells are given below:

<table>
<thead>
<tr>
<th>Conductivity cell</th>
<th>Cable resistance (Ω)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC511T</td>
<td>0</td>
</tr>
<tr>
<td>CDC861T</td>
<td>0</td>
</tr>
<tr>
<td>CDC565</td>
<td>0</td>
</tr>
<tr>
<td>CDC749</td>
<td>0.180</td>
</tr>
<tr>
<td>CDC267-9 with cable A94L136</td>
<td>0.145</td>
</tr>
<tr>
<td>CDC267-9 with cable A94L336</td>
<td>0.350</td>
</tr>
<tr>
<td>CDC241-9 with cable A94L136</td>
<td>0.145</td>
</tr>
<tr>
<td>CDC241-9 with cable A94L336</td>
<td>0.350</td>
</tr>
<tr>
<td>XE100 with cable A94L136</td>
<td>0.145</td>
</tr>
<tr>
<td>XE100 with cable A94L336</td>
<td>0.350</td>
</tr>
</tbody>
</table>

*Figure 7: Cable resistances of Radiometer Analytical conductivity cells*

If you create a conductivity cell from the Catalogue list, the cable resistance is automatically assigned to the conductivity cell created (and cannot be modified).

Enter 0 for the cable resistance of a 4-pole conductivity cell (whatever the conductivity cell used).

Enter in:

When creating an electrode with the Conductivity function and the option From = Other.
*Refer to "Create electrode", page 82.*

Available limits:

0.000 to 9.999 Ω
Calibrate electrodes

Refer to "Electrode calibration (Fixed mode, pH electrode)", page 105.  
Refer to "Electrode calibration (Free mode, pH electrode)", page 106.  
Refer to "Electrode calibration (Fixed mode, conductivity cell)", page 102.  
Refer to "Electrode calibration (Free mode, conductivity cell)", page 103.  
Refer to "Electrode calibration (ISE)", page 104.  
Refer to "Electrode calibration (SAC sequence)", page 107.

Calibrate conductivity cells

Refer to "Electrode calibration (Fixed mode, conductivity cell)", page 102.  
Refer to "Electrode calibration (Free mode, conductivity cell)", page 103.
Calibration = Automatic

Available if Electrode type = ISE single, ISE combined (w/o temperature sensor),

This ISE electrode calibration mode is simple to use as the user has just to pour into a beaker a known amount of supporting electrolyte. The 1 to 4 standards needed for the calibration are prepared by the instrument by automatic additions. The user enters, in the electrode calibration parameters, the initial volume of electrolyte solution and each standard concentration.

<table>
<thead>
<tr>
<th>What you have to do</th>
<th>What is done automatically by the instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Edit mode, enter: Initial volume and Concentration n (n=1 to 4 with C1 &lt; C2 &lt; C3 &lt; C4)</td>
<td>Addition of standard x1 ml Measurement Calibration point no.1 ( \text{E1, Concentration 1} )</td>
</tr>
<tr>
<td>Electrolyte solution = Initial volume</td>
<td>Standard no.1 = Initial volume + x1 ml</td>
</tr>
<tr>
<td></td>
<td>Addition of standard x2 ml Measurement Calibration point no.2 ( \text{E2, Concentration 2} )</td>
</tr>
<tr>
<td></td>
<td>Standard no.2 = Initial volume + x1+x2 ml</td>
</tr>
<tr>
<td></td>
<td>Addition of standard x3 ml Measurement Calibration point no.3 ( \text{E3, Concentration 3} )</td>
</tr>
<tr>
<td></td>
<td>Standard no.3 = Initial volume + x1+x2 + x3 ml</td>
</tr>
<tr>
<td></td>
<td>Addition of standard x4 ml Measurement Calibration point no.4 ( \text{E4, Concentration 4} )</td>
</tr>
<tr>
<td></td>
<td>Standard no.4 = Initial volume + x1+x2 + x3 + x4 ml</td>
</tr>
</tbody>
</table>

4 standards can be prepared

Figure 8: ISE electrode calibration in Automatic mode

See also: "Calibration = Manual": see page 63.
Calibration = Manual

Available if Electrode type = ISE single, ISE combined (w/o temperature sensor),

In this ISE electrode calibration mode, 1 to 9 standard of known concentration are to be prepared. The user enters each standard concentration in the Edit electrode > Solution menu.

<table>
<thead>
<tr>
<th>What you have to do</th>
<th>What is done automatically by the instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Edit mode, enter: Concentration n (n=1 to 9)</td>
<td>Calibration results</td>
</tr>
<tr>
<td>Standard no.1 = Concentration 1</td>
<td>Calibration point no.1</td>
</tr>
<tr>
<td>Standard no.2 = Concentration 2</td>
<td>Calibration point no.2</td>
</tr>
<tr>
<td>Standard no.3 = Concentration 3</td>
<td>Calibration point no.3</td>
</tr>
</tbody>
</table>

9 standards can be prepared

Figure 9: ISE electrode calibration in Manual mode

See also: "Calibration = Automatic": see page 62.
| **Calibration curve of an ISE electrode** | This is the $E = f (pC = -\log C)$ curve obtained at the end of a calibration cycle performed on an ISE electrode.  

**Displaying the calibration curve:**  
Refer to "Electrode calibration (ISE)", page 104.  

**Printing the calibration curve:**  
The curve is printed out automatically at the end of each calibration cycle if asked for in the Printouts menu of the calibration method, see "Printouts setup", page 157. |
|---|---|
| **Calibration delay elapsed** | This message appears at analysis start. A new electrode calibration is required. The delay Periodicity entered in the Edit electrode screen has elapsed, see "Periodicity", page 150.  
Press ✓ and perform a calibration. |
| **Calibration parameters** | For an electrode calibration method, see "Electrode calibration parameters", page 108. |
**Calibration point menu**

This menu is available for ISE electrode calibration that is edited with the **Calibration = Automatic** option.

These parameters describe how the standards are prepared using the automatic addition method.

With the automatic addition method, one beaker is only necessary to prepare for all the standards (1 to 4 standards).

An initial volume of electrolyte support solution is poured into the beaker. The user enters this initial volume in the Calibration parameters (see "Initial volume", page 125) and the 1 to 4 standard concentrations in the Calibration point menu. The Ion Analyser calculates the amounts of standard to be added to reach these concentrations then performs the necessary additions.

**To access:**

1. From the Electrode window, press 4.
2. Select the ISE electrode to be edited.
3. Press 2 Edit electrode and check that the **Calibration = Automatic** option has been selected.
4. Use the LEFT/RIGHT arrow keys to move to the last Edit electrode display.
5. Press 2 Calibration points.

![Calibration points ISE25CL window](image)

<table>
<thead>
<tr>
<th>ID</th>
<th>Concentration unit</th>
<th>Concentration 1</th>
<th>Concentration 2</th>
<th>Concentration 3</th>
<th>Concentration 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mol/l</td>
<td>1.0000E-5</td>
<td>1.0900E-4</td>
<td>0.0010980</td>
<td>0.010881</td>
</tr>
</tbody>
</table>

- **Select the standard used from the User or the Catalogue list.**
- **Select the standard concentration unit.**
- **Available units:** eq/l, meq/l, mol/l, mmol/l, g/l, mg/l, mg/ml, µg/ml, % or ppm.
- **Enter the concentration of each standard with the unit selected above.**
- **Available limits:** $10^{-10}$ to $10^{10}$. 

**Note:**
- For more information, refer to "Initial volume", page 125.
**Calibration request/Calibration**

*Available if Electrode type =*

- *pH single, pH combined (w/o temperature sensor),*
- *ISE single, ISE combined (w/o temperature sensor),*
- *Conductivity (w/o temperature sensor).*

Select the option *Calibration request = Fixed or Free* to calibrate a pH electrode or a conductivity cell.

Select the option *Calibration = Manual or Automatic* to calibrate an ISE electrode.

The corresponding calibration parameters and standards will be displayed.

**Enter in:**

Edit electrode menu

*Refer to "Calibration = Automatic", page 62.*
*Refer to "Calibration request = Fixed", page 67.*
*Refer to "Calibration request = Free", page 68.*
*Refer to "Calibration = Manual", page 63.*
Calibration request = Fixed

Available if Electrode type = pH single, pH combined (w/o temperature sensor), conductivity (w/o temperature sensor).

In this calibration mode, the electrode is calibrated with standards that belong to a list of predefined values. Moreover, for a pH electrode, the buffers/standards are automatically recognised. The user selects the buffer/standard values during method edition. Use this mode if you intend to calibrate the electrode using buffers/standards of the ION570 predefined list.

<table>
<thead>
<tr>
<th>pH Buffer (value at 25°C)</th>
<th>Radiometer Analytical part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>IUPAC - 1.679 pH</td>
<td>S11M001 (500 ml)</td>
</tr>
<tr>
<td>IUPAC - 4.005 pH</td>
<td>S11M002 (500 ml)</td>
</tr>
<tr>
<td>IUPAC - 6.865 pH</td>
<td>S11M003 (500 ml)</td>
</tr>
<tr>
<td>IUPAC - 7.000 pH</td>
<td>S11M004 (500 ml)</td>
</tr>
<tr>
<td>IUPAC - 7.413 pH</td>
<td>S11M005 (500 ml)</td>
</tr>
<tr>
<td>IUPAC - 9.180 pH</td>
<td>S11M006 (500 ml)</td>
</tr>
<tr>
<td>IUPAC - 10.012 pH</td>
<td>S11M007 (500 ml)</td>
</tr>
<tr>
<td>IUPAC - 12.454 pH</td>
<td>S11M008 (500 ml)</td>
</tr>
<tr>
<td>pH 4</td>
<td>S11M012 (500 ml)</td>
</tr>
<tr>
<td>pH 7</td>
<td>S11M013 (500 ml)</td>
</tr>
<tr>
<td>pH 10</td>
<td>S11M014 (500 ml)</td>
</tr>
</tbody>
</table>

Table 2: pH buffers of the ION570 predefined list

<table>
<thead>
<tr>
<th>Conductivity standard</th>
<th>Radiometer Analytical part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 D KCl</td>
<td>S51M001 (500 ml)</td>
</tr>
<tr>
<td>0.1 D KCl</td>
<td>S51M002 (500 ml)</td>
</tr>
<tr>
<td>0.01 D KCl</td>
<td>S51M003 (500 ml)</td>
</tr>
<tr>
<td>0.1 M KCl</td>
<td>C20C250 (500 ml)</td>
</tr>
<tr>
<td>0.01 M KCl</td>
<td>C20C270 (500 ml)</td>
</tr>
<tr>
<td>0.001 M KCl</td>
<td>C20C280 (500 ml)</td>
</tr>
<tr>
<td>0.05 % NaCl</td>
<td>S51M004 (500 ml)</td>
</tr>
<tr>
<td>25 µS/cm NaCl</td>
<td>S51M013 (250 ml)</td>
</tr>
</tbody>
</table>

Table 3: Conductivity standards of the ION570 predefined list

See also: "Calibration request = Free": see page 68.
**Calibration request = Free**

Available if Electrode type = pH single, pH combined (w/o temperature sensor), conductivity (w/o temperature sensor).

In this calibration mode, the buffer/standard values are entered freely by the user. Use this option to calibrate pH electrode or conductivity cells with buffers/standards that do not belong to the instrument predefined list. You must accurately know the pH/conductivity of the buffer/standard at given temperatures.

When running a calibration in Free mode and after stabilisation of the measurement, the user enters the pH buffer/standard conductivity value at the temperature measured in the buffer/standard.

See also: "Calibration request = Fixed": see page 67.

**Calibration stack**

For an electrode calibration method, see "Electrode calibration stack", page 109.

**Calibration results parameters**

Refer to "Results menu", page 173.

**Catalogue list**

List of Radiometer Analytical names of electrodes and commonly used reagents. This list cannot be modified.
Cell constant (parameter)

Enter the cell constant value. The cell constant is a specification of the conductivity cell and is normally provided by the cell manufacturer.

If you do not know the cell constant value or if you want to check its value, select Calibration request = Fixed or Free, edit and run a calibration method. It is recommended to periodically check the constant value by performing a cell calibration.

Refer to "Electrode calibration (Fixed mode, conductivity cell)", page 102.
Refer to "Electrode calibration (Free mode, conductivity cell)", page 103.
Refer to "Cell constant (definition)", page 70.

Access:
Edit Electrode menu (for a Conductivity type of electrode with Calibration request = No)

Range available:
0.050 to 15.000 cm⁻¹ (by steps of 0.001 cm⁻¹)
Cell constant (definition)

The ION570 calculates and displays the $\kappa$ conductivity based on a $G$ measured conductance and the $K$ cell constant of the conductivity cell used.

$$\kappa \text{ (in S.cm}^{-1}) = K \times G \text{ (in S)}$$

The $K$ constant (expressed in cm$^{-1}$) is a characteristic of the conductivity cell depending on the cell geometry.

To measure conductivities, you must know the cell constant value. With the ION570, you can directly enter $K$ in the Edit electrode menu (see "Cell constant (parameter)", page 69) or determine $K$ by calibrating the conductivity cell (see "Electrode calibration (Fixed mode, conductivity cell)", page 102 or see "Electrode calibration (Free mode, conductivity cell)", page 103).

Cell grounding

Defines the grounding of the measuring cell. Select one of the following options:

Reference

Grounding is ensured by a reference electrode - general use.

Metal

Grounding is ensured by a metal electrode connected to the GND socket on the ION570. Use this option in case of high resistive solutions in order to avoid measuring background noise at the electrodes.

Others

Grounding is not ensured by the reference electrode and is defined outside the method.

Enter in:
Edit method menu
**Cell window**

Use **LEFT/RIGHT** arrow keys to access. This window controls the stirring function of the measurement cell.

![Cell window diagram]

Select the instrument having the stirrer (ION for ION570, ABU1 or ABU2 for an ABU52).

**Start/stop stirrer**

Select stirring speed: 100 to 1100 rpm

**Animated icon:** indicates when stirrer or propeller is in operation

An external stirrer (propeller) can be connected to a ION570 or an ABU52.

*Refer to "Stirring", page 200.*

**Change electrode name**

1. Display the Electrode window.
2. Press 4 then 2.
3. In the ID field, enter the new name for the electrode (16 characters maximum).

**Change method name**

1. Display the Main window.
2. Press 4 then 2.
3. In the ID field, enter the new name (16 characters maximum).

**Change reagent name**

1. Display the Reagent window.
2. Press 4 then 2.
3. In the ID field, enter the new name (20 characters maximum).

**Change sequence name**

1. Select Sequence in the Main window.
2. Press 2.
3. In the Sequence/Sample stack menu, select ID.
4. Enter the new name (16 characters maximum).
Check command

If a Stormy or a Question mark icon appears in the Reagent/Electrode windows, press 1 to run the “Check” command. The ION570 will automatically guide you through the operations required to solve the problems encountered.

For example:

```
Station 1 09:06:54
Working mode: Method
Check "Measure" ④
Sequence/Sample stack ③
Select method ③
Method library ③
GLP Archives ③
```

Press 1

```
Measure
Error!
Check Installation/Location
```

Press ✓

Press 1 to start the Electrode Installation procedure.

Check electrodes

Press 3 in the Electrode window to display the parameters of the current electrode used in the system. For example, electrode ID and address.
Check reagents

Press 3 in the Reagent window to display the parameters of the current reagent used in the system. For example, reagent ID, expiry date etc.

Communication failure (SAC error)

The data transmission between the sample changer and the ION570 cannot be performed properly.

Check the cable connections and make sure that the sample changer is switched on and connected to the ION570 via the RS232 serial cable.

Press the ION570 key ✓ or Stop and restart the sequence. It is not possible to continue the sequence from the point it stopped.

Conc. 1 too high compared to reagent concentration

When calibrating an ISE electrode in automatic mode, the first standard concentration \( C_1 \) is higher than \( 1/3 \) of the addition reagent concentration.

Revise the method programmation. Decrease the value of Concentration 1 in the Calibration points menu, see "Calibration point menu", page 65 and/or use a more concentrated reagent standard.

Calibration must be restarted.

The first addition volume \( V_{a1} \) used to reach the \( C_1 \) concentration is equal to:

\[
V_{a1} = \frac{C_1}{C_T - C_1} \cdot V_{\text{init}}
\]

with:

\( C_T \) : concentration of the standard addition reagent

\( V_{\text{init}} \) : Initial volume of supporting electrode used

If \( C_1 = 1/3 C_T \), using the equation above, \( V_{a1} = 1/2 V_{\text{init}} \).

It results that you cannot add more than 50% of the initial volume. It is recommended that the first addition stays below 10% of the initial volume \( C_1 \) equal or less than 1/11 of \( C_T \).

Refer to "Electrode calibration (ISE)", page 104.
Conc. n too high compared to reagent concentration

When calibrating an ISE electrode in automatic mode, the last standard concentration \( C_n \) is higher than 1/3 of the addition reagent concentration.

You can ignore the message and run the calibration. The ION570 will use for calculation the \( n-1 \) points that gives concentrations below 1/3 of the addition reagent concentration.

You can also revise the method programmation. Decrease the concentrations in the Calibration points menu, see "Calibration point menu", page 65 and/or use a more concentrated reagent standard.

The cumulated addition volume \( V_{an} \) used to reach the \( C_n \) concentration is equal to:

\[
V_{an} = \frac{C_n}{C_T - C_n} \cdot V_{init}
\]

with:

- \( C_T \): concentration of the standard addition reagent
- \( V_{init} \): Initial volume of supporting electrode used

If \( C_n = 1/3 \ C_T \), using the equation above, \( V_{an} = 1/2 \ V_{init} \).

It results that cumulated volumes of standard added cannot be higher than 50\% of the initial volume.

**It is recommended that the cumulated addition volumes stay below 10\% of the initial volume (\( C_n \) equal or less than 1/11 of \( C_T \)).**

Refer to "Electrode calibration (ISE)", page 104.

Conc. not increasing in "method ID"

For an ISE electrode calibration method in automatic mode, the concentrations entered in the Calibration points menu, see "Calibration point menu", page 65 are not in increasing order.
**Concentration x**

Concentration of the measured species present in the standard no. x (x=1 to 9). These x standards are used to calibrate an ISE electrode.

**Enter in:**
Edit electrode > Solution or Calibration points (for an ISE electrode)

**Range available:**
\[ 10^{-10} \text{ to } 10^{10} \text{ (unit = Concentration unit)} \]

*Refer to "Calibration point menu", page 65.*
*Refer to "Solution menu", page 195.*

**Concentration unit**

Standard concentration unit used for an ISE electrode calibration.

**Enter in:**
Edit electrode > Solution or Calibration points (for an ISE electrode)

**Range available:**
\[ \text{eq/l, meq/l, mol/l, mmol/l, g/l, mg/l, mg/ml, } \mu \text{g/ml, } \% \text{ or ppm} \]

*Refer to "Calibration point menu", page 65.*
*Refer to "Solution menu", page 195.*

**Conductivity cell**

Refer to "EC socket", page 95.

**Conductivity cell calibration**

Refer to "Electrode calibration (Fixed mode, conductivity cell)", page 102.

Refer to "Electrode calibration (Free mode, conductivity cell)", page 103.
Conductivity measurement method

Measurement method using a conductivity cell connected to the ION570 EC socket. You enter the cell constant of the conductivity cell or determine it by calibrating the conductivity cell using a standard solution of known conductivity against temperature. 

Refer to "Cell constant (definition)", page 70.

The ION570 measures the $G$ conductance of the sample then calculates the $\kappa$ conductivity using the $K$ cell constant and the following equation:

$$\kappa \text{ (in S.cm}^{-1}) = K \times G \text{ (in S)}$$

The conductivity determined at the sample temperature can be corrected back to:

- a reference temperature of your choice (enter the reference temperature and a variation coefficient expressed in %/°C),
- 25 °C by using a correction table based on the variations of the conductivity against temperature for a natural water.

How to define a conductivity measurement method?

1. In the Main window, press 4 followed by 2 Edit method.
2. For Mode, select Measurement.
3. For Measurement, select Conductivity.
4. Edit the other parameters of this measurement method.

How to calibrate a conductivity cell?

Refer to "Cell constant (parameter)", page 69.
Refer to "Electrode calibration (Fixed mode, conductivity cell)", page 102.
Refer to "Electrode calibration (Free mode, conductivity cell)", page 103.

How to run a conductivity measurement method?

Refer to "Running a method", page 179.
Configuration menu

Press **Stop** 3 seconds in the Main window then press 1.
Contains the configuration parameters for the instrument.

<table>
<thead>
<tr>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistant function:  Yes</td>
</tr>
<tr>
<td>Archiving: Yes</td>
</tr>
<tr>
<td>User ID: Yes</td>
</tr>
<tr>
<td>Time: 15:00:50</td>
</tr>
<tr>
<td>Date: 31 Oct. 2003</td>
</tr>
<tr>
<td>Language: English</td>
</tr>
<tr>
<td>PC Keyboard: English(US)</td>
</tr>
<tr>
<td>Mains frequency: 50 Hz</td>
</tr>
</tbody>
</table>

*Refer to “Setup menu”, page 193.*

Connections

**ABU52**: *Refer to “ABU1/ABU2”, page 41.*

**Bar code reader**: *Refer to “Bar code reader connection”, page 54.*

**Electrodes**: *Refer to “Electrode connection”, page 110.*

**PC keyboard**: *Refer to “Keyboard connection”, page 132.*

**PC**: *Refer to “PC connection”, page 149.*

**Printer**: *Refer to “Printer connection”, page 155.*

**Sample changer**: *Refer to “Sample changer”, page 184.*

Connect electrodes

*Refer to “Electrode connection”, page 110.*
Contrast

The contrast of the display can be adjusted in the Main window.

- press 0 to increase the contrast
- press 7 to decrease the contrast

Proceed as follows to adjust the contrast of the ABU52 display from the ION570:

- Display the Cell window.
- At the line Instrument, select the ABU52 (ABU1 or ABU2) you want to adjust the display contrast. 
  Refer to "ABU1/ABU2", page 41.

  ![Contrast Adjustment Screenshot]

- press 0 to increase the contrast
- press 7 to decrease the contrast

Controlled by TTL IN

Refer to "Auxiliary input", page 53.
Copy electrode

This procedure is used to create an electrode by copying an existing one.

1. Enter the Electrod es window.
2. Press 4 then 1.
3. In the Function field, select the function according to the electrode type then press ✓, see "Electrode type", page 114.
4. Press ✓.
5. Select From = Catalogue.
6. In the ID field, select an electrode name from the Catalogue list.
7. In the id field, you can identify the electrode by assigning a second id name. This electrode will be called "ID id".
8. Press 1 to confirm then 2 Copy from electrode.
9. In the Library field, select the Preprogrammed or User list.
10. In the ID field, select the electrode to be copied from the list of available electrodes.
11. Press 1 to confirm. The electrode is created and saved in the User list.

⚠️ If you selected the option Preprogrammed, the list is limited to electrodes of the same type as the "copied" electrode.

⚠️ If you selected User, the list is limited to electrodes having the same function (pH, mV (i=0), mV (i>0), ISE, Conductivity, T°C, Reference or Ground) as the "copied" electrode.

It is not necessary to select Catalogue to create an electrode using the copy function. An electrode ID created from Other can also use the copy function.
Copy method

This procedure is used to create a method by copying an existing one.

1. Switch to Main window.
2. Select Method.
3. Press 4 then 1.
4. Press 3 in New method menu.
5. Enter a method name.
6. Press 2 Copy from method.
7. In the Library field, select the Preprogrammed or User list.
8. In the ID field, select the method to be copied from the list of available methods.
9. Press 1 to confirm. The method is created and saved in the User list.

Copy reagent

This procedure is used to create a reagent by copying an existing one.

1. Enter the Reagents window.
2. Press 4 then 1.
4. Select From = Catalogue.
5. In the ID field, select a reagent name from the Catalogue list.
6. Enter the "approximate" titre for the reagent (between 0.001 and 99 999) in the Target titre field.
7. Enter the unit indicated on the reagent bottle (mM = mmol/l, M = mol/l, mN = meq/l or N = eq/l).
8. Press 1 to confirm then 2 Copy from reagent.
9. In the Library field, select the Preprogrammed or User list.
10. In the ID field, select the reagent to be copied from the list of available reagents.
11. Press 1 to confirm. The reagent is created and saved in the User list.

It is not necessary to select Catalogue to create a reagent using the copy function. A reagent ID created from Other can also use the copy function.
A Coupled method is a combination of methods performed in the same beaker. When using a coupled method, the instrument runs all these methods on the same sample.

If you wish to run a series of methods in different beakers, it is necessary to program a Sequence instead of a Coupled method.

**Example: Combination of method 1 and method 2.**

The number of test portions (for example 3) is entered during programming. The method is then repeated in the number of beakers specified.

![Figure 10: Coupled method with three tests](image-url)
Create electrode

1. Enter the Electrode window.
2. Press 4 then 1.
3. Select the electrode function, see "Electrode type", page 114.
4. Press ✓ in the ID field.
5. Select From = Other.

*The option From = Catalogue allows you to create an electrode from a list of Radiometer Analytical electrodes.*

6. Enter the electrode name (up to 16 alphanumeric characters).
7. In the Confirm creation screen:
   - For pH, mV or ISE function electrodes only: select the electrode type.
     Refer to "Electrode type", page 114.
   - For combined pH or single pH electrodes; enter the internal pH (pH int) of the electrode.
     Refer to "pH int", page 151.
   - For combined pH, Metal/Redox or ISE electrodes or for a Conductivity electrode; select if the electrode has a built-in temperature sensor or not.
   - For reference electrodes or combined pH, Metal/Redox, ISE electrodes; enter the potential of the reference (in mV) versus the Standard Hydrogen Electrode.
     Refer to "Potential versus SHE", page 152.
   - For ISE electrodes only; enter the ion valency and molar weight (in g/mol).
     Refer to "Valency", page 210.
   - For conductivity cells only; enter the cable resistance (in Ω) and capacitance (in pF).
     Refer to "Cable resistance", page 60.
     Refer to "Cable capacity", page 59.
8. Press 1 to create the electrode. The Edit electrode menu is displayed. Enter the electrode definition parameters.
Create method
1. Enter the Main window.
2. Select Method.
3. Press 4 then 1.
5. Enter a method name (up to 17 alphanumeric characters).
6. Press 1 to create the method. Go to Edit method screen and enter the method parameters.
   Refer to "Programming method", page 158.

Create reagent
1. Enter the Reagents window.
2. Press 4 then 1.
4. Select From = Other.
   *The option From = Catalogue allows you to create a reagent from a list of commonly used reagents.*
5. In the ID field, enter the reagent name (up to 14 alphanumeric characters). It is advised to enter the chemical formula of the reagent followed by its concentration (e.g. HCl 0.1).
6. Enter the "approximate" titre of the reagent (5 characters) in the Target titre field.
7. Enter the unit indicated on the reagent bottle (mM = mmol/l, M = mol/l, mN = meq/l or N = eq/l).
8. Press 1 twice to create the reagent. The Edit reagent menu is displayed. Enter the reagent parameters.

Current value
This is the current sent to the Pt-Pt socket on the ION570. This parameter is available if mV (i > 0) has been selected for Measurement in the Edit method menu.

Enter in:
Method parameters menu

Range available:
-1000 to +1000 µA in steps of 1 µA
Curve

Select if you want to print:

- the $E = f(pC = -\log C)$ calibration curve at the end of each ISE electrode calibration cycle,
- the $GRAN = f(Volume)$ curve at the end of each test of a ISE standard addition analysis.

Enter in:
Edit method > Printouts (ISE standard addition methods)
Edit electrode > Printouts (ISE electrodes)

Curves data lost - Cal. Data kept - Methods kept

The last curve data acquisition is lost. Generally, this error occurs when the instrument is switched off while an analysis is in progress.

Customise

A name (max. 16 alphanumeric characters) can be assigned to the ION570. This name will be displayed in the title bar of the Main window.

If required, a maximum of 4 lines (32 characters) is available to enter personal information, or your company’s address. This information will appear as a header at the start of the report printout.

Enter in:
Setup window > Customise

Date entry

Enter current date in following format: dd:mm:yyyy.
Use the Up/Down arrow keys to jump to the month.

Enter in:
Setup menu > Configuration
**Default parameters**

Reset the parameters programmed in the method, reagent, or electrode. Use this command to reset the preprogrammed methods, reagents or electrodes to the ION570's default values.

**Proceed as follows:**
1. Display the Main, Reagent or Electrode window.
3. Select the method, reagent or electrode ID.
4. Press 3 Default parameters.
5. Press ✓ to confirm the reset.

**Delay after addition**

This delay is counted down after a reagent addition. This time allows the solution to stabilise after a reagent addition.

*While an addition method is running, you can carry on regardless this delay by pressing key Del.*

**Enter in:**
Edit method > Parameters (ISE standard addition method if Addition = Yes)

**Range available:**
00:00 to 99:59 min:s

**Delete electrode**

1. Select the electrode to be deleted.
3. Press ✓ to confirm or ESC to leave the menu with deleting.

*It is not possible to delete an electrode which is used in another method or sequence. Modify the method or sequence, e.g. change electrode ID or remove the electrode, before deleting.*

**Delete method**

1. Select the method to be deleted.
3. Press ✓ to confirm or ESC to leave the menu with deleting.

*It is not possible to delete a method which is part of a method sequence or coupled method. Remove the method from the sequence or from the coupled method before deleting.*
Delete reagent

1. Select the reagent to be deleted.
3. Press ✓ to confirm or ESC to leave the menu with deleting.

It is not possible to delete a reagent which is used in another method or sequence. Modify the method or sequence, e.g. change reagent ID or remove the reagent, before deleting.

Demand:

Locked

Electrode calibration

The routine user is not allowed to bypass an electrode calibration demand before continuing measurements. It means that the electrode calibration periodicity has been elapsed.

Reagent

The routine user is not allowed to bypass a reagent replacement demand before continuing measurements. It means that the expiry date of the reagent has elapsed.

QC sample analysis

If a QC sample periodicity has been reached, the next run of the method must be performed on a QC sample.

Sequence edition

The routine user is not allowed to create, edit or delete sequence of methods.

Enter in:

Setup menu > Access routine mode
Demand: Unlocked

**Electrode calibration**
The routine user is allowed to bypass an electrode calibration demand and continue measurements. This happens when the electrode calibration periodicity has elapsed.

**Reagent**
The routine user is allowed to bypass a reagent replacement demand and continue measurements. This happens when the expiry date of the reagent has elapsed.

**QC sample analysis**
If a QC sample periodicity has been reached, the routine user is able to run the method without having to use a QC sample.

**Sequence edition**
The routine user is allowed to create, edit or delete sequence of methods.

**Enter in:**
Setup menu > Access routine mode
Detailed

This parameter sets level of details of report printouts.

**Detailed = Low**
- The header only comprises the analysis name, time and date and the instrument serial number. These data are printed on the same line.
- Electrode calibration method: results are printed.

**Detailed = Medium**
This is the printout level selected by default.
- The header comprises the analysis name, time and date, the instrument serial number and the laboratory coordinates.
- Electrode calibration method: results are printed.

**Detailed = High**
This is the printout level selected by default.
- The header comprises the analysis name, time and date, the instrument serial number and the laboratory coordinates.
- Electrode data, electrode serial number, electrode calibration data and results, burette serial number are printed.
- The buffer or standard data (name and batch number, potential value) are printed.

**Enter in:**
Edit method > Printouts
Edit electrode > Printouts

---

Detection limit \((C_0)\)

Refer to "Direct ISE measurement method - definition", page 89.

Dilution (Yes/No)

Select **Dilution = Yes** when you are analysing samples which have been diluted. The **Final dil. amount** and **Aliquot** are to be entered next.

**Enter in:**
Edit method > Sample menu
Direct ISE measurement method - definition

Measurement method using a selective electrode (ISE) of the ion you want to determine the concentration.

In a Direct ISE measurement method, you must calibrate the ISE electrode using 1 to 9 standard solutions of known concentration. Refer to "Electrode calibration (ISE)", page 104.

If a calibration with 3 to 9 standards is carried out, \( E^0 \), \( S_{25} \) and \( C_0 \) are determined by non linear regression using the following equation:

\[
E = E^0 + S_{25} \times \frac{T}{T_{25}} \times (-\log(C+C_0))
\]

where:
- \( E \) = potential measured in the sample,
- \( E^0 \) = electrode standard potential,
- \( S_{25} \) = electrode response slope (sensitivity) at 25°C,
- \( T \) = temperature of the solution in K,
- \( T_{25} = 298.16 \text{ K} \),
- \( C \) = concentration of sample,
- \( C_0 \) = detection limit concentration. It is the “experimental detection limit of the electrode regarding the species under study”.

If a 1-point calibration is performed, only \( E^0 \) is calculated. The ION570 takes the \( S_{25} \) sensitivity from the last calibration done or takes the theoretical value which depends on the ion valency (for example: -59.16 mV for a positive monovalent ion). \( C_0 \) is equal to 0.

If a 2-point calibration is performed, \( E^0 \) and \( S_{25} \) are calculated using the same equation as above but with \( C_0 = 0 \). It is recommended to perform a 2-point calibration in the linear response zone of the ISE electrode.

Refer to "Direct ISE measurement method - notes", page 90.
Direct ISE measurement method - notes

The accuracy of the measurements using a Direct ISE method depends on the following elements:

- The concentrations of the standards used for a 2-point calibration must lie on either side of the samples to be measured.
- For calibration using more than 2 standards, one of the standard concentration must lie in the non-linear response zone of the ISE electrode.
- If you want to measure low concentrations (values situated in the non-linear response zone), run a 2 or 3-point calibration in the non-linear response zone of the electrode.
- It is recommended to measure sample concentrations above the \(C_0\) limit.
- A high value found for \(C_0\) may undergo false measurements (check your standards and electrode).
- A similar ionic strength must be found in both standards and samples (add a supporting electrolyte in the standards and samples).
- The samples must not contain a significant amount of interfering ions.
- Use the same temperature for your standards and samples (thermostate the solutions).

How to edit a Direct ISE measurement method?

see "Direct ISE measurement method - programmation", page 90.

How to run a Direct ISE measurement method?

Refer to "Running a method", page 179.

What is a Direct ISE measurement method?

see "Direct ISE measurement method - definition", page 89.

Direct ISE measurement method - programmation

Proceed as follows to edit a Direct ISE measurement method:

1. From the Main window, press 4 then 2 Edit method.
2. For Mode, select Measurement.
3. For Measurement, select ISE Direct.
4. Define the other parameters of this measurement method.

What is a Direct ISE measurement method?

see "Direct ISE measurement method - definition", page 89.

How to run a Direct ISE measurement method?

Refer to "Running a method", page 179.

Direct measurements

Refer to "Display measurement", page 92.
Disconnect electrodes

Disconnect all connected electrodes.

Proceed as follows:
1. Press 2 in the Electrode window.
2. Press 2 Disconnect electrodes.
3. Disconnect electrode from rear panel.
4. Press ✓ to confirm.
5. Repeat steps 3 and 4 for all other electrodes to be disconnected.

Display contrast

Refer to "Contrast", page 78.
Press 5 in the Electrode window.

The signal measured of a connected electrode in the current system is displayed. If several electrodes are connected, select the electrode at the ID line.

Depending on the type of electrode connected, the display shows:

- pH and corresponding potential difference in mV (pH electrodes)
- potential difference in mV (metal/redox or non-calibrated ISE electrodes)
- concentration in the electrode calibration unit (calibrated ISE electrodes)
- temperature in °C (temperature sensors)
- conductivity measured in mS/cm at sample temperature (conductivity cells). If the conductivity is not calibrated, the instrument displays a conductivity with a cell constant value equal to 1 cm$^{-1}$. The sample temperature is measured or is equal to 25 °C. There is no temperature correction performed.

To get accurate measurements, it is therefore recommended to calibrate the conductivity cell at a given temperature and thermostat the sample to that temperature before running the measurement.

Press 1 to apply or stop stirring.

Press Esc to stop measurements.
**Dyn. rinse**

You have the choice between rinsing dynamically the electrodes:

- **N-1/st in Park**: in previous (just analysed) beaker except 1st and calibration beakers in park,
- **N-1/st in Rinse 2**: in previous (just analysed) beaker except 1st and calibration beakers in R2 (static rinse beaker no.2),
- **In Park**: in park (all dynamic rinses performed in the park beaker).

For the first dynamic rinse of sample changer cycle run, we have the choice between rinsing dynamically the electrodes in the Park beaker or in the R2 beaker (static rinse beaker no.2). If R2 is selected, it means that only 1 beaker remains available for static rinses (static rinse beaker no.1 (R1)).

Refer to "Number of static rinses", page 148.

At the end of a dynamic rinse, the electrodes are left above a nearly emptied rinse beaker. The beaker contains a little solvent which has been used to rinse the end of the electrodes and the addition tips.

Refer to "Dynamic rinses", page 94.

Dynamic rinses can not occur in calibration beakers. When an electrode or a reagent calibration beaker is found in the sequence, the dynamic rinse which follows the measurement will occur in the Park or Rinse 2 beaker depending on the option selected for Dyn. rinse.


Enter in:
Setup menu > Configuration

Range available:
N-1/1st in Park, N-1/1st in Rinse 2 or In Park.
If Sample changer = SAC850 or SAC950
**Dynamic rinses**

Dynamic rinses are performed by a SAC850 or SAC950 Sample Changers if the Dynamic rinsing module is installed on the sample changer.

A Dynamic rinse performed in a Park or Rinse beaker consists of the following operations:

1. The electrode are positioned above the Park or Rinse beaker.
2. The electrodes are dipped into the beaker. The beaker is emptied to a waste in the same time. At the end, the electrodes are located in the emptied beaker at their downmost position.
3. The electrodes are washed with rinse solution (usually demineralised water) then start to move up under rinsing. At the end, the electrodes are located above a beaker filled with rinse solution and some remaining impurities.
4. Steps 2 and 3 can be repeated up to 8 times as up to 9 dynamic rinses can be programmed. Steps 2 and 3 are performed under stirring.

A Dynamic rinse performed in a Sample beaker consists of the following operations:

1. The electrodes are dipped into the Sample beaker. The beaker is emptied to a waste in the same time. At the end, the electrodes are located in the emptied beaker at their downmost position.
2. The electrodes move up and are washed in the same time with rinse solution (usually demineralised water). At the end, the electrodes are located above a beaker filled with rinse solution and some remaining impurities.
3. The sample beaker is emptied to a waste.
4. A last rinsing of the electrodes and delivery tips is carried out. At the end, the electrodes are located above a nearly emptied beaker containing a little solvent that was used to flush the electrodes and delivery tips.
5. Steps 1 to 3 can be repeated up to 8 times as up to 9 dynamic rinses can be programmed. Steps 1 to 3 are performed under stirring.

**E0 standard potential**

Refer to "Direct ISE measurement method - definition", page 89.
EC socket

6-pin DIN socket for connection of the conductivity cell with 2, 3 or 4 poles and a temperature sensor.

**Pin layout:**
- Pin 1: pole no.1
- Pin 2: pole no.2
- Pin 3: pole no.3
- Pin 4: pole no.4, also connected to pin no. 5
- Pin 5: 0 V (ground)
- Pin 6: temperature sensor

Potential imposed between poles 2 and 3: ±200 mV constant for all conductance ranges.

The current passing through poles 1 and 4 is measured. The potential between poles 1 and 4 cannot exceed 3 V in absolute value.

The following Radiometer Analytical conductivity cells can be connected to the EC socket:

<table>
<thead>
<tr>
<th>Conductivity cell</th>
<th>Number of poles</th>
<th>Built-in temperature sensor</th>
<th>Connection to ION570</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDC566T (*)</td>
<td>4</td>
<td>Yes</td>
<td>Direct connection</td>
</tr>
<tr>
<td>CDC866T (*)</td>
<td>4</td>
<td>Yes</td>
<td>Direct connection</td>
</tr>
<tr>
<td>CDC641T (*)</td>
<td>2</td>
<td>Yes</td>
<td>Direct connection</td>
</tr>
<tr>
<td>CDC511T</td>
<td>4</td>
<td>Yes</td>
<td>Direct connection</td>
</tr>
<tr>
<td>CDC741T (*)</td>
<td>2</td>
<td>Yes</td>
<td>Direct connection</td>
</tr>
<tr>
<td>CDC861T</td>
<td>4</td>
<td>Yes</td>
<td>Direct connection</td>
</tr>
<tr>
<td>CDC565</td>
<td>4</td>
<td>No</td>
<td>Direct connection</td>
</tr>
<tr>
<td>CDC749</td>
<td>2</td>
<td>No</td>
<td>Direct connection</td>
</tr>
<tr>
<td>CDC745-9 (*)</td>
<td>2</td>
<td>No</td>
<td>Via A94L136 cable</td>
</tr>
<tr>
<td>CDC267-9</td>
<td>2</td>
<td>No</td>
<td>Via A94L136 cable</td>
</tr>
<tr>
<td>CDC241-9</td>
<td>2</td>
<td>No</td>
<td>Via A94L136 cable</td>
</tr>
<tr>
<td>XE100</td>
<td>2</td>
<td>No</td>
<td>Via A94L136 cable</td>
</tr>
</tbody>
</table>

*Figure 11: Radiometer Analytical conductivity cells*

(*) This conductivity cell is present in the ION570 electrode library (Catalogue list)

**Conductivity cell with 2, 3 or 4 poles?**
see the “Conductivity theory and practice“ guide, part no. D61M002.
EC/pH measurement method - definition

Using this method, conductivity and pH are measured simultaneously in a same sample. This method uses a conductivity cell and a pH combined electrode (or a separate pH and reference electrode).

Method parameters are those of a conductivity and a pH measurement. Some parameters are common to the 2 types of measurements such as the Acceptation time and the Maximum stabilisation time. When both pH and the conductivity measurements are stable, the ION570 displays the 2 results as R1 and R2.

Refer to "EC/pH measurement method - programmation", page 97.
Proceed as follows to edit an EC/pH measurement method:

1. From the Main window, press 4 then 2 Edit method.

For Mode, select Measurement. For Measurement, select EC/pH.

2. Press the Right arrow key, press 1.

Select a pH electrode and enter a pH measurement stability criterion.
Select a Conductivity cell and enter a conductivity measurement stability criterion.
Some parameters are common to both pH and Conductivity measurements (Acceptation, Max. Stab time, Auxiliary output, Stirring).
Temp. correction, Temp. coef. and Reference Temp. parameters deal with conductivity measurements.

3. Press the Esc key, press 3 and edit the Results parameters.

4. Press the Esc key, press 4 and edit the Printouts parameters.

What is an EC/pH measurement method?
Refer to "EC/pH measurement method - definition", page 96.
**Edit electrode menu**

In this menu, you can rename the electrode (line ID), revise electrode data, decide if you want to calibrate the electrode (line Calibration request) and enter the electrode calibration data if relevant.

**To access:**

1. Press **4** in the Electrode window.
2. Press **2** Edit electrode.

<table>
<thead>
<tr>
<th>Edit electrode</th>
<th>PHC2401-a</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID:</td>
<td>PHC2401-a</td>
</tr>
<tr>
<td>Type:</td>
<td>Combined pH</td>
</tr>
<tr>
<td>Potential vs. SHE:</td>
<td>200.0 mV</td>
</tr>
<tr>
<td>pH int:</td>
<td>6.65 pH</td>
</tr>
<tr>
<td>Address:</td>
<td>ION / EI</td>
</tr>
<tr>
<td>Maintenance:</td>
<td>No</td>
</tr>
<tr>
<td>Calibration request:</td>
<td>Fixed</td>
</tr>
</tbody>
</table>

If an electrode calibration is requested, the following menus are accessible using the arrow keys:

- Calibration parameters.  
  *Refer to "Electrode calibration parameters", page 108.*

- Calibration solutions.  
  *Refer to "Solution menu", page 195.*

- Results.  
  *Refer to "Results menu", page 173.*

- Printouts.  
  *Refer to "Printouts menu", page 157.*
**Edit method menu**

In this menu, you can rename the method (line ID), revise and enter method data.

**To access:**

1. Press 4 in the Main window.
2. Press 2 Edit electrode.

The following menus are accessible using the arrow keys:

- Method parameters.  
  *Refer to "Method parameters menu", page 139.*

- Sample.  
  *Refer to "Sample menu", page 186.*

- Results.  
  *Refer to "Results menu", page 173.*

- Printouts.  
  *Refer to "Printouts menu", page 157.*

- QC Data  
  *Refer to "QC data menu", page 160.*
**Edit reagent menu**

In this menu, you can rename the reagent (line ID) and revise reagent data.

**To access:**

1. Press 4 in the Reagents window.
2. Press 2 Edit reagent.

<table>
<thead>
<tr>
<th>Edit reagent</th>
<th>NaF 0.001N</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>NaF 0.001N</td>
</tr>
<tr>
<td>Unit</td>
<td>N</td>
</tr>
<tr>
<td>Address</td>
<td>ION / 1</td>
</tr>
</tbody>
</table>

Quit: Esc      Change: ✓
**Edit sequence menu**

Use this menu to program a sequence (add, insert, remove a method from a sequence or delete the sequence). You can also specify the number of times a method must be repeated within the sequence (parameter *Number of samples*).

At the line Beakers: [F;L], the instrument displays the positions F and L occupied by the first and last beakers in the sequence.

In the title bar, “x/y” (1/1) indicates the position "x" occupied by the method in the sequence and "y" the total number of methods listed in the sequence.

The ID and type of the selected method cannot be modified at this level. They are defined in the *Add method* or *Insert method* menu.

**To access:**

1. Select Sequence or SAC Sequence for *Working mode* in the Main window,
2. Press 2 Sequence/Sample stack,
3. Enter a name for the sequence,
4. Press 3 Edit sequence.
1. Select the method which uses the conductivity cell to be calibrated.

2. Connect the electrode system, see "Electrode connection", page 110.

3. Press 1 Calibrate electrodes in the Electrode window.

4. Select the conductivity cell from the list.

5. Press 1 to Run, and follow the messages on the display. Measurements start in beaker no.1.

6. After stabilisation or at the end of the maximum stabilisation time, the ION570 calculates the standard conductivity at the measured or entered temperature. Then, the instrument calculates and displays the cell constant.

7. Accept or reject the result then start a new calibration cycle (new beaker of the same standard) or end the calibration. Refer to "Result accepted (Yes/No)", page 170.

8. The cell constant (mean of all cycle results accepted) is saved with the electrode. To consult the calibration results, see "GLP-Archives menu", page 122.

If you are not using a temperature probe and want to get accurate measurements, it is recommended to thermostat your standard beakers at the temperature you have entered (or at 25°C).

Pay attention to the temperature range of the standard used: see "Standard (conductivity standard)", page 197.

The ION570 displays the conductance measured. The displayed temperature is the temperature measured, entered or is equal to 25°C according to the calibration method programmed.
Electrode calibration (Free mode, conductivity cell)

1. Select the method which uses the conductivity cell to be calibrated.
2. Connect the electrode system, see "Electrode connection", page 110.
3. Press 1 Calibrate electrodes in the Electrode window.
4. Select the conductivity cell from the list.
5. Press 1 to Run, and follow the messages on the display.
   Measurements start in the user standard.

The ION570 displays the conductance measured. The displayed temperature is the temperature measured, entered or is equal to 25°C according to the calibration method programmed.

Note:
An ID can be assigned to the standard. In this case, the standard ID entered replaces the name "User standard".

If you are not using a temperature probe and want to get accurate measurements, it is recommended to thermostat your standard beakers at the temperature you have entered (or at 25°C).

6. After stabilisation in the user standard.

7. The ION570 calculates and displays the cell constant.
   Accept or reject the result then start a new calibration cycle (new beaker of the same standard) or end the calibration.
   Refer to "Result accepted (Yes/No)", page 170.

8. The cell constant (mean of all cycle results accepted) is saved with the electrode.
   To consult the calibration results, see "GLP-Archives menu", page 122.
Electrode calibration (ISE)

Preparation of the calibration standards:
see "Calibration = Automatic", page 62,
see "Calibration = Manual", page 63.

1. Select the method which uses the electrode to be calibrated.
2. Connect the electrode system, see "Electrode connection", page 110.
3. Press 1 Calibrate electrodes in the Electrode window.
4. Select the electrode from the list.
5. Press 1 to Run, and follow the messages on the display.

For a 3 to 9-point calibration, the $E^0$ standard potential, $S_{25}$ sensitivity at 25°C and $C_0$ detection limit concentration are calculated at the end of the calibration.

For a 2-point calibration, $E^0$ and $S_{25}$ are calculated. $C_0 = 0$.

For a 1-point calibration, only $E^0$ is calculated, $S_{25}$ comes from the last multi-point calibration performed or is equal to the default value (59.16 mV/pC for a monovalent ion). $C_0 = 0$.

At the end of a calibration cycle, you can display the $E (mV) = f (pC = -\log C)$ calibration curve. The calibration points are marked (here 3). To display the curve of a calibration cycle, press 2 More details then 4 Curve from the result data display.

The calibration results are saved with the electrode.
To consult the calibration results, see "GLP-Archives menu", page 122.

It is recommended to maintain all your standards at the same temperature. Then the temperature entered at the start of a calibration cycle is valid for all your standards.
Electrode calibration (Fixed mode, pH electrode)

1. Select the method which uses the electrode to be calibrated.
2. Connect the electrode system, see "Electrode connection", page 110.
3. Press 1 Calibrate electrodes in the Electrode window.
4. Select the electrode from the list.
5. Press 1 to Run, and follow the messages on the display. Measurements start in buffer no.1.

```
PHC3081-a
Serial number: Beaker: 1
4.005 (IUPAC)
Batch no.: BN 001
S === 00:26 26.6 °C
180.3 mV
```

The ION570 displays the potential measured. The displayed temperature is the temperature measured, entered or is equal to 25°C according to the calibration method programmed.

6. After stabilisation of the measurement in buffer no.1:

```
PHC3081-a
Rinse electrodes
Then
Dip electrode in
Beaker 2
10.012 (IUPAC)
```

The ION570 has recognised buffer no.1. Enter the batch number for buffer no.2 and dip the electrodes in buffer no.2. Measurements start in buffer no.2 and so on. A pH calibration can be performed over 1 to 5 buffers.

The electrode zero pH and sensitivity are calculated at the end of a multi-point calibration. For a 1-point calibration, only the zero pH is calculated, the slope comes from the last calibration performed or is equal to the default value (59.16 mV/pH unit). The calibration results are saved with the electrode.

To consult the calibration results, see "GLP-Archives menu", page 122.

*It is recommended to maintain all your buffers at the same temperature. Then the temperature entered at the start of a calibration cycle is valid for all your buffers.*
1. Select the method which uses the electrode to be calibrated.
2. Connect the electrode system, see "Electrode connection", page 110.
3. Press 1 Calibrate electrodes in the Electrode window.
4. Select the electrode from the list.
5. Press 1 to Run, and follow the messages on the display. Measurements start in buffer no.1.

6. After stabilisation of the measurement in buffer no.1:

The ION570 displays the potential measured. The displayed temperature is the temperature measured, entered or is equal to 25°C according to the calibration method programmed.

Note: An ID can be assigned to the pH buffers. In this case, the buffer ID entered replaces the name "Buffer n".

Press ✓ and enter the pH value of your buffer at the temperature displayed. Press 1 to confirm.

The electrode zero pH and sensitivity are calculated at the end of a multi-point calibration. For a 1-point calibration, only the zero pH is calculated, the slope comes from the last calibration performed or is equal to the default value (59.16 mV/pH unit). The calibration results are saved with the electrode.

To consult the calibration results, see "GLP-Archives menu", page 122.

It is recommended to maintain all your buffers at the same temperature. Then the temperature entered at the start of a calibration cycle is valid for all your buffers.
Electrode calibration (SAC sequence)

In a calibration sequence, the standard solution beakers are handled automatically using a sample changer. A SAC80, SAC90, SAC850 or SAC950 Sample Changer must be connected and declared in the Configuration menu.

1. Select the SAC Sequence option in the Main window. This SAC Sequence must use the electrode to be calibrated.

2. If a Question mark "?" is present in the Electrode and/or Reagent tabs, it means that the sequence needs to be programmed - a reagent or an electrode is missing. Review programming in Supervisor mode. Refer to “Programming sequence”, page 159.

3. Install the sample changer and connect it to the SAC socket of the ION570 using the cable, part no. A95A202 or A95X501. Refer to the User’s Guide of the sample changer (part no.: D21T002 for a SAC90, D21T013 for a SAC80, D21T085 for a SAC850 or SAC950).

4. Connect the electrode system, see "Electrode connection", page 110.

5. Press 1 Calibrate electrodes in the Electrode window.

6. Select the electrode from the list of the electrode system.

7. Press 2 Calibration sequence.

8. Prepare the electrode calibration stack, see "Electrode calibration stack", page 109.

9. Press Esc then 1 to run the calibration sequence. Follow the messages on the display.

10. The sample changer cycle is initiated.
    - 1 to 9 dynamic rinses (if programmed with a SAC850/SAC950)
    - 1 to 3 static rinses (if programmed).
    - Electrodes are dipped into the first standard solution. Measurement starts.
    - Between each standards (beakers), 1 to 9 dynamic rinses (if programmed with a SAC850/SAC950) then 1 to 3 static rinses are performed (if programmed to do so).

11. At the end, the ION570 displays the calibration results. The calibration results are saved with the electrode.
    To consult the calibration results, see "GLP-Archives menu", page 122.

When running a calibration sequence with a SAC80 Sample Changer, do not use the STOP key of the SAC80.
**Electrode calibration not required**

Message appears at the start of a sequence, if a method sequence has been programmed with an electrode calibration. The electrode used has been programmed without calibration **Calibration request** = No.

Go to Sequence/Sample stack, **Edit sequence** menu and remove the electrode calibration method.

**Electrode calibration parameters**

This menu contains parameters concerning the electrode calibration method (measurement stabilisation criteria in particular).

**To access:**

1. From the Electrode window, press 4.
2. Select the electrode to be edited.
3. Press 2 Edit electrode and check that the **Calibration request** = **Fixed** or **Free** option (pH electrode) or **Calibration = Manual** or **Automatic** option (ISE electrode) has been selected.
4. Edit the electrode calibration general parameters.
5. Use the **LEFT/RIGHT** arrow keys to move to the last Edit electrode display.
6. Press 1 Calibration parameters.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>PHC3081-a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stability</td>
<td>15mVpH/min</td>
</tr>
<tr>
<td>Acceptance</td>
<td>01min30s</td>
</tr>
<tr>
<td>Max. stab. time</td>
<td>03min00s</td>
</tr>
<tr>
<td>Iso pH</td>
<td>6.65pH</td>
</tr>
</tbody>
</table>

Refer to "Calibration = Automatic", page 62.
Refer to "Calibration = Manual", page 63.
Refer to "Calibration request = Fixed", page 67.
Refer to "Calibration request = Free", page 68.
The electrode calibration stack defines individual data for each buffer solution beakers present in an electrode calibration sequence.

Prepare the electrode calibration stack as follows:

1. Declare a sample changer (SAC80, SAC90, SAC850 or SAC950) in the Setup > Configuration menu. Refer to "Configuration menu", page 77.

2. In the Main window, select SAC Sequence or SAC method for the working mode. This SAC sequence or SAC method must use the electrode you want to calibrate. Edit the sequence or the method if relevant, see "Programming sequence", page 159.

3. Enter the Electrode window.

4. Press 1 Calibrate electrodes and select the electrode to calibrate.

5. Press 2 Calibration sequence.

<1/15> means the first beaker over 15 programmed in the sequence. Use the LEFT/RIGHT arrows to review the other beakers in the sequence.

Run 1/5 means that this beaker deals with the first cycle over 5 programmed in the sequence.

Enter the batch number of each buffer solution.

Beakers are numbered in that order:
Cycle 1, Buffer 1 - Cycle 1, Buffer 2 ..... Cycle 1, Buffer n (n=1 to 5)
Cycle 2, Buffer 1 - Cycle 2, Buffer 2 .....Cycle 2, Buffer n
.......................................................
Cycle m (m=1 to 9), Buffer 1 - Cycle m, Buffer 2 .....Cycle m, Buffer n
n and m are entered in the Edit electrode menu. The buffer solutions are selected in the Solutions menu.

Label the beakers indicating the running number in the sequence, for example: 1/15, 2/15 etc.... and the name of the buffer solution.
Place the beakers in the numbered position on the sample changer.
If rinses are programmed, position the corresponding rinse beakers at the right places.
Refer to "Number of static rinses", page 148.
Refer to "Dynamic rinses", page 94.
You can print the calibration stack by pressing Print from the calibration menu.

6. Press Esc then run the sequence by pressing 1 Run calibration.
Electrode connection

Proceed as follows to connect/install electrodes and temperature sensors:

1. In the Electrode window, press 2 then 1 Connect electrode.

2. Enter serial number

3. Connect electrodes to the rear panel socket of the ION570 (ION) or ABU52 (ABU1 or ABU2), see "ABU1/ABU2", page 41. See figure and table below. For example: pHC2001 to address ION/E1. Refer to "Address", page 48.

4. Install electrodes on the ION570 (ION), ABU52 or sample changer holder.

5. Press 1 to confirm.

![Figure 12: Electrode sockets](image)

<table>
<thead>
<tr>
<th>Socket</th>
<th>Type of electrode</th>
</tr>
</thead>
<tbody>
<tr>
<td>REF</td>
<td>Single reference</td>
</tr>
<tr>
<td>TEMP</td>
<td>Temperature</td>
</tr>
<tr>
<td>GND</td>
<td>Ground metal for cell grounding only</td>
</tr>
<tr>
<td>Pt-Pt</td>
<td>Double metal</td>
</tr>
<tr>
<td>E1/E2</td>
<td>Indicating (pH, Metal/Redox, ISE) single or combined</td>
</tr>
<tr>
<td>EC</td>
<td>Conductivity cell w/o temperature sensor</td>
</tr>
</tbody>
</table>

Table 4: Connecting electrodes

If the current method in use requires an electrode different to the one already connected, the ION570 will prompt you to disconnect the electrode before connecting the new one, see "Disconnect electrodes", page 91.

Refer to "Electrode connection - Important", page 111.
Electrode connection - Important

In order to simplify user operations when performing several types of daily analyses, the instrument allows the connection of electrodes that do not belong to the electrode system, provided that the electrodes are compatible. In this way, the user will have a minimum of operations to perform. It involves that all connected electrodes must be immersed in the solution.

1st case

When you change from a method using a double platinum electrode or a conductivity cell to a method using a pH electrode for example, the instrument prompts you to check the double platinum electrode or the conductivity cell connection then asks you to connect the pH electrode. The instrument allows the presence of a double platinum electrode or a conductivity cell even though these electrodes are not used in the operating system. However, the instrument switches to differential measurement mode using the reference of the pH electrode disconnected from the ground. This is because it is the double platinum electrode or the conductivity cell that provides the connection to the instrument ground. It involves that the double platinum electrode or the conductivity cell must be immersed in the solution.

2nd case

You edit a method using the differential mode (Cell grounding = Metal) with, for example, a pH and a metal electrode. After several tests, you decide to change the method programmation and clear the differential mode (Cell grounding = Reference). In this case, the instrument does not prompt you to disconnect the metal electrode and thus, continues to use the differential measurement mode. It involves that the metal electrode must be immersed in the solution.

If you no longer want to use the differential mode due to your work schedule or the your installed electrodes, you just have to perform a complete electrode uninstallation procedure (select Install electrodes > Disconnect electrodes then Connect electrodes). By doing this, the electrodes in the system will only be installed.

Refer to "Disconnect electrodes", page 91.

Electrode function

Refer to "Function", page 120.
**Electrode icons**  
Select to access Electrode window.  
Indicates the state of the electrode system.

* Sunny icon:  
The calibration has been performed on all the electrodes present in the system and/or all the electrodes have been installed.

* Cloudy icon:  
The electrode calibration of one of the electrodes present in the system should be performed within 24 hours. 
*Note: when the Periodicity is set to 1 day, this icon will appear to indicate that a calibration must be performed within 12 hours.*

* Stormy icon:  
The calibration date has elapsed for one of the electrodes present in the system.  
If acceptance limits have been set for the calibration: at least one calibration result lies outside the programmed acceptance limits.  
At least one of the electrodes present in the system has not been installed.

* Question mark:  
The electrode system has not been programmed correctly. Enter Supervisor mode and Check the electrode parameters in the Method parameters menu. If a temperature sensor has been defined in the Electrode menu, use the same sensor in method.

*Press 1 in the Main window, the instrument will indicate the possible errors and prompt you to correct them.*

**Electrode ID**  
Name assigned to the electrode (max. 16 alphanumeric characters).

*Enter in:*  
Electrode window > Edit electrode
**Electrode library**

To access, press 4 in Electrode window.

The electrode library comprises the following menus and commands:

- **Electrode library**
  - **Commands/ actions**
    - New electrode
    - Default parameters
    - Delete electrode
  - **Programming data**
    - Edit electrode
      - Calibration parameters
      - Calibration solutions
      - Results
      - Printouts

*Figure 13: Electrode library overview*

**Electrode not calibrated**

The electrode has not been calibrated and there is no electrode data stored in the archives. Press ✓ and calibrate the electrode.

**Electrode system**

An electrode system comprises all the electrodes necessary to run a method or a sequence of methods.

A **method**, consists of an indicating electrode, a reference electrode and, if required a temperature sensor.

A **sequence**, can consist of several indicating electrodes.

*When a method/sequence is run, the instrument prompts you to connect or disconnect the electrodes that will be required to run this method/sequence.*
Electrode type

The electrode type is displayed with respect to the function selected (see "Function", page 120). The electrode type is defined when a new electrode is created.
Refer to "Create electrode", page 82.
The different electrode types are listed below:

<table>
<thead>
<tr>
<th>Type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single pH</td>
<td>pH</td>
</tr>
<tr>
<td>Combined pH (w/o temperature sensor)</td>
<td>pH</td>
</tr>
<tr>
<td>Single metal/redox</td>
<td>mV (i=0)</td>
</tr>
<tr>
<td>Combined metal/redox (w/o temperature sensor)</td>
<td>mV (i=0)</td>
</tr>
<tr>
<td>Single ISE (w/o temp. sensor)</td>
<td>ISE or mV (i=0)</td>
</tr>
<tr>
<td>Combined ISE (w/o temp. sensor)</td>
<td>ISE or mV (i=0)</td>
</tr>
<tr>
<td>Reference T°C</td>
<td>Reference</td>
</tr>
<tr>
<td>Temperature sensor</td>
<td>T°C</td>
</tr>
<tr>
<td>Ground metal</td>
<td>Ground</td>
</tr>
<tr>
<td>Double metal</td>
<td>mV (i &gt;0)</td>
</tr>
<tr>
<td>Conductivity: conductivity cell with 2, 3 or 4 poles (w/o temp. sensor)</td>
<td>Conductivity</td>
</tr>
</tbody>
</table>

Table 5: Electrode functions and types

If Combined pH is defined, the ION570 prompts you to specify if it has a built-in temperature sensor.

If a Single electrode is defined, the ION570 prompts you to define a reference electrode.
**Electrode window**

This window contains all the information and operations concerning the electrodes.

**To access:**

Use **LEFT/RIGHT** arrow keys.

<table>
<thead>
<tr>
<th>Electrodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calibrate electrodes</td>
</tr>
<tr>
<td>Install electrodes</td>
</tr>
<tr>
<td>Check electrodes</td>
</tr>
<tr>
<td>Electrode library</td>
</tr>
<tr>
<td>Display measurement</td>
</tr>
<tr>
<td>CLP-Archives</td>
</tr>
</tbody>
</table>

**Empty burette**

1. Enter the Burette functions menu.
2. Select the burette in the **Address** field, *see “Address”, page 48.*
3. Press **2 Empty**. The burette is emptied at maximum speed (approximate emptying time: 25 s).

**Empty sequence**

Involves removing the methods present in the sequence.

**Proceed as follows:**

1. Select the sequence to be emptied.
2. Press **3** twice.
3. Press **2**, then ✓ to confirm or press **Esc** to leave the screen without emptying the sequence.

*Refer to “Remove method from a sequence”, page 166.*
**Enter titre**

1. Select the method or sequence which uses the reagent you want to enter the titre.
2. If necessary, install the reagent.
3. Press 1 in the Reagent window.
4. Press ✓ and select the reagent from the list.
5. Press 1, enter user ID, press 1 to confirm.
6. Enter the titre value in the Titre line.
7. Enter the reagent calibration certificate number (up to 10 characters).
8. Press 1 to confirm.

**Range available:**
0 to $1 \times 10^{10}$

**ERR#32 (SAC error)**

Refer to "SAC switch Off/On (SAC error)", page 182.
Error - Error messages

See also "Check command", page 72.

ION570 errors:

* "Active electrode unknown in "method ID"": see page 43.
* "Archives data lost - Cal. Data lost - Methods kept": see page 50.
* "Calibration delay elapsed": see page 64.
* "Curves data lost - Cal. Data kept - Methods kept": see page 84.
* "Conc. 1 too high compared to reagent concentration": see page 73.
* "Conc. n too high compared to reagent concentration": see page 74.
* "Conc. not increasing in "method ID"": see page 74.
* "Electrode calibration not required": see page 108.
* "Electrode not calibrated": see page 113.
* "Expiry date elapsed": see page 118.
* "Ground conflict": see page 124.
* "Input address conflict": see page 125.
* "Insufficient number of beakers": see page 127.
* "Max. stab reached": see page 136.
* "Method wrong type": see page 140.
* "QC analysis required": see page 160.
* "QC not required": see page 160.
* "QC periodicity elapsed": see page 161.
* "Reagent titre not entered": see page 163.
* "Ref. electrode conflict": see page 166.
* "Reset memory": see page 169.
* "Same buffer change buffer": see page 183.
* "Sample dilution conflict": see page 186.
* "Sample unit conflict": see page 189.
* "Std conc. too low (or high)": see page 199.
* "Temp. limit exceeded": see page 205.
* "The sequence is empty": see page 206.
* "Wrong buffer": see page 211.

SAC errors:

* "Communication failure (SAC error)": see page 73.
* "ERR#32 (SAC error)": see page 116.
* "Missing beaker (SAC error)": see page 143.
* "No stirrer (SAC error)": see page 144.
* "SAC arm obstructed (SAC error)": see page 181.
* "SAC option missing (SAC error)": see page 182.
* "SAC switch Off/On (SAC error)": see page 182.
* "Tray missing (SAC error)": see page 207.
* "Turntable blocked (SAC error)": see page 208.
* "Wrong type (SAC error)": see page 211.

Expiry date

The expiry date of a reagent is to be entered when installing or replacing a reagent. The expiry date is given on the reagent bottle. The reagent cannot be used once this date is exceed. The ION570 prompts you to replace the reagent bottle.

Format used:

dd:mmm:yyyy

Use the UP and DOWN keys to select the month.
Expiry date elapsed
The reagent expiry date has elapsed. Replace the reagent.
The expiry date is entered while installing the reagent.

Fill burette
1. Enter the Burette functions menu:
2. Select the burette in the Address field, see "Address", page 48.
3. Press 1 Fill. The burette is filled at maximum speed using the installed reagent. Approximate filling time: 25 s.

Final dil. amount
Amount of sample after dilution, see "Aliquot", page 49.
Enter in:
Edit method > Sample

Range available:
0.001 to 10000 ml

Fixed (calibration mode)
Refer to "Electrode calibration (Fixed mode, conductivity cell)", page 102.
Refer to "Electrode calibration (Fixed mode, pH electrode)", page 105.
Flush burette

A flush rinses the burette, tubings and delivery tip thoroughly. It is recommended to flush the burette on a daily basis.

The ION570 carries out a flush after each installation or reagent replacement procedure.

To run a flush:
1. Enter the Burette functions menu.
2. Select the burette in the Address field.
3. Press 3 Flush.

The flush procedure runs as follows:
- Empty,
- Fill 4 ml (*) then empty (5 times).

(*) 1 ml for a 10 ml burette and 10 ml for a 50 ml burette.

The length of the “Flush” procedure depends on the volume of the burette.

You can also flush simultaneously all installed burettes, see “Global flush burettes”, page 121.

Format (printouts)

Format = Listing

The whole report is printed in one operation.

Format = Page by page

The printer waits until a preset number of lines have been collected then prints one page (this number is set by the Nb line per page parameter), see “Nb lines per page (printouts)”, page 144.

The printing format applies for automatic printouts (at the end of a test) or manual printouts (by pressing key Print).

Access:
Setup Menu > Configuration
Refer to “Printouts”, page 156.

Free (calibration mode)

Refer to “Electrode calibration (Free mode, conductivity cell)”, page 103.
Refer to “Electrode calibration (Free mode, pH electrode)”, page 106.
Function

Select the electrode function relative to the electrode in use.
The possible electrode functions are:

- pH,
- ISE,
- mV (i = 0),
- mV (i>0)
- °C,
- Reference,
- Ground,
- Conductivity.

Refer to "Electrode type", page 114.

Fuses

For continued protection replace the fuse with one of a high interrupting capacity, same type and rating:

2 x fuses, slow blow, 1.0 A (5 x 20 mm), part no. 450-020.

To replace the fuses:

1. Switch off the instrument
2. Disconnect line cord
3. Remove the fuse holder
4. Replace the used fuses with ones of the same type and rating
5. Put the cap back in place

Figure 14: Fuse replacement
Global flush burettes

A “Global flush” function is available to expell the air bubbles that may be trapped in the tubings. All installed burettes are flushed simultaneously.

Perform the following operations:

1. Display the Burette functions menu:

<table>
<thead>
<tr>
<th>Burette functions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address:</td>
</tr>
<tr>
<td>Fill</td>
</tr>
<tr>
<td>Empty</td>
</tr>
<tr>
<td>Global flush</td>
</tr>
<tr>
<td>Rinse</td>
</tr>
<tr>
<td>Install burette</td>
</tr>
</tbody>
</table>

   [Quit Esc] [Select: ]

2. Select all for Address.


The “Global flush” procedure runs as follows:

- Empty 4 ml or the full burette (if burette volume < 4 ml),
- Fill,
- Empty 10 ml or the full burette (if burette volume < 10 ml),
- Fill.
The GLP-Archives (Good Laboratory Practice) command is available in the Main, Reagent and Electrode windows provided that Yes has been entered for Archiving in the Setup > Configuration menu (see "Archiving", page 51):

To access:
- Sample results: enter Main window and press 5
- Reagent titre entries: enter Reagent window and press 6
- Electrode calibration results: enter Electrode window and press 6

Storage capacity:
- Last 200 sample results.
- Last 100 reagent titre entries.
- Last 100 electrode calibration results.

When the GLP-Archives is full and a new result arrives, the oldest result stored will be the first one removed.
GRAN = \( f(\text{Volume}) \) curve

Definition:
Refer to "GRAN representation:“, page 222.

Displaying the GRAN = \( f(\text{volume}) \) curve:
At the end of an ISE standard addition test, the instrument displays the concentration and the slope calculated at 25°C:

Printing the GRAN = \( f(\text{volume}) \) curve:
The curve is printed automatically at the end of each test if asked for in the Printouts menu of the ISE standard addition method, see "Printouts setup", page 157.

Example of printout:
Ground conflict

Ground conflict: External grounding defined in Setup/Configuration and a metal electrode or a conductivity cell.

An external grounding is defined for the measurement system cell in the Configuration screen and a Ground metal or Conductivity type electrode is used by the method.

When a metal electrode or a conductivity cell is used, select $\text{ION cell external Gnd} = \text{No}$ in the Configuration menu.

Help

Refer to "Check command", page 72.

High (result indicator)

Refer to "Result indicators", page 171.

Icons

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>☀️</td>
<td>Everything is OK. Run the method or sequence.</td>
</tr>
<tr>
<td>🌧️</td>
<td>Action required within 12 or 24 hours (for a calibration) and one week (for a reagent replacement).</td>
</tr>
<tr>
<td>⛈️</td>
<td>Electrode calibration date elapsed. An electrode or a reagent has not been installed.</td>
</tr>
<tr>
<td>🎨</td>
<td>Programming error.</td>
</tr>
<tr>
<td>🏤</td>
<td>Animated icon, indicates when a run method is in progress.</td>
</tr>
<tr>
<td>🔄</td>
<td>Animated icon, indicates when stirring is in progress.</td>
</tr>
</tbody>
</table>

Refer to "Electrode icons", page 112. Refer to "Reagent icons", page 162.
ID

Refer to "Electrode ID", page 112.
Refer to "QC ID", page 160.
Refer to "Reagent addition ID", page 161.
Refer to "Reagent ID", page 163.
Refer to "Sample ID", page 186.
Refer to "Standard addition ID", page 198.
Refer to "Temperature sensor ID", page 206.
Refer to "User ID (Yes/No)", page 208.

Initial volume

Volume of electrolyte support solution to be used for starting an ISE electrode calibration in Automatic mode. This volume can be added manually (select Addition = No) or automatically (select Addition = Yes and select the Reagent ID).

Enter in:
Edit electrode > Calibration parameters (for an ISE electrode)

Range available:
0.01 to 999 ml.

Input address conflict

Two electrodes have been defined at the same address.
Enter the Edit electrode menu and modify the address of one of the electrodes.
Insert method menu

Use this menu to set the ID and the type of method to be inserted before or between two methods in a sequence. This menu is the same as Add method, see "Add method menu", page 44.

To access:
Press 2 in the Edit sequence menu.
The sequence must contain at least one method.

Install burette

The burette must be installed before installing a reagent.

Proceed as follows:

- Press 7.
- Press 5.
- Enter burette volume and serial number.

Install the burette on the ION570 or the ABU52 at the address indicated, see "Address", page 48.

If required, use the burette functions to replace or remove the installed burette.
Install reagent

Proceed as follows:

1. Select the method or the sequence which uses the reagent.

2. Enter the Reagents window. Press 7 to check that the burette is installed. If not, install the burette by pressing 5, see “Install burette”, page 126.

3. Press 2 then 1.

4. The reagent's identification data is displayed.

5. Enter the batch number and expiry date.

   If a reagent used by the method is already installed at the address indicated. The instrument will automatically detect the reagent. All you have to do is to check the ID, batch no. and expiry date. If the ID is wrong, run the Replace reagent procedure. If the ID is correct and the batch number is wrong, run the Replace reagent bottle procedure.


7. Press 1 to rinse the burette before installing the reagent. Press 2, if no rinse required.

8. Install the new reagent bottle, press ✓. The instrument runs a Flush using the new reagent then fills the burette. The installation is complete.

Insufficient number of beakers

This message will appear when the number of beakers defined in the method sequence is greater than 126.
**ION cell external Gnd**

Specify in the Configuration menu if the grounding of the measuring cell takes place using an external connection to the measurement system.

This is the case when the solution is grounded via a metal shield or via a conductivity cell connected to a conductivity meter.

The following configurations will be therefore not possible:

- connecting a metal electrode to the **GND** socket of the measurement system,
- connecting a conductivity socket to the **EC** socket of the measurement system.
- connecting a double platinum electrode to the **Pt-Pt** socket of the measurement system.

If **ION cell external Gnd = Yes** and a reference electrode is connected to the **Ref.** socket of the measurement system, grounding will take place by an external link and not by the **Ref.** socket.

If **ION cell external Gnd = No**, grounding of the cell will be determined in the method by the measurement type (pH or mV) and the parameter **Cell grounding (Reference/Metallic/Other)**.

*Refer to "Cell grounding", page 70.*

**ISE calibration**

**results parameters**

*Refer to "Results menu", page 173.*

**ISE calibration solutions**

*Refer to "Solution menu", page 195.*

*Refer to "Calibration point menu", page 65.*
ISE Standard addition method - definition

Measurement method using an selective electrode (ISE) of the ion you want to determine the concentration.

In this method, a sample measurement is performed then followed by 1 to 9 additions of a standard of known volume and concentration. When working in the linear response zone of the ISE electrode, this standard addition measurement method allows to determine the sample concentration using the following equation (*):

\[
C_{\text{sm}} = \frac{Ca \times Va}{(C_{\text{sm}} \times Va) \times 10^{\frac{(E1 - E)}{S}} - V_{\text{sm}}}
\]

With:

- \(C_{\text{sm}}\) = sample concentration (unknown, to be calculated),
- \(V_{\text{sm}}\) = sample initial volume,
- \(Ca\) = standard concentration,
- \(Va\) = volume of standard added,
- \(E1\) = potential measured after the addition,
- \(E\) = potential measured before the first addition,
- \(S\) = ISE response slope at the sample temperature. This slope is recalculated after each addition. If only one addition is performed, the slope must be determined by calibrating the ISE electrode. Refer to "Electrode calibration (ISE)", page 104.

(*): This equation does not include the dilution factor due to the addition of a supporting electrolyte. Refer to "2. ISE measurements - ISE standard addition method", page 222 for a description of all calculations done.

In a standard addition method, the total volume of standard added must be small in comparison with the sample volume. The accuracy of the method depends on the following:

- No variation of the ionic strength (add a supporting electrolyte),
- No interfering ions present in the sample,
- No variation of the reference electrode junction potential,
- The number of additions performed. Higher this number is, higher the measurements accuracy will be.

With the ION570, the additions can be:

- programmed: the user enters the volume of one addition and the number of additions to be performed,
- automatic: the user enters the potential jump due to all additions and the number of additions to be performed. The ION570 determines automatically the volume to be added.

How to edit an ISE standard addition method?
see "ISE Standard addition method - programmation", page 130.

How to run an ISE standard addition method?
Refer to "Running a method", page 179.
**ISE Standard addition method - programmation**

Proceed as follows to edit an ISE standard addition method:

1. From the Main window, press 4 then 2 Edit method.
2. For **Mode**, select **Measurement**.
3. For **Measurement**, select **ISE Std Addition**.
4. Use the LEFT/RIGHT arrow keys to move to the last Edit method display.
5. Press 1 **Method parameters**.
6. Select the ISE electrode, the standard addition ID and the number of additions to be performed (from 1 to 9).
7. At the line **Std add volume**:  
   - select **Programmed** then enter the volume of one addition (in ml),  
   - or select **Automatic** then enter the potential jump due to all n additions (n = 1 to 9).  
   The ION570 calculates the volume to be poured for each addition.

   *To avoid modifying the ionic strength of the solution by dilution effect, it is recommended to add small amounts of standard. The addition cumulative volumes should not exceed 10% of the sample test quantity.*

   In an ISE Standard addition method with automatic determination of the volumes, if the cumulative volumes calculated is higher than 50 % of the sample test quantity, the analysis stops and the instrument calculates the results with the data available. A **Vstd>max** note is added to the result value to show that the cumulative volumes of the standard additions is higher than 50 % of the sample test quantity.

8. Define the other parameters of this measurement method.

What is an ISE Standard addition measurement method?  
*see "ISE Standard addition method - definition", page 129.*

How to run an ISE standard addition method?  
*Refer to "Running a method", page 179.*
**Iso pH**

pH at which the electrode potential is no longer temperature dependant. The Iso pH is an electrode characteristic supplied with every Radiometer Analytical electrode.

Values are normally between 6.3 and 7.3 pH

**Enter in:**
Edit Electrode > Calibration parameters menu

**Range available:**
0.00 to 14.00 pH
Keyboard connection

Connect an external mini-keyboard to the ION570 via the 6-pin mini DIN port situated on the right hand side of the instrument. Keyboard type: PCT or compatible with a 6-pin mini DIN connector. A Notebook Keyboard Mask, part no. X31T108 indicating the keyboard functions is available for use with the mini keyboards. Refer to "Keyboard connection - Important", page 133.

Keyboard functions

In combination with the ION570 (ION) the keys of the PC keyboard perform predefined functions. Refer to the table below.

<table>
<thead>
<tr>
<th>PC keyboard</th>
<th>ION570 keys</th>
<th>ION570 operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Print screen&gt;</td>
<td>Print</td>
<td>Printout data</td>
</tr>
<tr>
<td>&lt;Esc&gt;</td>
<td>Esc</td>
<td>Leave menus</td>
</tr>
<tr>
<td>&lt;Pause&gt;</td>
<td>Stop</td>
<td>Stop analysis</td>
</tr>
<tr>
<td>&lt;Del&gt;</td>
<td>Del</td>
<td>Deletion of a character. End a Delay after addition.</td>
</tr>
<tr>
<td>Enter</td>
<td>Check mark</td>
<td>Confirmation of an entry</td>
</tr>
<tr>
<td>&lt;Up arrow&gt;</td>
<td>Up arrow</td>
<td>Menu lines can be scrolled</td>
</tr>
<tr>
<td>&lt;Down arrow&gt;</td>
<td>Down arrow</td>
<td>Menu lines can be scrolled</td>
</tr>
<tr>
<td>&lt;Left arrow&gt;</td>
<td>Left arrow</td>
<td>Select a window</td>
</tr>
<tr>
<td>&lt;Right arrow&gt;</td>
<td>Right arrow</td>
<td>Select a window</td>
</tr>
<tr>
<td>Home</td>
<td>-</td>
<td>Go to Main screen</td>
</tr>
<tr>
<td>&lt;F1&gt;</td>
<td>-</td>
<td>Run analysis</td>
</tr>
<tr>
<td>&lt;F2&gt;</td>
<td>-</td>
<td>Enter titre of a reagent</td>
</tr>
<tr>
<td>&lt;F3&gt;</td>
<td>-</td>
<td>Calibrate electrode</td>
</tr>
<tr>
<td>&lt;F4&gt;</td>
<td>-</td>
<td>Select method or Edit sample stack</td>
</tr>
<tr>
<td>&lt;F5&gt;</td>
<td>-</td>
<td>Install reagent system</td>
</tr>
<tr>
<td>&lt;F6&gt;</td>
<td>-</td>
<td>Install electrode system</td>
</tr>
<tr>
<td>&lt;F7&gt;</td>
<td>-</td>
<td>Burette functions</td>
</tr>
<tr>
<td>&lt;F8&gt;</td>
<td>-</td>
<td>Direct measurement</td>
</tr>
<tr>
<td>&lt;F10&gt;</td>
<td>-</td>
<td>Select stirring speed-Cell menu</td>
</tr>
<tr>
<td>&lt;F11&gt;</td>
<td>-</td>
<td>GLP - Archives (Sample)</td>
</tr>
<tr>
<td>&lt;F12&gt;</td>
<td>Stop 3 s</td>
<td>Enter Setup menu</td>
</tr>
</tbody>
</table>

Figure 15: Keyboard functions
Keyboard connection - Important

To make sure that the ION570 complies with the requirements of the EMC Directive 89/336/EEC, the PC keyboard connected to the instrument’s PS2/DIN socket must be fitted with a ferrite. This ferrite is placed as close as possible to the PS2/DIN keyboard cable plug.

All the mini keyboards supplied by Radiometer Analytical are fitted with a ferrite. This ferrite must not be removed!

If you intend to use the ION570 with a keyboard that is not supplied by Radiometer Analytical, you must make sure that the ferrite is positioned next to the PS2/DIN keyboard cable plug.

Note: the absence of the ferrite on the PC keyboard cable will not in any way impede the correct operation of the ION570.

Language

Select from English, French, German, Danish, Spanish, Italian or Swedish.

Enter in:
Setup menu > Configuration

Linear (temperature correction)

Refer to “Temp. correction None/Linear/Nat. water”, page 204.

Low (result indicator)

Refer to “Result indicators”, page 171.
Main window

First window to appear when the instrument is switched on:

To navigate in the window use:

- **RIGHT** and **LEFT** arrow keys, to move between the Method, Reagent, Electrode and Cell windows
- **UP** and **DOWN** arrow keys allow you to select a line.
- Press ✓ to select an option (or use the corresponding numerical key).
- Press ESC to leave the menus without applying changes.

Mains frequency

Specify the mains supply frequency (50 or 60 Hz). This selection will optimise the signal/background noise ratio for your measurements.

**Enter in:**
Setup menu > Configuration
Maintenance

If you want a message to be displayed once a week upon starting a method, a sequence of methods or an electrode calibration with a particular electrode, select Maintenance = Yes and enter the message (3 lines of 32 characters maximum). This message can remind you to check or to clean an electrode.

With the electrode parameters entered above, the ION570 will display the following message when you run a method using this electrode:

Perform the required operation and click ✓. The instrument displays the Main window. If you restart the method, the message is not displayed. The instrument will display this message again if you repeat a method using this electrode 7 days at the earliest.

Enter in:
Edit electrode menu

Refer to "Calibration = Manual", page 63.
Manual dosing

A manual dosing consists in adding varying size of reagent volumes at varying addition speeds with or without measuring a signal. No measurements are stored.

1. Select a method, see "Select method", page 189. You can run a Manual dosing only if at least one reagent has been declared in the method currently selected. This is the case of an ISE standard addition method or a Coupled method comprising an Addition.

2. Install the burette, see "Install burette", page 126.

3. Install the reagent on the burette, see "Install reagent", page 127.

4. Connect the electrodes if measurements are to be performed, see "Electrode connection", page 110.


Max. stab reached

Unstable measurement. Stability has not been reached before the preset Max. Stab time.

Resume the test or end the analysis.
Max. stab time

If the stability criterion has not been fulfilled during the time entered for the Maximum stabilisation time an error message will appear. Check your electrode before repeating the measurement.

*In the case of an EC/pH measurement method, stability is reached when both pH and conductivity measurement stability criteria have been fulfilled.*

Enter in:
Edit method > Parameters menu
Edit electrode > Calibration parameters menu

Range available:
0 to 59:59 min:s

Measurement

Measurement type for the method.

Enter in:
Edit method menu.

Range available:
pH measurement (pH), zero-current potential measurement (mV), imposed current potential measurement (mV(i>0)).

For Measurement methods (Mode = Measurement : see "Mode", page 143), 4 other options are available: ISE Direct, ISE Std Add, Conductivity and EC/pH (pH and conductivity measurements are performed simultaneously in the same beaker).

*If you select mV(i>0), connect the double platinum electrode to the Pt-Pt socket on the rear panel. One of the electrode's poles is connected to the ground, so it is necessary to select ION ext. cell Gnd = No in the Setup window.*

*If you select Conductivity, connect the conductivity cell to the EC socket on the rear panel. One of the EC socket pin is connected to the ground, so it is necessary to select ION ext. cell Gnd = No in the Setup window.*
**Measurement method**

For this method, one result is obtained after satisfaction of a user-selectable stability criterion or at the end of a preset delay.

Several measurement types are available:

- pH,
- mV,
- mV \( (i>0) \)
- Direct ISE measurements, see "Direct ISE measurement method - definition", page 89,
- ISE Standard addition, see "ISE Standard addition method - definition", page 129,
- Conductivity, see "Conductivity measurement method", page 76,
- EC/pH see "EC/pH measurement method - definition", page 96.

**Method**

A method groups the parameters necessary to perform a sample analysis. The following groups of parameters exist:

- **Edit method parameters**
- **Sample parameters**
- **Result parameters**
- **Printout parameters**
- **QC parameters**

An electrode calibration method is defined and saved with the electrode. Call the method up using the electrode name.

The method modes available on a ION570 are:

- Measurement (pH, mV, mV\(<0\)), ISE Direct, ISE Std Add, Conductivity, EC/pH),
- Coupled,
- Addition.

*The electrode and reagent installed in the working system must also be defined as part of the method. Go to **Method parameters menu** and define the electrode and reagent used.*

Refer to "Programming method", page 158.
Method library

To access, press 4 in the Main window.

The method library comprises the following menus and commands:

- **Method library**
  - **Commands/actions**
    - New method
    - Default parameters
    - Delete methods
  - **Programming data**
    - Edit Method
      - Method parameters
        - Sample
        - Results
        - Printouts
        - QC data

*Figure 16: Method library overview*

**Method parameters menu**

This menu contains the general parameters concerning the electrode and reagent (when required) used by the method. The method parameters necessary to run the analysis are also programmed.

*Do not forget to select the electrode, temperature sensor and reagent created in this menu!*

**To access:**

1. Press 4 in the Main window.
2. Press 2 Edit method.
3. Use arrow keys to move to last display.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrode</td>
<td>PHC2401-10</td>
</tr>
<tr>
<td>Stability</td>
<td>50mV/min</td>
</tr>
<tr>
<td>Temp. sensor</td>
<td></td>
</tr>
<tr>
<td>ID:</td>
<td></td>
</tr>
<tr>
<td>Auxiliary output:</td>
<td>No</td>
</tr>
<tr>
<td>Acceptation:</td>
<td>10min00s</td>
</tr>
<tr>
<td>Max. stab. time:</td>
<td>03min00s</td>
</tr>
</tbody>
</table>

Change: 4
Method results menu

To access:
1. Press 4 in the Main window.
2. Press 2 Edit method.
3. Use arrow keys to move to last display.
4. Press 3 Results.

<table>
<thead>
<tr>
<th>Results</th>
<th>My method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptance criteria:</td>
<td>No</td>
</tr>
<tr>
<td>T°C minimum value:</td>
<td>0°C</td>
</tr>
<tr>
<td>T°C maximum value:</td>
<td>60°C</td>
</tr>
<tr>
<td>Number of decimals:</td>
<td>3</td>
</tr>
</tbody>
</table>

Method wrong type

This message appears at the start of a coupled method if it contains a Coupled method.

A Coupled method cannot be part of a Coupled method.

Min. cell cst - Max. cell cst

Acceptance range for the cell constant.

If the cell constant lies outside the defined range, the conductivity cell calibration must be repeated.

Enter in:
Edit electrode > Result menu (Conductivity type electrodes)

Range available:
Min. cell cst = 0.05 cm$^{-1}$ to Max. cell cst
Max. cell cst = Min. cell cst to 15.00 cm$^{-1}$
**Min. pH(25) - Max. pH(25)**

Acceptance range for the zero pH. If the zero pH lies outside the defined range, the pH calibration must be repeated.

**Enter in:**
Edit electrode > Result menu

**Range available:**
Min. pH(25) = -9.000 pH to Max. pH(25)
Max. pH(25) = Min. pH(25) to 23.000 pH

**Min. sensitivity - Max. sensitivity**

Acceptance range for the electrode sensitivity. If the sensitivity lies outside the defined range, the calibration must be repeated.

**Enter in:**
Edit electrode > Result menu

**Range available:**
Min. sensitivity = 80% to Max. sensitivity
Max. sensitivity = Min. sensitivity to 110%

**Min. Temp. - Max. Temp.**

Acceptance range for the temperature measured in the standard solution. If the temperature lies outside the defined range the calibration is stopped.

**Enter in:**
Edit electrode > Result menu

**Range available:**
Max. Temp = Min. Temp. to +99°C
If the acceptance criteria option has been set to Yes, enter the acceptance range for the result. If the result lies outside these limits, a "High" or "Low" warning message appears and the result is rejected by the instrument.

Enter in:
Edit method > Results menu (Acceptance criteria = Yes)
Edit method > QC data menu

Range available:
Minimum value = 0.0 to Maximum value
Maximum value = Minimum value to $10^{10}$

Unit:
Sample method: Result unit

*In a Direct or Standard addition ISE measurement method, the instrument rejects all results that is higher than $10^{30}$ ("High" is displayed) even if you do not enter acceptance limits for the result.*

*In the same way, in a Direct ISE measurement method, the instrument rejects all results that is lower than the $C_0$ concentration ("Low" is displayed).*

Select Acceptance criteria = No in the Results menu of the method if you do not want to enter acceptance limits for the result, see "Acceptance criteria", page 42.
**Missing beaker (SAC error)**

Beaker not detected. Solve the problem and restart the sequence from the beaker it stopped (key 1 Resume analysis).

**Warning!**

Do not change the turntable before restarting the sequence from the beaker it stopped (key 1) or before restarting the sequence from the next beaker (key 2). The sample changer identifies a turntable only when a new sequence is initialized (equivalent to a keystroke on End of sequence followed by Run sequence).

**Causes:**

1. There is no beaker at the dedicated position and/or there is not enough liquid in the beaker and the beaker cannot be detected. Refer to “Beaker detection minimum height”, page 57. Add solution in the beaker or desactivate the beaker automatic detection by clearing the option "Beaker detection" in TitraMaster 85 (refer to TitraMaster 85 on-line help, topics "Editing an application - Configuration").

2. Using a level, check that the sample changer is installed on a flat and horizontal bench surface.

3. If points 1 and 2 have failed, adjust the beaker detector position (refer to the User's Guide of the sample changer, chapter 6 "Maintenance").

**Mode**

This is the type of method used.

**Enter in:**
Edit method menu

**Range available:**
Measurement, Coupled or Addition.

**Molar weight**

This parameter is available when you create an ISE electrode with the From = Other option. Refer to "Create electrode", page 82.

**Range available:**
0.001 to 1000 g/mol.

**Nat. water (temperature correction)**

Refer to "Temp. correction None/Linear/Nat. water", page 204.
**Nb lines per page (printouts)**

When printing page by page (see "Format (printouts)", page 119), this parameter sets the maximum number of lines for one printed page.

**Access:**
Setup Menu > Configuration

**Range available:**
26 to 255

---

**None (temperature correction)**

Refer to "Temp. correction None/Linear/Nat. water", page 204.

---

**No stirrer (SAC error)**

SAC950 Sample changer error: there is no magnetic stirring possible for the beaker position mentioned.

When using a 2 or 3-radii turntable with a SAC950, you must use a propeller stirrer to stir the solutions that are placed on the smallest row (2-radii turntable) or on the 2 smallest rows (3-radii turntable).

Green positions : magnetic and propeller stirring possible
Red positions : propeller stirring only


You can also edit a sample stack in order to use a 1-radius turntable or to use only the largest row of a multi-radii turntable. In this case, the magnetic stirring is possible. Refer to "Sample stack", page 188.
Notification message

Select Notification = Yes if you want to a message to be displayed on starting a measurement method. Type the message (3 lines of 1 to 32 alphanumerical characters).

Enter in:
Edit method menu

Number of additions

Set the number of additions to be performed automatically by an Addition method or an ISE standard addition method.
Refer to "Addition method - definition", page 46.
Refer to "ISE Standard addition method - definition", page 129.

Enter in:
Edit method menu (Addition method)
Edit method > Parameters (ISE standard addition method)

Range available:
1 to 3 (Addition method)
1 to 9 (ISE standard addition method)

Number of buffers

Available if Calibration request = Fixed or Free

Number of pH standards to be used for the calibration. Work with at least two standards to calculate the electrode sensitivity. If one standard is used only the zero pH is calculated.

Enter in:
Edit electrode menu

Range available:
1 to 5
Refer to "pH buffer", page 150.
**Number of cycles**

Available if Calibration request = Fixed or Free (pH electrode or conductivity cell). Available if Calibration = Manual or Automatic (ISE electrode).

Number of times the calibration is to be repeated, i.e. the number of beakers to be prepared for each pH, conductivity or ISE standard.

**Enter in:**
Edit electrode menu

**Range available:**
1 to 9

---

**Number of decimals**

Number of decimals (0 to 3) to be displayed and printed for the result.

**Enter in:**
Edit method > Results (for a pH measurement method)

---

**Number of digits**

Number of significant digits (1 to 5) to be displayed and printed for the result calculated.

**Example:** If Number of digits = 4:
- 1456.1 is displayed “1456”
- 12.124 is displayed “12.12”
- 0.15872 is displayed “0.1587” (the first significant digit is “1”)
- 0.4 is displayed “0.4000” (the first significant digit is “4”)

**Enter in:**
Edit method > Results (for ISE measurement methods)

---

**Number of dynamic rinses**

If a SAC850 or SAC950 Sample Changer is in use, enter the desired number of dynamic rinses to be carried out before each beaker analysis of a SAC sequence, *see also "Dynamic rinses", page 94.*

**Enter in:**
Setup menu > Configuration

**Range available:**
0 to 9
**Number of solutions**

Available for an ISE electrode if Calibration = Manual. If Calibration = Automatic, this parameter is replaced by Number of points.

Number of ISE standards to be used for the ISE electrode calibration. Work with at least 3 standards to calculate the electrode C₀ concentration which represents the experimental detection limit of the ISE electrode regarding the ion under study. Work with at least two standards to calculate the electrode sensitivity. If only one standard is used, only the E₀ electrode standard potential will be calculated. Refer to "Direct ISE measurement method - definition", page 89.

Enter in:
Edit electrode menu (ISE electrodes)

Range available:
1 to 9.
Number of static rinses

If a Sample Changer is in use, enter the desired number of static rinses to be carried out before each sample run of a SAC sequence.

During a static rinse, the electrodes are dipped for a time (selectable between 0 and 30:59 min:s, see "Rinse time", page 174) into a beaker filled up with a rinse or conditioning solution.

These rinse beakers are located:

- on the 1, 2 or 3 last positions of the SAC80 turntable,
- on the RINSE 1, RINSE 2 or RINSE 3 dedicated rinse positions of a SAC90 tray,
- on the last 1 or 2 available positions of the SAC850 tray,
- on the 1 or 2 dedicated rinse positions of the SAC950 reconditioning beakers extension.

Enter in:
Setup menu > Configuration

Range available:

- 0, 1, 2 for a SAC850 or SAC950.
- 0, 1, 2 or 3 for a SAC80/SAC90

Refer to User’s Guide of the sample changer used (part no.: D21T002 for a SAC90, D21T013 for a SAC80, D21T085 for a SAC850 or SAC950).

Number of tests

This is the number of times you wish to repeat the method on the same sample. The method will be repeated in a new beaker. If the method is part of a coupled method the number entered here will not be taken into account. It will be the number of tests entered in the Coupled method parameters that will be used.

Enter in:
Edit method menu.

Range available:

1 to 99.

OK (result indicator)

Refer to "Result indicators", page 171.
Others list
Choice enabling you to enter electrodes and reagents other than those from Radiometer Analytical.

Parameters menu
For a sample method, see "Method parameters menu", page 139.
For an electrode calibration method, see "Electrode calibration parameters", page 108.

PC cable - A95X501

PC connection
Connect the PC serial port to the PC/Printer socket of the ION570 using the cable, part no. A95X501.
Refer to "PC cable - A95X501", page 149.

PC keyboard
Specify the PC keyboard in use. For example, English (US) for a Qwerty keyboard.

Enter in:
Setup menu > Configuration

Range available:
English (US), French, German, Spanish, Italian, Danish, Swedish.
**Periodicity**

*Available if Calibration request = Fixed or Free (pH electrode or conductivity cell). Available if Calibration = Manual or Automatic (ISE electrode)*

Maximum period of time between two calibrations. If the period of time is exceeded, measurements can no longer be performed using this electrode. A new calibration is required except if *Alarm : Unlocked* has been set in the Setup > Access Routine mode menu.

**Enter in:**
Edit electrode menu

**Range available:**
1 to 999 days

**Periodicity for QC samples**

This is the number of samples to be placed between two successive QC samples. When this number is reached, a QC analysis must be run using this method except if *Alarm : Unlocked* has been set in the Setup > Access Routine mode menu.

**Enter in:**
QC data menu

**Range available:**
1 to 999 samples

**pH0(25)**

This is the pH of the solution at 25°C at which the measured electrode potential is equal to zero. The potential developed depends on both electrodes; the reference and the glass. These potentials may vary to bring about an electrode drift. This drift can be compensated by frequent calibrations.

Normally the following ranges are used by default (6.850 pH and 7.200 pH)

**Enter in:**
Edit electrode > Results

**Range available:**

pH(0)25 min. = -9.000 pH to pH0(25) max.
pH0(25) max. = pH0(25) min. to 23.000 pH

**pH buffer**

*Refer to "Solution menu", page 195.*
**pH int**

This parameter is available when creating a single or a combined pH electrode with the option *From* = *Other*. 
*Refer to "Create electrode", page 82.*

This is the internal pH of a single or combined pH electrode. The pH int is used for the buffer recognition. The table below gives the pH int of Radiometer Analytical pH electrodes:

<table>
<thead>
<tr>
<th>Electrode</th>
<th>pH int</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHG301, PHG311, XG100, XG200, XG250</td>
<td>6.06 pH</td>
</tr>
<tr>
<td>PHG201, PHG311</td>
<td>6.65 pH</td>
</tr>
<tr>
<td>PHC2001, PHC2011, PHC2085, PHC2401,</td>
<td>6.65 pH</td>
</tr>
<tr>
<td>PHC2501, PHC2601, PHC3001, PHC3011,</td>
<td></td>
</tr>
<tr>
<td>PHC3081, PHC3185, XC100, XC111, XC120,</td>
<td></td>
</tr>
<tr>
<td>XC161</td>
<td></td>
</tr>
<tr>
<td>PHC4000</td>
<td>6.80 pH</td>
</tr>
</tbody>
</table>

*Table 6: pH int of Radiometer Analytical electrodes*

**Range available:**

0.00 to 14.00 pH

**Potential jump**

In an ISE standard addition method with automatic determination of the standard volumes added, the user enters the absolute value of the potential jump due to all n additions (n = 1 to 9). The ION570 determines automatically the potential jump due to one addition then calculates the volume to be poured for each addition.

**Select in:**

Edit method > Parameters

(ISE standard addition method with *Std add volume* = *Automatic*)

**Available limits:**

5.0 to 100.0 mV by steps of 0.1 mV

*Refer to "ISE Standard addition method - definition", page 129.*

*Refer to "ISE Standard addition method - programmation", page 130.*
Potential versus SHE

This parameter is available when creating a reference or a combined electrode with the option \texttt{From} = \texttt{Other}.

Refer to “Create electrode”, page 82.

This parameter enables you to calibrate electrodes with automatic buffer checking using any kind of reference electrodes (for example with a mercurous sulphate electrode Hg/Hg2SO4 (Sat. K2SO4)). You just need to know the potential of the reference electrode versus the Standard Hydrogen Electrode.

This potential is taken into account in the buffer recognition algorithm and for pH calculation when no calibration is performed. When you create a reference or a combined electrode with the option \texttt{From} = \texttt{Catalogue}, the instrument calculates pH using the potential versus SHE stored in memory for the reference electrode selected. In this case, potential versus SHE cannot be changed.

The table below gives the potential at 25°C versus the SHE (E SHE) of a few "reference elements/filling solution" couples.

<table>
<thead>
<tr>
<th>Reference element and filling solution</th>
<th>E SHE (mV)</th>
<th>Radiometer Analytical Reference electrodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hg/Hg2Cl2 – Sat. KCl SCE: Saturated Calomel Electrode</td>
<td>+244</td>
<td>pHC4000, pHC4001, pHC4006, XC601, REF401, REF421, REF451, XR100, XR110, XR130, XR150, MC408PtREF401, REF421, PHC4000</td>
</tr>
<tr>
<td>Hg/Hg2Cl2 – 1M LiCl</td>
<td>+280</td>
<td>REF921</td>
</tr>
<tr>
<td>Hg/Hg2SO4 - Saturated K2SO4</td>
<td>+651</td>
<td>REF601, REF621, XR200, XR230, MC602Pt, MC6091Ag</td>
</tr>
<tr>
<td>Hg/Hg2SO4 - 1 M H2SO4</td>
<td>+616</td>
<td></td>
</tr>
<tr>
<td>Hg/HgO - 0.1 M KOH</td>
<td>+174</td>
<td>XR400, XR430, XR440</td>
</tr>
<tr>
<td>Ag/AgCl - Saturated KCl</td>
<td>+199</td>
<td>XR300, XR820, XC100, XC111, XC120, XC161, XC200, XC250</td>
</tr>
<tr>
<td>Ag/AgCl - 3 M KCl</td>
<td>+208</td>
<td>pHC3001, pHC3005, pHC3006, pHC3011, pHC3081, pHC3185, REF321, REF361, MC3051Pt, ISEC301F</td>
</tr>
<tr>
<td>Ag/AgCl - 1 M KCl</td>
<td>+235</td>
<td></td>
</tr>
<tr>
<td>Ag/AgCl - 0.6 M KCl (sea water)</td>
<td>+250</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Reference electrode potentials versus SHE

Range available:

0.0 mV to +1000.0 mV
Preprogrammed list

Ready-to use list of methods, electrodes and reagents which have been programmed in the ION570 during manufacturing. This list cannot be deleted nor modified.
These lists can be used to create methods, electrodes or reagents using the copy command, and store them in the user list.

Printer

Declare a printer:
Refer to "Printouts setup", page 157.

Connect a printer:
Refer to "Printer connection", page 155.

Printouts parameters:
Refer to "Printouts menu", page 157.
Refer to "Printouts title", page 158.
Refer to "Printouts detailed", page 156.

Contents of a printout:
Refer to "Printouts", page 156.
Printer cables -
A95P201, A95X506

Figure 18: Printer cable, A95P201

Figure 19: Printer cable, A95X506
**Printer connection**

Connect the printer to the **PC/Printer** socket on the rear panel using the cable, 9-25 pin, part no. A95P201.

The printer must have the following characteristics for connection to the ION570.

- 80 characters,
- RS232C interface,
- 9600 baud, no parity, 8 data bits, 1 stop bit,
- Flux control via the DTR line (pin 20 on the 25-pin plug),
- Printout of tables,
- IBM fonts; character sets.

*To connect the Kyoline MTP640 Thermal Pocket Printer, part no. A70P020 (230 V), A70P021 (115 V), use the cable 5-9 pin, part no. A95X506.*

*For use with an ION570, the dip-switch of the Kyoline MTP640 Thermal Pocket Printer should be set as follows:*

<table>
<thead>
<tr>
<th>SW no.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td>On</td>
<td>On</td>
<td>Off</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
<td>On</td>
<td>Off</td>
</tr>
</tbody>
</table>

*Table 8: Dip switch setting of the Kyoline MTP640 Thermal Pocket Printer*

*Refer to "Printer cables - A95P201, A95X506", page 154.*

**Print in table**

If you have defined a printer in the Setup > Configuration menu, select for **Print in table** if you want to print all the sequence results in a table (one line per method) or to print the results method by method (one frame per method).

*Refer to "Programming sequence", page 159.*

**Access:**

Menu Sequence/Sample stack
Printouts

Printouts can be initiated automatically at the end of a test or manually by pressing key **Print** from the following data screens:

- Main window: list of available methods.
- Reagent window: list of available reagents.
- Electrode window: list of available electrodes.
- Edit method menu: list of method parameters.
- Edit reagent menu: list of reagent parameters.
- Edit electrode menu: list of electrode parameters.
- GLP - Archives (methods) menu: sample results.
- GLP - Archives (reagents) menu: reagent data saved.
- GLP - Archives (electrodes) menu: electrode calibration results.
- Sequence/Sample stack menu: sample stack of the sequence (for each beaker: method type and ID, beaker number and ID).
- Beaker menu (while preparing an electrode calibration stack): calibration stack (for each beaker: buffer ID and batch number, beaker number).

Automatic printouts

They contain the following information:

- **Header**: information entered in the Setup > Customise menu with the instrument serial number and the date and time of analysis.
- **Title of report**: entered in Printouts menu, during method with the method name (ID).
- **Analysis ID**: User ID and Sample ID entered at the start of the analysis.
- **Footnote**: appears automatically at the end of printouts.
- **Calibration data (if relevant)**: electrode used to perform the measurement.
- **The calibration curve E = f(pC) of an ISE electrode** (if programmed in the Printouts menu of the calibration method).
- **The GRAN = f(volume)** of an ISE standard addition method (if programmed in the Printouts menu of the method).
- **Measurement results**: obtained at the end of the analysis and an analysis counting number.

In automatic mode, the printout format depend on the High/Medium/Low option selected for the Detailed parameter. Refer to "Detailed", page 88.
Printouts menu

To access:
- **Method**: Method library > Edit method > Printouts (key 4).
- **Electrode**: Electrode library > Edit electrode > Printouts (key 4).

<table>
<thead>
<tr>
<th>Printouts</th>
<th>My method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
<td>Analysis bulletin</td>
</tr>
<tr>
<td>Detailed:</td>
<td>Medium</td>
</tr>
<tr>
<td>Curve:</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Printouts setup

Perform the following, before printing:
1. Connect the printer to the ION570.
2. Enter the Setup menu (Stop, 3 seconds from the Main window).
3. Press 1 Configuration.
4. Select **Printer = 80 columns**.
5. Select the printout format (Listing or Page by Page).
   Refer to "Format (printouts)", page 119.
6. Press Esc then 3 to customise the printouts, e.g. enter workstation name.
7. In the Edit method > Printouts and Edit electrode > Printouts menus, define the contents of the printouts. The Detailed = High/Medium/Low option set the amount of information that will be printed automatically at the end of each test.
   Refer to "Detailed", page 88.
8. In the Edit method > Printouts menu of an ISE standard addition method, select whether you want to print or not the GRAN = f(volume) curve. This curve will be printed automatically at the end of each test.
   Refer to "GRAN = f(Volume) curve", page 123.
9. In the Edit electrode > Printouts menu of an ISE electrode calibration method, select whether you want to print or not the calibration curve (E = f(pC = -log C)). This curve will be printed automatically at the end of each calibration cycle.
   Refer to "Calibration curve of an ISE electrode", page 64.
**Printouts title**

Title of the report printout (1 to 23 characters).

**Enter in:**

Edit method > Printouts

Edit electrode > Printouts

**Programming method**

1. Check or create the electrode(s) to be used by the method.
2. Check or create the reagent(s) to be used by the method.
3. Finally, create the method, which will consequently use the electrode(s) and reagent(s) created in the first two steps of programming.
4. In the Main window, select *Working mode = Method* or *SAC Method*, whether you want to run a single method without Sample Changer or a single method to be used with a Sample Changer.

*Only the Supervisor is allowed to program the methods. Once you have finished programming, make sure that NO question marks “?” are displayed in the Reagent and Electrode tabs!*

*If “?” are displayed in the Reagent and Electrode tabs, press 1 in the Main window to check the method. The instrument indicates the possible errors and prompts you to correct them, until “?” disappears.*

*Refer to "Programming methods", page 27.*
Programming sequence

1. Start by programming each method that will be used in the sequence, see “Programming method”, page 158.

2. If you are using a Sample Changer only:
   In the Configuration menu, declare the model of sample changer used (SAC80, SAC90, SAC850 or SAC950). Depending on the model of sample changer used, enter the sample changer configuration parameters. Refer to “Sample changer”, page 184.

3. In the Main window, select:
   - **Working mode = SAC Sequence**, for automatic sample handling using a sample changer.

   or

   - **Working mode = Sequence** for manual sample handling.

4. Press 2 in the Main window.

5. At the line ID, enter a name for the sequence.

6. In a SAC Sequence, for **Skip empty position**, select whether you want or not the sample changer to skip to the next beaker if an empty position is found. If you answer No, 3 options are offered if an empty position is found: restart the analysis in the same beaker, skip to the next beaker or end the analysis. Refer to “Skip empty position”, page 194.

7. If you have defined a printer in the Setup > Configuration menu, select for **Print in table**, if you want to print all the sequence results in a table (one line per method) or to print the results method by method (one frame per method).

8. Press 3 Edit sequence then edit the sequence. see “Edit sequence menu”, page 101.

9. Press 1 Sample stack then edit the sample stack, see “Sample stack”, page 188.

Refer to “Programming ION sequences”, page 27.
Refer to “Programming SAC sequences”, page 29.
QC (result indicator) Refer to "Result indicators", page 171.

QC analysis required This message is displayed at the start of a method requiring a QC sample.
Press ✓ and run a QC analysis.

QC data menu This menu is available for all measurement methods.

To access:
1. Enter the Main window.
2. Select or create a method.
4. Use the LEFT/RIGHT arrow keys to move to the last Edit method display.
5. Press 5 QC data.

<table>
<thead>
<tr>
<th>QC Data</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periodicity:</td>
<td>10 samples</td>
</tr>
<tr>
<td>Measurements at:</td>
<td>25.0°C</td>
</tr>
<tr>
<td>Tolerance:</td>
<td>2°C</td>
</tr>
<tr>
<td>Result unit:</td>
<td>eq/l</td>
</tr>
<tr>
<td>Minimum value:</td>
<td>0.00000000</td>
</tr>
<tr>
<td>Maximum value:</td>
<td>1000.0</td>
</tr>
</tbody>
</table>

QC ID Enter the name of the QC sample (16 alphanumeric characters). This name is called up when you run a QC sample analysis.

 QC not required Message appears at the start of a sequence, that originally included a method programmed with a QC sample.
The method to has now been reprogrammed without QC sample.
Go to Sequence/Sample stack, Edit sequence screen and remove the QC sample from the sequence.
**QC periodicity elapsed**  
This message is displayed at the start of a method requiring a QC sample. The Periodicity, entered in the QC Data screen of the method has elapsed. For example, if Periodicity = 10 samples, then a QC sample must be performed every 10 samples.  
Press ✓ and run a QC analysis.

**QC sample**  
Quality control (QC) samples are used as a means of studying the variation within and between batches of a particular analysis. A typical QC sample will be stable, homogenous, typical in composition to the types of sample normally examined. The concentration of a QC sample is known accurately and its composition is as close as possible to one of the samples to be analysed.  
Quality control samples can be used for all measurement methods.

**QC sample (Yes/No)**  
Select Yes for QC sample if you wish to perform measurements on QC samples.  
The QC sample ID, the periodicity of QC samples and the minimum and maximum acceptance limits for the control test are entered in the QC data menu.  
*If the QC test fails, the method can be locked, so that it is impossible to run the method while the QC sample results lie outside the preset limits.*

Enter in:  
Edit method menu

**Reagent addition ID**  
The name of the reagent to be added by an ISE standard addition method. The reagent can be selected from the User list or created from the Catalogue list.

Enter in:  
Edit method (Addition method), *see "Addition method - definition", page 46.*  
Edit method > Parameters (ISE standard addition method If Addition = Yes).
Reagent addition volume

Volume of reagent to be added.

Enter in:
Edit method (Addition method), *see "Addition method - definition", page 46.*

Edit method > Parameters (ISE standard addition method If Addition = Yes).

Range available:
0.001 ml to 999 ml

Reagent icons

 Indicates the state of the reagent system. This icon is displayed at the bottom of the Reagent window.

*Sunny icon:*
The titre has been entered for all the reagents present in the system.

*Cloudy icon:*
The expiry date of one of the reagents in the system will expire in less than one week.

*Stormy icon:*
The expiry date has elapsed for one of the reagents present in the system.
At least one of the reagents present in the system has not been installed.

*Question mark:*
The reagent system has not been programmed correctly. Enter supervisor and check the reagent parameters in the Method parameters menu.

*Press 1 in the Main window, the instrument will indicate the possible errors and prompt you to correct them.*
**Reagent ID**

Name of the reagent. It is recommended to enter the chemical formula of the reagent followed by its concentration (e.g. HCL 0.1)

**Enter in:**
Reagent window > Edit reagent.

**Range available:**
Up to 20 alphanumeric characters.

**Reagent library**

To access, press 4 in the Reagent window.

The reagent library comprises the following menus and commands:

- **Reagent library**
  - **Commands/ actions**
    - New reagent
    - Default parameters
    - Delete reagent
  - **Programming data**
    - Edit reagent

**Reagent system**

A reagent system comprises all the reagents necessary to run a method or a sequence of methods:

*When a method/sequence is run, the instrument prompts you to install or replace the reagents that will be required to run this method/sequence.*

**Reagent titre not entered**

The reagent titre of the active reagent has not been entered in the Reagent library.

Press 1 in the Reagents window, press 1 Enter titre.
Reagent unit

Specify the reagent concentration unit. The unit is given on the reagent bottle or is the unit used to express the reagent titre.

Enter in:
Reagent library > Edit reagent menu.

Range available:
Select, mM = mmol/l, M = mol/l, mN = meq/l or N = eq/l.

Once the units have been confirmed, they are added to the reagent ID.

Reagent window

This window contains all the information and operations concerning the reagents.

To access:
Use LEFT/RIGHT arrow keys
Recalculate results

You can recalculate a result at the end of an ISE standard addition test. The old result is replaced with the new. The recalculated result is saved with the indication "Recalculated". Proceed as follows to recalculate a result:

- At end of a test, press 2 More details the 3 Recalculate in the results screen.

```
<table>
<thead>
<tr>
<th>My sample</th>
<th>Test 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Result accepted:</td>
<td>Yes</td>
</tr>
<tr>
<td>Save and continue</td>
<td>4</td>
</tr>
<tr>
<td>More details</td>
<td>5</td>
</tr>
<tr>
<td>C: 0.05935 eq/l</td>
<td>OK</td>
</tr>
<tr>
<td>S25: 99.9 %</td>
<td>OK</td>
</tr>
</tbody>
</table>
```

- Change the calculation parameters.

```
<table>
<thead>
<tr>
<th>My sample</th>
<th>1/1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recalculate</td>
<td></td>
</tr>
<tr>
<td>Sample amount:</td>
<td>45.000ml</td>
</tr>
<tr>
<td>Final dil. amount:</td>
<td>50.000ml</td>
</tr>
<tr>
<td>Test 1:</td>
<td>50.000ml</td>
</tr>
</tbody>
</table>
```

The test quantity can be modified for each test performed. If pre-diluted samples are used, the Sample amount and Final dilution amount can also be changed for the first test of each sample (or analysis).

Press 2 to recalculate the result(s) or 1 to return to the first screen without recalculating the result(s).

- Recalculated results are displayed.

```
<table>
<thead>
<tr>
<th>My sample</th>
<th>1/1</th>
</tr>
</thead>
<tbody>
<tr>
<td>New results</td>
<td></td>
</tr>
<tr>
<td>Continue</td>
<td>4</td>
</tr>
<tr>
<td>New calculation</td>
<td>5</td>
</tr>
<tr>
<td>C: 0.05935 eq/l</td>
<td>OK</td>
</tr>
<tr>
<td>S25: 99.9 %</td>
<td>OK</td>
</tr>
</tbody>
</table>
```

You can start a new recalculation (press 2) or return to the first screen above (press 1).

You can accept then save the recalculated results (press 1 Back then 1 Save and continue). To view the results, see "GLP-Archives menu", page 122.

A result that has been accepted by the instrument can be rejected after recalculation (and vice versa).
**Ref. electrode conflict**

Two reference electrodes are being used in the same beaker. Change one of the reference electrodes in the electrode system.

**Reference Temp.**

Refer to "Temp. correction None/Linear/Nat. water", page 204.

**Reject a result**

Refer to "Result accepted (Yes/No)", page 170.

**Remove burette**

Before removing, rinse the burette to remove the reagent.

1. Enter the Burette functions menu:
2. Press 6 Remove burette. The piston is moved to its lowest position (filling operation).
3. Check the burette data and press 1.
4. Remove the burette and press ✓, see "Install burette", page 126.

**Remove method from a sequence**

1. Select the sequence.
2. Press 3 Edit sequence.
3. Select the method to be removed using the LEFT/RIGHT arrow keys.
4. Press 3.
5. Press 1 Remove method.

*The method is removed from the sequence but is not deleted.*

**Remove reagent**

Use this procedure when you no longer wish to use the reagent. To remove a reagent, run the rinse procedure in the Burette functions menu.

Refer to "Burette functions menu", page 58.
Replace burette

Before replacing, rinse the burette to remove the reagent.

1. Enter the Burette functions menu.
2. Select the burette to be replaced at the Address line, see "Address", page 48.
3. Press 5 Replace burette. The piston is moved to its lowest position (filling operation).
4. The data of the burette to be replaced are displayed. Check and press 1.
5. Enter the new burette volume and serial number as for a burette installation. Press 1 to confirm.
6. Remove the burette and press ✓.
7. Install the new burette at the displayed address and press ✓, see "Install burette", page 126.

Replace electrodes

Use this procedure to replace an electrode with another one of the same type and ID.

Proceed as follows:

1. Select the method/sequence using the electrode.
2. Press 2 in the Electrode window.
3. Press 3 Replace electrode.
4. Select the electrode to be replaced. The ID list contains all the electrodes connected.
5. Disconnect electrode and press ✓ to confirm.
6. Connect the new electrode at the address indicated.
7. Enter the serial number and confirm.
Replace reagent

The procedure described below installs the reagents used by the current sequence or method. If a reagent with an ID different to the one used by the method, is installed at the address indicated, the ION570 detects the error and prompts you for the replacement. During replacement, a new batch number and expiry date are entered. A reagent replacement can be performed with or without rinsing the burette.

Replace the reagent as follows:

1. Select the method or the sequence which uses the new reagent.
2. In the Reagents window, press 2 then 1.
3. Check the new reagent's identification data.
4. Enter the batch number and expiry date of the new reagent.
5. Press 1 to confirm.
6. Press 1 to rinse the burette. Press 2 to continue with no rinse.
7. The burette is emptied. A rinse is performed (if requested). The burette is filled with air then emptied.
8. Install the new reagent bottle, press ✓.
9. The instrument runs the Flush procedure using the new reagent, then fills the burette. The replacement is complete.

Replacing reagent bottle

The bottle exchange procedure allows you to replace the reagent bottle with another reagent of same ID. During the procedure, a new batch number and expiry date are entered. A bottle exchange is performed without rinsing the burette.

Replace the reagent bottle as follows:

1. Select the method or the sequence which uses the reagent that requires replacing.
2. From the Reagents window, press 2 Install reagents then 2 Bottle exchange.
3. Select the reagent ID from the list.
4. Press 1 to confirm.
5. As for a reagent installation, enter the batch number and expiry date given on the reagent bottle. Press 1 to confirm.
6. Follow the instructions displayed. At the end the burette is filled with the new reagent.
**Reset memory**

An internal error has occurred. Press ✓. The ION570 resets the parameters to default settings. The method, electrode and reagent lists are reset to the preprogrammed list. All the results are lost.

**Reset to factory settings**

Use this command to restore the methods, reagents and electrode menu to factory settings. The method, reagent and electrode user lists are reset to the preprogrammed lists.

*A reset to factory settings is equivalent to a memory reset and all the results and user entered methods are deleted.*

Press 4 in the Setup menu and confirm the reset.
Result accepted (Yes/No)

A result is automatically accepted by the instrument if it lies within the minimum/maximum acceptation limits set. The user can then decide to keep the result or reject it.

A result will be automatically rejected by the instrument if it lies outside these limits. The user (at the Supervisor level only) can then decide to accept the result or to reject it.

To accept a result accepted by the instrument:
At the end of the run, press 1 Save and continue.

To reject a result accepted by the instrument:
At the end of the run, press 2 More info and select Accept result: No. Press 1 Back then 1 again Save and continue.

To accept a result rejected by the instrument (Supervisor only):
At the end of the run, press 2 More info and select Accept result: Yes. Press 1 Back then 1 again Save and continue.

To reject a result rejected by the instrument:
At the end of the run, press 1 Save and continue.

A rejected result is stored in the GLP-Archives but is not used for mean and standard deviation calculations.
Result indicators

Appear with the result at the end of a run.

- **OK**: accepted by the instrument (result lies within the acceptance limits).
- **Low**: alarm, rejected by the instrument (result lies below the acceptance limit or below the $C_0$ blank concentration in the case of a Direct ISE measurement method).
- **High**: alarm, rejected by the instrument (result lies above the acceptance limit or above $10^{30}$ in the case of a Direct ISE or Standard addition ISE method).
- **Time max**: the measurement has been accepted at the end of the Acceptance delay.
- **QC**: the user has bypassed a QC sample analysis demand.
- **Vstd>max**: In an ISE Standard addition method with automatic determination of the volumes, a Vstd>max note is added to the result if the cumulative volumes of the standard additions is higher than 50% of the sample test quantity. 
  Refer to "ISE Standard addition method - programmation", page 130.

You can reject a result that was accepted by the instrument. 
You can accept a result that was rejected by the instrument (Supervisor users only). 
Refer to "Result accepted (Yes/No)", page 170.

Result unit

Unit used for the result.

**Enter in:**
Edit method > Results (ISE measurement methods)

**Range available:**
eq/l, meq/l, mol/l, mmol/l, g/l, mg/l, mg/ml, µg/ml, % (m/v) or ppm (m/v)

**Warning!**
In a Direct or a Standard addition ISE method, the ppm and % units are expressed in weight/volume. Nevertheless, if the standard (or addition) solution has been prepared in % or ppm (weight/weight), the % or ppm result will be in weight/weight.
You can also use the Results factor to convert in % or ppm (weight/weight) a result obtained in % or ppm (weight/volume). 
Refer to "Results factor (Yes/No)", page 173.
Results

The following results are displayed automatically at the end of a run.

**pH calibration**
Mean of zero pH (pH0(25))
Mean of sensitivity

**ISE calibration**
Mean of E0
Mean of sensitivity
Mean of Co detection limit concentration

**Conductivity cell calibration**
Mean of cell constant

**Measurement method**
Measurement
Mean ± standard deviation

Results can be accepted or rejected at the end of each test performed, see "Result accepted (Yes/No)", page 170.
Results factor (Yes/No)

This multiplying factor is applied to the method result.

Access:
Edit method > Results (ISE direct measurement or standard addition method)

Proceed as follows to multiply the method result by a factor:

- In the method Results menu, select Results factor = Yes.
- Run the method:

![Method Results Menu](image)

Enter the results factor (from 0.001 to 10 000) then press 1 to start the method.

There is no results factor for an electrode calibration method.

Results menu

This menu displays the result identification parameters and acceptance criteria required to run a sample method or an electrode calibration.

To access:

- **Method**: Method library > Edit method > Results (key 3).
- **Electrodes**: Electrode library > Edit electrode > Results (key 3).

![Results Menu](image)

The Results menu for an ISE standard addition method
**Rinse aux. output**

*Option available when sample changer in use.*

This command will set the auxiliary signal on during a programmed rinse.

**Enter in:**
Set up > Configuration menu

**Range available:**
No, 5 V, or 12 V

---

**Rinse burette**

For safe reagent handling rinse the burette each time the burette is to be replaced. It makes sure the delivery tubes and tubings are reagent free. The rinse cycle lasts for approximately 5 minutes.

**To rinse a burette:**
1. Enter Burette functions menu:
   1. Select the burette in the Address field, see "Address", page 48.

**The rinse procedure runs as follows:**
- Empties the burette.
- Prompts you to remove the reagent bottle from the specified address.
- Fills the burette with air, then empties.
- Prompts you to install the rinse bottle.
- Runs the rinse programme using the rinse solution.
- Prompts you to remove the rinse bottle.
- Fills the burette with air, empties, then refills.

---

**Rinse time**

When a Sample Changer is in use enter the time (in minutes and seconds) the electrodes should be immersed in each rinse beaker.

**Enter in:**
Set up menu > Configuration

**Range available:**
00:00 to 30:59
Routine mode

In “ROUTINE” mode the user is able to select and run methods. Clear-text messages and icons present on the large graphic display guide the user at every step. However, the routine user cannot create or modify methods, reagents or electrodes.

When the working order is respected i.e. ELECTRODE then REAGENT, you will be able to perform the following:

- **RUN** the active method,
- **CONNECT** the electrode system or **CALIBRATE** an electrode (if required),
- **INSTALL** the reagent system, **CHANGE THE REAGENT BOTTLE** and **ENTER** a reagent titre (if required).

*Refer to "User’s rights", page 209.*
**Run window**

Follow the measurements on this window when an analysis is in progress. The displayed information depends on the type of method which is running.

**Enter in:**

Run an analysis. Refer to "Running a method", page 179.

---

**Figure 20: Run window of a Measurement method (pH)**

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**Figure 21: Run window of a Measurement method (Conductivity)**

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**Figure 22: Run window of a Measurement method (EC/pH)**

Refer to "Run window (continued)", page 177.
Figure 23: Run window of an ISE Direct method

Figure 24: Run window of an ISE Standard addition method
Running a manual dosing

To prepare a manual dosing, see "Manual dosing", page 136.

Adjust the increment size (0.01 ml to 10 ml).
Select Yes to add the increments continuously
Select No to add a given number of increments.
Press 1 to start dosing the reagent
(one increment is added or reagent is added automatically increment by increment ).
If measurements have been selected, the potential and/or temperature are displayed live.

Automatic add. = No
An increment is added each time key 1 is pressed.

Automatic add. = Yes
The reagent is added automatically if you press 1. Dosing stops when the Max. volume has been delivered or if you press 1 again.

If no measurements: the volume already dispensed is displayed.
Curve volume (in ml) = f(time)
is displayed live.

Displaying the direct curve: press Del.
Condition: Measurements must have been performed

Press 1 to quit the manual dosing.
Use the RIGHT/LEFT arrow keys to move along the curve and display the point coordinates shown by the cursor.

Stopping a manual dosing: press Stop.
The Reagent window is displayed.
Running a method

1. Select method.
   Refer to "Select method", page 189.

2. If Question marks "?" are present in the Electrode and/or Reagent tabs, it means that the method needs to be programmed - an electrode and/or a reagent is missing. Review programming in Supervisor mode. Refer to “Programming method”, page 158.

   If you have a problem running the analysis, the ION570 will guide you through the necessary operations so that you are able to run the analysis in no time at all.

3. Connect/calibrate the electrode(s).
   Refer to "Electrode connection", page 110.

   To calibrate a pH electrode
   see "Electrode calibration (Fixed mode, pH electrode)", page 105,
   see "Electrode calibration (Free mode, pH electrode)", page 106.

   To calibrate an ion selective electrode (ISE),
   see "Electrode calibration (ISE)", page 104.

   To calibrate a conductivity cell,
   see "Electrode calibration (Fixed mode, conductivity cell)", page 102,
   see "Electrode calibration (Free mode, conductivity cell)", page 103.

   To run a calibration sequence (pH or ISE electrode, conductivity cell),
   see "Electrode calibration (SAC sequence)", page 107.

4. Install/Check reagent(s).
   Refer to "Install reagent", page 127.

5. When Sunny icons are visible in the Electrode and Reagent tabs. Press 1 in the Main window. Refer to "Electrode icons", page 112.

6. If prompted to do so, enter the User’s name (ID) and press 1.

7. Enter the Sample name (ID) and press 1.

8. Dip the electrodes into the sample beaker and press 1 to continue.

   For the following steps:
   Refer to "Run window", page 176.
Running a SAC sequence

1. Select SAC sequence, see "Select sequence", page 190.

2. If Question marks "?" are present in the Electrode and/or Reagent tabs, it means that the method needs to be programmed - an electrode and/or a reagent is missing. Review programming in Supervisor mode. If necessary, edit the sequence, see "Programming sequence", page 159.

3. Install the sample changer and connect it to the SAC socket of the ION570 using the cable, part no. A95A202 or A95X501. Refer to the User's Guide of the sample changer (part no.: D21T002 for a SAC90, D21T013 for a SAC80 or D21T085 for a SAC850/SAC950).

4. Connect/check the electrode(s). Refer to "Electrode connection", page 110.

5. Install/Check reagent(s). Refer to "Install reagent", page 127.

6. Prepare the sample stack. Refer to "Sample stack", page 188.

7. Press 1 in the Main window to run the sequence from the first beaker of the sample stack.

8. If prompted to do so, enter the User's name (ID) and press 1.

9. The sample changer cycle is initiated.
   - 1 to 9 dynamic rinses (if programmed with a SAC850/SAC950)
   - 1 to 3 static rinses (if programmed).
   - Electrodes are dipped into the first beaker. Measurement starts.
   - Between each sample tests (beakers), 1 to 9 dynamic rinses (if programmed with a SAC850/SAC950) then 1 to 3 static rinses are performed (if programmed to do so).

10. At the end, the ION570 displays the mean result and standard deviation calculated for all accepted tests.

   When running a sequence with a SAC80 Sample Changer, do not use the STOP key of the SAC80.

   See also "Electrode calibration (SAC sequence)", page 107.
Running an ION sequence

1. Select sequence, see "Select sequence", page 190.
2. If Question marks "?" are present in the Electrode and/or Reagent tabs, it means that the method needs to be programmed - an electrode and/or a reagent is missing. Review programming in Supervisor mode.
3. Connect/calibrate the electrode(s).
   Refer to "Electrode connection", page 110.
4. Install/Check reagent(s).
   Refer to "Install reagent", page 127.
5. Prepare the sample stack.
   Refer to "Sample stack", page 188.
6. When a Sunny icon is visible in the Electrode tab, press 1 in the Main window to run the sequence from the first beaker of the sample stack.

   If you have a problem running the analysis, the ION570 will guide you through the necessary operations so that you are able to run the analysis in no time at all.

For the following steps:
Refer to "Run window", page 176.

SAC80/SAC90/SAC850/SAC950

Define and connect a sample changer:
Refer to "Sample changer", page 184.
Edit a sequence with a sample changer:
Refer to "Programming sequence", page 159.
Select a sequence with a sample changer:
Refer to "Select sequence", page 190.
Run a sequence with sample changer:
Refer to "Running a SAC sequence", page 180.

SAC arm obstructed (SAC error)

The arm has been blocked and or cannot function properly.
Remove the obstruction and press Resume analysis (key 1) to continue the sequence from the point it stopped.
Sample changer error: The SAC option addressed is missing and not installed on the sample changer.

**Examples:**

- Dynamic rinses are programmed in the sequence and no dynamic rinse module is installed and the sample changer. Review the Setup > Configuration parameters and/or install missing pump (in particular, check the electrical connection between the pump and the sample changer).

- A reagent addition is programmed in the sample preparation and no peristaltic pump is installed on the sample changer. Review the Edit sequence parameters, parameter Sample preparation no. and/or install missing peristaltic pump (in particular, check the electrical connection between the pump and the sample changer).

For TitrAMaster 85 users only, check and, if necessary, edit the sample preparation routine. Refer to "Sample preparation no.", page 187.

If a Sample Changer is in use, specify if the grounding of the measuring cell takes place using an external connection to the sample changer. This is the case when a solution is grounded using a metal shield or via a conductivity cell connected to a conductivity meter.

Refer to "Working mode", page 211.

Refer to "Sequence/SAC sequence", page 191.

Either the data transmission between sample changer and the ION570 cannot be performed properly, in which case you should check the cable connections, or the measurement stopped due to a movement error.

End the sequence by pressing key Stop on the sample changer keypad or key Stop of the ION570, and check that nothing is obstructing sample changer movements.
**Same buffer change buffer**

This message appears at the start of an pH electrode calibration in *Fixed* mode (see "Calibration request = Fixed", page 67). The same buffer has been programmed for 2 successive steps in the calibration procedure.

Press ✓ and change one of the buffer values in the Solutions menu of the electrode calibration method.

This message can also appear during a pH electrode calibration in *Free* mode (see "Calibration request = Free", page 68) if the difference of potential measured between 2 successive calibration beaker does not exceed 10 mV. Check the buffers and start a new calibration cycle or end the analysis.

**Sample amount**

Enter the amount of sample used for the analysis or the dilution.

Enter in:
Edit method > Sample

**Range available:**
0.001 to 100000 (unit = Sample unit)
Sample changer

To automate your entire analysis procedure (up to 126 samples in one go), the SAC80, SAC90, SAC850 or SAC950 sample changers can be connected to the SAC socket of the ION570 using the cable, part no. A95A202 (SAC80/SAC90) or A95X501 (SAC850/SAC950). 

Refer to "Sample changer cable - A95A202 (SAC80/SAC90)", page 185.

Refer to "Sample changer cable - A95X501 (SAC850/SAC950)", page 185.

When using a sample changer, you have to indicate to the ION570 which model is used.

Enter in:
Setup menu > Configuration

Range available:
SAC80, SAC90, SAC850, SAC950, No

Depending on the sample changer used, you have to enter other configuration parameters:

- **For a SAC80 or SAC90:**
  Number of rinses, see "Number of static rinses", page 148,
  Duration of a rinse, see "Rinse time", page 174.

- **For a SAC850 or SAC950:**
  Automatic detection of beakers, see "Beaker detection", page 56,
  Number of rinses, see "Number of static rinses", page 148,
  Duration of a rinse, see "Rinse time", page 174.
  Number of dynamic rinses, see "Dynamic rinses", page 94,
  Location of dynamic rinses, see "Dyn. rinse", page 93,
  Sequence end in Park, see "Sequence end in Park (Yes/No)", page 192.

See also:

- **Edit a sequence with a sample changer:**
  Refer to "Programming sequence", page 159.

- **Select a sequence with a sample changer:**
  Refer to "Select sequence", page 190.

- **Run a sequence with sample changer:**
  Refer to "Running a SAC sequence", page 180.
Sample changer cable - A95A202 (SAC80/SAC90)

Sample changer cable - A95X501 (SAC850/SAC950)
**Sample dilution conflict**

In a coupled method, the sample parameters are not the same for the two methods. For example: Sample method 1 has been programmed with Dilution = Yes. Sample method 2, has been programmed with Dilution = No.

Check the method Sample screens of each method.

**Sample ID**

The Sample ID is entered during a run procedure.

**Range available:**

16 characters

**Sample menu**

This menu is available for an ISE standard addition method.

**To access:**

1. Enter the Main window.
2. Select or create a method.
3. Use the **LEFT/RIGHT** arrow keys to move to the last display.
4. Press **2 Sample**.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Fluor in water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilution:</td>
<td>Yes</td>
</tr>
<tr>
<td>Sample unit:</td>
<td>ml</td>
</tr>
<tr>
<td>Sample amount:</td>
<td>45,000ml</td>
</tr>
<tr>
<td>Final dil. amount:</td>
<td>50,000ml</td>
</tr>
<tr>
<td>Aliquot:</td>
<td>50,000ml</td>
</tr>
</tbody>
</table>

**Quit: Esc**  **Change: ✓**
Sample preparation no.

The Sample preparation routine gathers all the information required by a SAC850 or SAC950 Sample Changer to prepare each sample beakers of the sequence (sample dilution by adding a solvent, stirring delay, sample degassing, set the sample to a given temperature, start a dynamic rinse, etc.).

One Sample preparation routine is defined per method executed. A SAC850 or SAC950 can run up to 10 different sample preparations in a given sequence.

Sample preparation routines are created and edited from a PC and TitraMaster 85 PC software. They are loaded in the ION570 memory on connecting the instrument to TitraMaster 85.

On running a sequence, the ION570 sends to the sample changer all sample preparations to be runned for the sequence (one preparation per method).

Enter in:
- Edit sequence menu (with a SAC850 or SAC950)

Range available:
- 0 to 10
- 0 means no sample preparation selected.
Sample stack

The sample stack gathers individual data for all the samples present in a sequence.

1. Perform steps 1 to 8 of the "Programming sequence" procedure. Refer to "Programming sequence", page 159.

2. In the Main window, press 2 Sequence/Sample stack.

3. If required enter a new sequence ID.

4. Press 1 to enter the sample stack.

5. Enter sample data.

Label the beakers indicating the number of beakers in the sequence, for example: 1/11, 2/11 etc... the sample ID and the number of times the method is to be performed in the beaker.

Place the beakers in the numbered position on the sample changer. If static rinses and/or dynamic rinses are programmed, position the corresponding rinse beakers at the right places. Refer to "Number of static rinses", page 148. Refer to "Dynamic rinses", page 94.

You can print the sample stack by pressing Print from the Sequence/Sample stack screen (screen displayed at step 2 of the operating procedure above).

Sample unit

Unit of the sample amount. The sample unit can be expressed in ml or in µl.

Enter in:

Edit method > Sample menu (ISE standard addition method)
Sample unit conflict
In a Coupled method, the sample unit is not the same for the two methods.
Check the Sample screens of each method of the Coupled method.

Select electrode
Routine user
Is able to select an electrode to check the parameters and/or start a calibration.
1. Select the method/sequence using the electrode.
2. Press 1 to start a calibration or 3 to check the electrode parameters. In both cases, the electrodes available will be those specified in the actual working method or sequence.

Supervisor
From the Electrode window.
2. In the ID field, select the electrode from the User list.

Select method
To select a single method:
1. Select Working mode = Method in the Main window.
2. Press 3.
3. In the ID field, select the method from the User list.

To select a method to be run using a sample changer:
1. Select Working mode = SAC Method in the Main window. If this option is not available, enter the Setup menu > Configuration and define a sample changer.
2. Press 3.
3. In the ID field, select the method from the User list.
**Select reagent**

**Routine user**

Is able to select a reagent to check the parameters and/or enter a reagent titre.

1. Select the method or the sequence using the reagent.
2. Press 1 to enter the reagent titre or 3 to check the reagent parameters. In both cases, the available reagents are those specified in the actual working method or sequence.

**Supervisor**

From the Reagent window.

2. In the ID field, select the reagent from the User list.

---

**Select sequence**

**To select a Sequence (sample changer not in use):**

1. Select `Working mode = Sequence` in the Main window.
2. Press 2 Sequence/Sample stack.

**To select a Sequence to be run using a sample changer:**

1. Select `Working mode = SAC Sequence` in the Main window. If this option is not available, enter the Setup menu > Configuration and define a sample changer.
2. Press 2 Sequence/Sample stack.

*Refer to "Sequence/SAC sequence", page 191.*

---

**Sensitivity**

Measure of the electrode condition. For ideal electrode chains the sensitivity is 100%. However, it is generally lower. It is expressed as a percentage of the theoretical slope (59.16 mV/pH) of the curve at 25°C and is determined during a calibration on at least 2 points.
Sequence/SAC sequence

Two sequences are available: Sequence or SAC Sequence. The sequences are empty and must be programmed.

Unlike Coupled methods, sequences also allow you to link electrode calibration methods.

A sequence is a chain of up to 10 methods that will be carried out in different beakers and in a defined order given by the operator.

**Sequence**: The beakers are changed manually.

**SAC Sequence**: The beakers are changed automatically using a sample changer.

**Example:**
Method 1 performed on 2 samples using 4 test portions (2 x 4 beakers),
Method 2 performed on 1 sample with 3 test portions (1 x 3 beakers).
Thus 11 beaker system will run as follows:

![Sequence of methods](image)

Figure 27: Sequence of methods

The number of samples is entered in the Edit sequence menu and the number of test portions in the Edit method screen.

**SAC Sequence and pH electrode/conductivity cell calibration in Free mode.**

*In this case, the measurement system will wait for the user to enter the buffer (or standard) value before going ahead automatically with the next beaker.*

Refer to "Working mode", page 211.
Refer to "Select sequence", page 190.
Refer to "Programming sequence", page 159.
Refer to "Running an ION sequence", page 181.
Refer to "Running a SAC sequence", page 180.
Sequence/Sample stack menu

In this menu, you can edit a sequence and the sample stack associated.

To access:

1. In the Main window, select *Sequence* or *SAC/sequence* for *Working mode*.
2. Press **Sequence/Sample stack**.

Refer to "Edit sequence menu", page 101.
Refer to "Sample stack", page 188.
Refer to "Skip empty position", page 194.
Refer to "Sequence/SAC sequence", page 191.

Sequence end in Park (Yes/No)

At the end of a sample changer sequence, you can dip the electrodes into the Park beaker filled with a conditioning solution or you can leave the electrodes above the Park beaker (electrodes are stored dry in this case).

Enter in:

Setup menu > Configuration (if *Sample changer = SAC850 or SAC950*)
Serial number  

**Burette**

The serial number is indicated on the burette and is entered during the installation or replacement procedures.

**Enter in:**

Reagent library > Burette functions > Install burette.
Reagent library > Burette functions > Replace burette.

**Format:**

10 characters (one letter + 5 digits+ 1 dash '-' + 3 decimals).

**Electrode**

The serial number is entered when connecting or replacing an electrode.

**Enter in:**

Electrode window > Install electrodes > Connect electrodes
Electrode window > Install electrodes > Replace electrode

**Format:**

10 characters

Setup menu

Press **Stop** 3 seconds or press key **F12** in the Main window. The title bar indicates the instruments name and the software version.

<table>
<thead>
<tr>
<th>SETUP</th>
<th>ION570 U03.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supervisor code:</td>
<td></td>
</tr>
<tr>
<td>Configuration</td>
<td>①</td>
</tr>
<tr>
<td>Access routine node</td>
<td>②</td>
</tr>
<tr>
<td>Customise</td>
<td>③</td>
</tr>
<tr>
<td>Reset to factory settings</td>
<td>④</td>
</tr>
<tr>
<td>Exit</td>
<td>⑤</td>
</tr>
</tbody>
</table>

Select: □
**Simultaneous additions (Yes/No)**

In an Addition method, you can run automatically 2 or 3 additions. These additions can be performed simultaneously or one after the other. Refer to "Addition method - definition", page 46.

The reagents are added using burettes all controlled by the ION570. These burettes can be installed on the ION570 or on an ABU52 connected to the ION570.

**Enter in:**
Edit method menu (Addition method with 2 or 3 additions).

---

**Skip empty position**

Parameter of a SAC Sequence for sample beaker positions only. Does not apply to electrode calibration beaker positions. Does not apply if a SAC850 or SAC950 sample changer is used with the Beaker detection option cleared (deselected), see "Beaker detection", page 56.

Selects whether you want or not the sample changer (SAC80, SAC90, SAC850 or SAC950) to skip to the next beaker position if an empty position (*) is found. If No is answered, 3 possibilities are offered if an empty position is found: restart the analysis in the same beaker, skip to the next beaker or end the analysis.

**Enter in:**
Press 2 Sequence/Sample stack from the Main window. Refer to "Programming sequence", page 159.

(*) **Empty position:**
An empty position means no beaker present at the position. When you are using a SAC850 or SAC950, an empty position also means a beaker with less liquid than the minimum detection limit or a beaker with a solid or a powder sample. Refer to "Beaker detection minimum height", page 57.

---

**Software version**

The software version is displayed in the title bar of the Setup menu. The version is also displayed for a few seconds while switching on the instrument.
Solution menu

This menu is available for:

- pH electrodes that are edited with the Calibration request = Fixed option.
- ISE electrodes that are edited with the Calibration = Manual option.

Refer to "Calibration request = Fixed", page 67.
Refer to "Calibration request = Free", page 68.
Refer to "Calibration = Automatic", page 62.
Refer to "Calibration = Manual", page 63.

To access:

1. From the Electrode window, press 4.
2. Select the electrode to be edited.
3. Press 2 Edit electrode and check that the Calibration request = Fixed (pH electrodes) or Calibration = Manual (ISE electrodes) option is selected.
4. Use the LEFT/RIGHT arrow keys to move to the last Edit electrode display.
5. Press 2 Calibration solutions.

For a pH electrode calibration

Select the pH standard solutions to be used for the calibration. The pH values are given at 25°C. The following values are available: IUPAC pH standards (pH 1.679, 4.005, 6.865, 7.000, 7.413, 9.180, 10.012 or 12.454) or 4-7-10 Series (pH 4, 7 or 10).

For an ISE electrode calibration

Enter the name of the standard used (16 characters maximum).
Select the standard concentration unit. Available units: eq/l, meq/l, mol/l, mmol/l, g/l, mg/l, mg/ml, µg/ml, % or ppm.
Enter the concentration of each standard with the unit selected above. Available limits: $10^{-10}$ to $10^{10}$. 
Stability

The stability criterion is used to control the stability of the electrode signal. Selecting a low value will bring about accurate but long measurements.

Enter a stability which is close to the default value (50 mpH/min, 3.0 mV/min or 1.0 %/min).

A zero stability criteria will have no effect on the stability test performed, the reading will be taken into account when the Acceptation time is exceeded.

Enter in:
- Edit method > Parameters menu
- Edit electrode > Calibration parameters menu

Range available:
- 0 to 99 mpH/min or 0 to 99.9 mV/min or 0 to 99.9 %/min
Selection of the conductivity standard used to calibrate the conductivity cell. 9 standards are available:

<table>
<thead>
<tr>
<th>Conductivity standard</th>
<th>Temperature range</th>
<th>Radiometer Analytical part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 D KCl</td>
<td>0 to 27 °C</td>
<td>S51M001 (500 ml)</td>
</tr>
<tr>
<td>0.1 D KCl</td>
<td>0 to 50 °C</td>
<td>S51M002 (500 ml)</td>
</tr>
<tr>
<td>0.01 D KCl</td>
<td>0 to 50 °C</td>
<td>S51M003 (500 ml)</td>
</tr>
<tr>
<td>0.1 M KCl</td>
<td>0 to 36 °C</td>
<td>C20C250 (500 ml)</td>
</tr>
<tr>
<td>0.01 M KCl</td>
<td>0 to 34 °C</td>
<td>C20C270 (500 ml)</td>
</tr>
<tr>
<td>0.001 M KCl</td>
<td>0 to 30 °C</td>
<td>C20C280 (500 ml)</td>
</tr>
<tr>
<td>0.05 % NaCl</td>
<td>0 to 99.9 °C</td>
<td>S51M004 (500 ml)</td>
</tr>
<tr>
<td>25 μS/cm NaCl</td>
<td>0 to 100 °C</td>
<td>S51M013 (250 ml)</td>
</tr>
</tbody>
</table>

Figure 28: Conductivity standards available in the ION570

The ION570 determines the cell constant from the conductivity values of the standard which are saved versus temperature.

Access:

1. From the Electrode window, press 4.
2. Select the Conductivity type electrode to be edited.
3. Press 2 Edit electrode and check that the Titre = Calibrate option has been selected.
4. Use the LEFT/RIGHT arrow keys to move to the last display.
5. Press 2 Standard line.
6. At the ID line, select the standard used for the calibration of the conductivity cell.
<table>
<thead>
<tr>
<th><strong>Standard addition ID</strong></th>
<th>Name assigned to the standard added during an ISE standard addition method. This reagent can be selected from the User list or created from the Catalogue list.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enter in:</strong></td>
<td>Edit method (for an ISE standard addition method) &gt; Parameters, see &quot;ISE Standard addition method - definition&quot;, page 129.</td>
</tr>
<tr>
<td><strong>Standard addition method</strong></td>
<td>Refer to &quot;ISE Standard addition method - definition&quot;, page 129. Refer to &quot;ISE Standard addition method - programmation&quot;, page 130.</td>
</tr>
<tr>
<td><strong>Standard potential</strong></td>
<td>Refer to &quot;Direct ISE measurement method - definition&quot;, page 89.</td>
</tr>
<tr>
<td><strong>Standard solution (conductivity measurements)</strong></td>
<td>Refer to &quot;Standard (conductivity standard)&quot;, page 197.</td>
</tr>
<tr>
<td><strong>Standard solution (ISE measurements)</strong></td>
<td>Refer to &quot;Solution menu&quot;, page 195.</td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
<td>When several tests are performed on the same sample, the mean and standard deviations are calculated from the accepted tests.</td>
</tr>
</tbody>
</table>
### Std add volume

**Automatic**

The user enters the potential jump due to all additions (from 5 to 100 mV) and the number of additions (1 to 9) to be performed. The ION570 determines automatically the potential jump due to one addition then calculates the volume to be added for each addition.

**Programmed**

The user enters the volume of one addition (from 0.01 to 999 ml) and the number of additions (1 to 9) to be performed.

### Select in:

Edit method > Parameters (for an ISE standard addition method)

Refer to "ISE Standard addition method - definition", page 129.
Refer to "ISE Standard addition method - programmation", page 130.

### Std conc. too low (or high)

This message is displayed when running an ISE standard addition method with automatic determination of the volumes in the following 2 cases:

- The ION570 performs a first addition equal to 0.1% of the aliquot volume. If after this first addition, the potential jump is already higher than the maximum value \( \Delta E_{\text{total}} \times (1 + 0.1 \times n) / n \text{ mV} \), the **Std conc. too high** error message is displayed.
  \( \Delta E_{\text{total}} \) and \( n \) are user-programmable parameters of an ISE standard addition method:
  - Potential jump (from 5 to 100 mV) and
  - Number of additions (from 1 to 9).

- If the cumulate addition volumes become higher than 1% of the aliquot volume while the potential jump measured remains below 1 mV, the **Std conc. too low** error message is displayed.

In the 2 cases, the test is rejected and you can start a new test (press 2 then 1 New test) or end the analysis (press 3).
### Stirring

**Internal stirrer, e.g. magnetic**

Display the Cell window.

<table>
<thead>
<tr>
<th>Instrument:</th>
<th>ION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Stirring:</td>
<td>Off</td>
</tr>
<tr>
<td>Speed:</td>
<td>500 rpm</td>
</tr>
</tbody>
</table>

Select the instrument having the stirrer (ION for ION570, ABU1 or ABU2 for an ABU52).

- Start/stop stirrer
- Select stirring speed: 100 to 1100 rpm

Refer to "ABU1/ABU2", page 41.

**External stirrer, e.g. propeller**

1. Connect the Stirring Propeller, part no. 847-731, to the **Propeller** socket.

2. Display the Cell window.

<table>
<thead>
<tr>
<th>Instrument:</th>
<th>ION</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Stirring:</td>
<td>Off</td>
</tr>
<tr>
<td>Speed setting</td>
<td></td>
</tr>
</tbody>
</table>

Select the instrument the stirrer is connected to (ION for ION570, ABU1 or ABU2 for an ABU52).

- Start/stop stirrer

3. Select **External stirring = On** and adjust stirring by turning the stirrer propeller knob or select **Speed setting** and choose a stirring speed from the table.

<table>
<thead>
<tr>
<th>Speed setting (rpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: 500 2: 780</td>
</tr>
<tr>
<td>3: 1080 4: 1360</td>
</tr>
<tr>
<td>5: 1650 6: 1940</td>
</tr>
<tr>
<td>7: 2230 8: 2520</td>
</tr>
<tr>
<td>9: 2800</td>
</tr>
</tbody>
</table>

4. To stop stirring, select **External stirring = Off**.
Stop analysis

The **Stop** key enables you to stop a test and display the following screen:

![Stop screen](image)

- **Stop requested**
- **Resume analysis**
- **Next sample analysis**
- **End of analysis**

Press 2 to start a new test in the same, or different sample or end the analysis.
Press 3 to end the measurements. The active test is not saved.

The **Del** key enables to stop an analysis and calculate the results. The result of an interrupted test is saved with a "Man. stop" note.

**Warning:**

- **When you end the analysis on a sample and several tests have been accepted, a mean and standard deviation is calculated for the result and stored in the archives.**

- **When you end the analysis and have not performed the number of tests required for one sample, you have the choice between starting a new test on that sample (key 1) or ending the analysis (key 2).**
Supervisor code

Enter a Supervisor code to differentiate between the 2 operator modes - Routine and Supervisor.

This code will protect your parameters from any unwanted changes.

**DO NOT FORGET** this code! It will be asked for each time you try and enter the SETUP mode during Routine use. If you forget the code, you are unable to gain access to the Supervisor mode, and will be obliged to work in Routine mode.

When you exit the **Setup** menu after entering a code, you have the choice to remain in Supervisor mode or return to Routine mode.

If you select Supervisor, the instrument will remain in this mode until the instrument is switched off. If you select Routine, the instrument will switch to Routine mode.

*If no code is entered, all users will have free access to all parameters.*

**Enter in:**

Setup menu

**Range available:**

1 to 10 alphanumerical characters

*Refer to "User's rights", page 209.*
Supervisor mode

In **SUPERVISOR** mode, you can create, select, edit, delete sequence of methods, electrodes and reagents.

To select the Supervisor mode, a supervisor code is required.

**Proceed as follows:**

- Press **Stop** for 3 seconds in the Main window.
- Enter the Supervisor code.
- Press 5 Exit
- Select Return in mode = Supervisor.

*Refer to "User's rights", page 209.*

T°C minimum/maximum value

If the temperature measured lies outside these limits a warning message will be displayed.

**Enter in:**
Edit method > Results (for a measurement method using a temperature sensor).

**Range available:**
T°C minimum value: -9 °C to T°C maximum value.
T°C maximum value: T°C minimum value to 100 °C.

Target titre

Approximate value of the reagent titre.

**Enter in:**
Reagent window > New reagent

**Format:**
5 characters

Temp. coef.

*Refer to "Temp. correction None/Linear/Nat. water", page 204.*
None

The ION570 displays the sample conductivity at the sample temperature. No correction is performed.

Linear

The ION570 measures the sample conductivity and sample temperature and then converts it to the reference temperature using a temperature linear compensation function and displays the conductivity at the reference temperature.

Enter the Reference temperature and a Temperature coefficient expressed in % of conductivity variation per °C.

You can determine experimentally the Temperature coefficient: see the “Conductivity theory and practice“ guide, part no. D61M002.

Nat. water

The ION570 measures the sample conductivity and sample temperature and then converts it to 25 °C using a temperature non-linear compensation function based on natural waters according to ISO/DIN7888. Then, the conductivity is displayed at 25°C.

Select in:
Edit Method > Method parameters (for a conductivity measurement method)

Range available:
Reference Temp.: 0 to 99°C in steps of 1°C
Temp. coef.: 0.00 to 9.99 %/°C in steps of 0.01 %/°C

As conductivities vary versus temperature, it is recommended for high accuracy measurement:

• to use a temperature sensor or a conductivity cell with built-in temperature sensor.
• to thermostate samples, so that the same temperature is used for the calibrating and measuring.
**Temp. limit exceeded**

When calibrating a conductivity cell in the Fixed mode, the temperature measured in your standard is out of the range.

<table>
<thead>
<tr>
<th>Conductivity standard</th>
<th>Temperature range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 D KCl</td>
<td>0 to 27 °C</td>
</tr>
<tr>
<td>0.1 D KCl</td>
<td>0 to 50 °C</td>
</tr>
<tr>
<td>0.01 D KCl</td>
<td>0 to 50 °C</td>
</tr>
<tr>
<td>0.1 M KCl</td>
<td>0 to 36 °C</td>
</tr>
<tr>
<td>0.01 M KCl</td>
<td>0 to 34 °C</td>
</tr>
<tr>
<td>0.001 M KCl</td>
<td>0 to 30 °C</td>
</tr>
<tr>
<td>0.05 % NaCl</td>
<td>0 to 99.9 °C</td>
</tr>
<tr>
<td>25 µS/cm NaCl</td>
<td>0 to 100 °C</td>
</tr>
</tbody>
</table>

Adjust the temperature of the standard and repeat the calibration.

*Refer to "Electrode calibration (Fixed mode, conductivity cell)", page 102.*

**Temperature Probe/ Fixed at 25°C/Entered**

**Probe**

The sample or standard temperature can be measured using a temperature sensor connected to the Temp socket of the ION570. Select a temperature sensor in the Method parameters menu.

**Fixed at 25°C**

If measurements are to be performed at a constant temperature of 25°C.

**Note:**

No temperature correction is available for conductivity measurements.

**Entered**

If the temperature is to be entered manually.

**Select in:**

Edit method menu

Edit electrode menu if Calibrate request = Fixed, Free or Calibrate = Manual, Automatic
### Temperature sensor ID
Name of the temperature sensor or name of the electrode with a built-in temperature sensor.

**Enter in:**
- Edit Electrode > Calibration parameters menu
- Edit Method > Method parameters

**Range available:**
16 characters

### Test amount
Sample quantity to be placed into the beaker.

**Enter in:**
Menu Beaker (Menu Sequence/Sample stack then press 1 Sample stack).
*Refer to "Sample stack", page 188.*

**Range available:**
0.001 to 100000 (unit = Sample Unit)

### The sequence is empty
You are trying to run or complete a sample stack/sequence experiment which contains no programmed methods.

Go to Sequence/Sample stack, Edit sequence screen and check the sequence.

### Time max (result indicator)
*Refer to "Result indicators", page 171.*

### Title
Enter the title of the calibration report sheet (max. 23 alphanumeric characters).

**Enter in:**
- Edit method > Printouts
- Edit electrode > Printouts
Tray missing (SAC error)

On starting a sequence, the sample changer cannot read the RFID tag of the turntable. Check that a turntable is correctly mounted on the sample changer.

Check the model of turntable used and refer to the User’s Guide of the sample changer, chapter 6 "Accessories".

In particular, note that a SAC850 turntable can be used on a SAC950 but a SAC950 turntable cannot be used on a SAC850.

Solve the problem then restart the sequence.

TTL 5 V OUT/ TTL 12 V OUT (sockets)

Red and black banana sockets (diameter = 2 mm).

The red banana sockets send a TTL $0 \pm 5$ V or $0 \pm 12$ V.

The black banana sockets are connected to the electrical zero of the instrument.

This auxiliary signal is programmed in the Method parameter menu, see "Auxiliary output", page 54.

Specifications (potential difference is given in absolute value)

Output signal

Level 0: 0 to 0.4 V

Level 1: higher than 2.4 V and equal to or less than 5 V (or 12 V)

Output impedance: 1 KOhm at level 0 and 2 kOhm at level 1

A TTL 0-level does not mean a 0 V output. The voltage difference varies from 0 to ±400 mV.
**TTL IN (sockets)**

Red and black banana sockets (diameter = 2 mm).

The auxiliary input socket can be connected to an external device unit used to send an analysis start command. The red banana socket receives a signal TTL 0 ±5 V and the black banana socket is connected to the instrument electrical zero.

**Specifications (potential difference is given in absolute value)**

**Input signal**

- **Level 0:** 0 to 0.8 V
- **Level 1:** higher than 2 V and equal to or less than 5 V

Input impedance: 10 KΩm

The auxiliary input signal is programmed in the Configuration menu, see "Auxiliary input", page 53.

⚠️ **A TTL 0-level does not mean a 0 V output. The voltage difference varies from 0 to ±400 mV.**

**Turntable blocked (SAC error)**

The turntable has been blocked or forced and or cannot function properly.

Remove the obstruction and press **Resume analysis** (key 1) to continue the sequence from the point it stopped.

**Warning!**

Do not change the turntable before restarting the sequence from the beaker it stopped (key 1) or before restarting the sequence from the next beaker (key 2). The sample changer identifies a turntable only when a new sequence is initialized (equivalent to a keystroke on **End of sequence** followed by **Run sequence**).

**Type of method**

The type of method is selected in the Add method menu while editing a sequence. The following types are available:

- Sample only methods,
- Electrode calibration methods,
- QC sample methods (Yes has been selected for QC sample in the Edit method menu).

**User ID (Yes/No)**

If specified, User ID will be asked for each time an analysis is run.

**Enter in:**

Setup menu > Configuration menu
**User list**

List of user defined methods, electrodes and reagents. The list is initialised to the preprogrammed methods, electrodes and reagents.

**User’s rights**

The Supervisor and Routine modes set the user’s rights as shown in the table below:

<table>
<thead>
<tr>
<th>Action</th>
<th>Supervisor</th>
<th>Routine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create, edit sequence. Remove all methods from a sequence. Delete a sequence</td>
<td>Yes</td>
<td>Yes (if the Supervisor gives the right to), see &quot;Demand: Unlocked&quot;, page 87.</td>
</tr>
<tr>
<td>Create method, electrode, reagent</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Copy method, electrode, reagent</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Program sequence, method, electrode, reagent</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Delete method, electrode, reagent</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Reset method, electrode, reagent parameters</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Reset parameters to factory settings</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Select sequence, method, electrode, reagent</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Check method, electrode, reagent parameters</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Install/replace/remove reagents</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Connect/replace/disconnect electrodes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Run sequence, method, electrode calibrations</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Consult results</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Figure 29: User’s rights*
Valency

This parameter is available when creating an ISE electrode with the option From = Other.
Refer to "Create electrode", page 82.

Select the valency of the ion under study.
For example: Valency = -1 for a fluoride (F⁻) ion selective electrode.

Range available:
+1, +2, -1 or -2.

Volume

In an ISE standard addition method with programmed volumes, the user enters the volume of each addition being performed.

To avoid modifying the ionic strength of the solution by dilution effect, it is recommended to add small amounts of standard. The addition cumulative volumes should not exceed 10% of the sample test quantity.

Example:
5 additions programmed with a sample amount of 1 ml.
Enter a volume for one addition equal to or less than 20 µl and use a 1 ml burette to perform the 5 additions.

Enter in:
Edit method > Parameters
(ISE standard addition method with Std add volume = Programmed).

Refer to "ISE Standard addition method - definition", page 129.
Refer to "ISE Standard addition method - programmation", page 130.

Vstd>max
(result indicator)

Refer to "Result indicators", page 171.
**Working mode**  
Select the way in which you want to work.  
*Method:* to run a single method.  
*Sequence:* to create or run a sequence of methods. Beakers are manually changed between two method runs.  
*SAC Method:* to run a single method to be performed using a sample changer.  
*SAC Sequence:* to create a sequence of methods to be performed using a sample changer.  
*Note:* the working mode selected will have no effect on the type of method you wish to create.  
---  
Define the sample changer in the Configuration menu before selecting SAC Method or SAC Sequence.  
---  
**Enter in:**  
Main window

**Wrong buffer**  
While running an electrode calibration, the buffer analysed has not been identified by the instrument.  
End the calibration cycle. Check the buffer then start a new calibration cycle.

**Wrong type (SAC error)**  
Sample changer error: the sample changer connected does not correspond to the one programmed in the Setup > Configuration menu.  
**Example:**  
A SAC850 is connected to the ION570, SAC socket and you have declared a SAC950 in the Setup > Configuration menu.  
Review the Setup > Configuration parameters and/or connect the correct model of Sample Changer to the SAC socket of the ION570. Refer to the Sample Changer User’s Guide, part no. D21T085.

**Zero pH**  
This is the pH value (pH₀) at which the potential is zero. The zero pH is calculated after a one-point calibration.  
*Refer to "pH₀(25)", page 150.*
Appendixes
## Appendix 1: Preprogrammed methods

<table>
<thead>
<tr>
<th>Method name</th>
<th>Type</th>
<th>Reagent</th>
<th>Electrodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>Measure pH</td>
<td>-</td>
<td>PHC2401-a</td>
</tr>
<tr>
<td>EC ISO7888</td>
<td>Measurement conductivity</td>
<td>-</td>
<td>CDC741T-a</td>
</tr>
<tr>
<td>EC-pH</td>
<td>Coupled “EC ISO7888”+ “pH of water”</td>
<td>-</td>
<td>PHC3081-a CDC741T</td>
</tr>
<tr>
<td>ISE butter Cl-</td>
<td>Measurement Direct ISE</td>
<td>ISE25CL butter REF601-a T201-a</td>
<td></td>
</tr>
<tr>
<td>ISE water Cl-</td>
<td>Measurement Direct ISE</td>
<td>ISE25CL water REF601-a T201-a</td>
<td></td>
</tr>
<tr>
<td>Fluor in water</td>
<td>Measurement ISE Std addition 3 additions</td>
<td>NaF 0.001 M</td>
<td>ISEC301F-a T201-a</td>
</tr>
<tr>
<td>Nitrates in food</td>
<td>Measurement Direct ISE</td>
<td>ISE25NO3-a REF251 NO3 T201-a</td>
<td></td>
</tr>
<tr>
<td>pH of water</td>
<td>Measurement pH</td>
<td>-</td>
<td>PHC3081-a</td>
</tr>
</tbody>
</table>
Appendix 2: General information

Cleaning

The ION570 requires minimum maintenance. The exterior surface can be cleaned with tepid water and wiped dry with a soft cloth. Never use another solvent unless you have first consulted your Radiometer Analytical representative.

Transporting the ION570

Always use the packaging supplied by the manufacturer.

Remove the metal rod before transporting the ION570. Never pick-up or carry the instrument by the metal rod.

Servicing

The ION570 has been developed for connection to a grounded mains supply. The peripherals that are likely to be connected to the ION570 must conform to the relative safety standards.

DO NOT ATTEMPT TO SERVICE THIS PRODUCT YOURSELF. For servicing, please contact your Radiometer Analytical service representative at the address given below:

RADIOMETER ANALYTICAL SAS
72, rue d'Alsace
69627 Villeurbanne CEDEX - France
Tel.: +33 (0) 4 78 03 38 38
Fax: +33 (0) 4 78 03 38 27
E-mail: radiometer@analytical.com
or your local service representative:
International Standards

CE

EMC Directive (89/336/CEE)

The ION570 complies with following standards:

Class A equipment for laboratory use, according to the norm EN 61326-1.

EN 61000-4-2 level 2
EN 61000-4-3 level 1
EN 61000-4-4 level 2
EN 61000-4-5 level 2
EN 61000-4-6 level 1
EN 61000-4-11
EN 61000-3-2
EN 61000-3-3
EN 55011

Low Voltage Directive (73/23/EEC)

The ION570 complies with the following standard:

Reference standard: EN 61010-1.

Standard applied:

Standard for Electrical Equipment for Laboratory use: UL 61010A - 1

Appendix 3: Result calculations

1. ISE measurements - Direct ISE method

In Direct ISE measurements, the ion selective electrode (ISE) must be calibrated using 1 to 9 standard solutions.

For an ion selective electrode, the measured electrode potential $E$ can be plotted versus the logarithm of concentration:

$$E = E^0 - S_{25} \times \frac{T}{T_{25}} \times \log(C + C_0)$$

Where:
- $E$ = measured potential of the solution,
- $E^0$ = electrode standard potential,
- $S_{25}$ = response slope of the line $E = f(\log C)$ at 25°C in mV/pC,
- $C$ = ion concentration in the solution,
- $C_0$ = concentration (also called “experimental detection limit of the ISE electrode regarding the species under study”).
Once the $E^0$, $S_{25}$ and $C_0$ values are known, the ION570 displays the $C_{smp}$ concentration measured in the sample at the $T_{smp}$ sample temperature using the following Nernst equation:

$$C_{smp} = 10 \frac{E - E^0}{S_{25}} \frac{T_{25}}{T_{smp}} - C_0$$

While running direct ISE measurements (or standard addition measurements or ISE electrode calibration), the temperature cannot vary by more than $5^\circ C$ over the whole batch of samples (if this condition is not fulfilled, a warning message is displayed with the indication dT>5 and the result is rejected). Moreover, the temperature should be as closer as possible to the calibration temperature to get more accurate measurements.

The result is converted as follows according to the result and standard unit selected:

$$Result\ unit = standard\ unit \times c$$

where $c$ is the conversion factor.

**c conversion factor values**

This $c$ factor takes the following values according to the result and standard unit selected. The sample quantity is always expressed in volume units.

Available result and standard units:
eq/l, meq/l, mol/l, mmol/l, mg/l, µg/ml, g/l, mg/ml, ppm and %.

<table>
<thead>
<tr>
<th>Result unit</th>
<th>Standard solution unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>eq/l</td>
<td>eq/l meq/l mol/l mmol/l mg/l or µg/ml ppm g/l or mg/ml % (w/v)</td>
</tr>
<tr>
<td>eq/l</td>
<td>1 0.001 V 0.001<em>V 0.001</em>V/Ms V/Ms 10*V/Ms</td>
</tr>
<tr>
<td>meq/l</td>
<td>1000 1 1000<em>V V V/Ms 1000</em>V/Ms 10000*V/Ms</td>
</tr>
<tr>
<td>mol/l</td>
<td>1/V 0.001/V 1 0.001 0.001/Ms 1/Ms 10/Ms</td>
</tr>
<tr>
<td>mmol/l</td>
<td>1000/V 1/V 1000 1 1/Ms 1000/Ms 10000/Ms</td>
</tr>
<tr>
<td>mg/l or µg/ml or ppm</td>
<td>M_s<em>1000/V M_g/V 1000</em>M_s M_s 1 1000 10000</td>
</tr>
<tr>
<td>g/l or mg/ml</td>
<td>M_s/V 0.001<em>M_s/V M_s 0.001</em>M_s 0.001 1 10</td>
</tr>
<tr>
<td>% (w/v)</td>
<td>M_s* 0.1/V 0.0001<em>M_s/V 0.1</em>M_s 0.0001*M_s 0.001 0.1 1</td>
</tr>
</tbody>
</table>

**Table 9: c conversion factors**

Where:
- $M_s = $ standard molar weight (g/mol).
- $V =$ valency: equal to 1 or 2.

According to the result unit selected, the ION570 may require the molar weight of the analysed species. When you create an ISE electrode, you are prompted to enter the molar weight of the element. This molar weight cannot be changed as it is the case for the ion valency.
A Results factor can be defined in a direct ISE method. This factor can be set to the dilution factor and solve the dilution factor problem in a case of a direct ISE method.

**Warning!**

In a Direct or a Standard addition ISE method, the ppm and % units are expressed in weight/volume or in weight/weight with a density of the solution equal to 1.
2. ISE measurements - ISE standard addition method

In an ISE standard addition method, the additions are automatically performed using a pre-programmed standard addition reagent. The addition volumes can be programmed or automatically determined.

In the case of programmed volumes, the user selects the standard reagent, enters the volume of one addition then the number of additions to be performed.

In the case of automatically determined volumes, the ION570 calculates the volume to add in order to get a potential jump ($\Delta E$ total) due to all additions (n additions) equal to a user-selectable value (between 5 and 100 mV). The potential jump per addition ($dE$) is then determined by:

$$dE = \frac{\Delta E_{total}}{n} \geq 2mV$$

The $dE$ minimum value is 2 mV. The algorithm starts with addition of small volumes in order to determine the volume to be added to reach the potential jump target.

**Calculation principle (for programmed or automatically determined additions):**

The Cs sample concentration is determined using an iterative calculation on this following equation:

$$E_i = E^0 - \frac{S_{25} \times T}{T_{25}} \times \log \left[ \frac{C_s V + C_a V_i}{(V + V_{elec} + V_i)} \right]$$

- $C_s$ = sample concentration
- $V$ = sample initial volume
- $C_a$ = concentration of the addition
- $V_i$ = volume of the addition
- $V_{elec}$ = volume of electrolyte added
- $T$ = temperature (mean of all measured points).

**GRAN representation:**

$$\frac{(E_i - E_f)T_{25}}{S_{25}T} \times \left( \frac{V + V_{elec} + V_i}{V + V_{elec}} \right) = GRAN(V_i)$$

We use the GRAN = f(V) graphical representation allows to show the dispersion of the experimental points regarding the regression straight line.

The GRAN=f(V) curve is displayed in the "More details" menu. This curve can be printed at the end of analysis if asked for in the Edit method > Printouts menu.
During an ISE standard addition measurement, the temperature cannot vary by more than 5°C. A warning message (dT>5) is displayed and the result is rejected if this condition is not fulfilled.

The result is converted as follows according to the result and standard unit selected:

\[ \text{Result unit} = \text{standard unit} \times c \times \frac{V_{\text{dil}}}{V_{\text{smp}}} \]

where:

- \( V_{\text{dil}}/V_{\text{smp}} \) = if a dilution is programmed for the sample.
  - \( V_{\text{dil}} \) = Final dil. amount.
  - \( V_{\text{smp}} \) = Aliquot.

- \( c \) = conversion factor.

Sample and result units and the factor \( c \) have the same values as those encountered for a Direct ISE measurement method, see "c conversion factor values", page 220.
3. Conductivity measurements

To determine a conductivity value, the ION570 performs the following operations in this order:

2. Cable correction (cable resistance and cable capacity correction): $G_m$ corrected conductance value.
3. The cell constant is used to calculate the $\kappa$ conductivity at the $T$ sample temperature (measured or entered).
4. Temperature correction: conductivity recalculated at the $T_{ref}$ reference temperature or at $25^\circ$C depending on the method programmation.

3.1 Cable correction

The cable correction takes into account the cable resistance and the cable capacity.

1. Cable resistance

The influence of the cable resistance on the $G_m$ measured conductance is as follows:

$$G_m = \frac{G_S}{1 + (R \times G_S)}$$

Where:

- $G_S$ = conductance of solution (S)
- $R$ = cable resistance ($\Omega$)

The cable resistance is entered upon creating a 2 or 3 pole conductivity cell. Enter a cable resistance of 0 for a 4-pole conductivity cell. This value cannot be changed afterwards. Refer to "Create electrode", page 82.

2. Cable capacity

The cable capacity influences the measurements of very low conductance. The ION570 performs a cable capacity correction when low conductance are measured ($< 4 \mu$S).

The equation used by the ION570 enables an accurate measurement correction to be obtained for cable capacities up to 1000 pF.

The cable capacity is entered upon creating the electrode. This value cannot be changed afterwards. Refer to "Create electrode", page 82.
3.2 Cell constant correction

The ION570 calculates and displays the \( k \) conductivity of a solution on the basis of the \( G_m \) conductance measured (after cable resistance and capacity correction) and the K cell constant of the conductivity cell used.

\[
k \text{ (in } \text{S} \cdot \text{cm}^{-1} ) = K \times G_m \text{ (in S)}
\]

The K constant (expressed in cm\(^{-1}\)) is a specification of the conductivity cell which depends on the cell geometry.

To measure conductivities, you must know K. With the ION570, you can directly enter the K value in the Edit electrode menu (see "Cell constant (parameter)", page 69) or determine K by calibrating the conductivity cell (see "Electrode calibration (Fixed mode, conductivity cell)", page 102 or see "Electrode calibration (Free mode, conductivity cell)", page 103).

3.3 Temperature correction

Two types of temperature correction are available using the ION570:

- The linear correction,
- The non-linear correction of "Natural water" type.

The linear correction

Conductivities are corrected to a reference temperature using a temperature coefficient \( \theta \), a reference temperature and the following equation:

\[
k_{T_{ref}} = \frac{100}{100 + \theta \times (T - T_{ref})} \times k_T
\]

Where:

- \( T_{ref} \) = reference temperature in °C
- \( T \) = sample temperature in °C
- \( k_{T_{ref}} \) = conductivity at \( T_{ref} \)
- \( k_T \) = conductivity at \( T \)
- \( \theta \) = temperature coefficient of the sample in %/°C

With the ION570, the reference temperature can be entered between 0 and 99°C (resolution: 1°C) and the temperature coefficient between 0.00 and 9.99 %/°C (resolution: 0.01 %/°C).

These 2 parameters are available in the Edit method > Parameters menu, see "Temp. correction None/Linear/Nat. water", page 204.

"Natural water" type correction

The conductivity \( k_T \) measured at the sample temperature \( T \) is corrected to 25°C to give \( k_{25} \) using the following equation:

\[
k_{25} = f_{25} (T) \times k_T
\]

\( f_{25} (T) \) is the temperature correction factor used for the conversion of conductivity values of natural water from \( T \) to 25°C.
f_{25}(T) is calculated from a 4-degree polynomial equation. This equation fits (deviation < 0.1%) the conductivity variations against temperature for a natural water stated by ISO/DIN 7888.

\[ f_{25} = a_0 + a_1 \times T + a_2 \times T^2 + a_3 \times T^3 + a_4 \times T^4 \]

Where:
\[ a_0 = 1.917442 \]
\[ a_1 = -0.06165928 \]
\[ a_2 = 1.493149 \times 10^{-3} \]
\[ a_3 = -2.453671 \times 10^{-5} \]
\[ a_4 = 1.898527 \times 10^{-7} \]

The available range for T is 0 to 35.9°C and the factor \( f_{25}(T) \) varies from 0.808 to 1.918.

A "Natural water" type of temperature correction can be selected in the Edit method > Parameters menu, see "Temp. correction None/Linear/Nat. water", page 204.
4. Conductivity cell calibration

This is a 1-point calibration. A conductance and a temperature measurement is performed on a standard solution that has been defined in the Edit electrode menu of the conductivity cell, see "Standard (conductivity standard)", page 197.

The calibration result is the conductivity cell constant K expressed in cm⁻¹.

4.1 KCl Demal standards

Concentrations used are: 1 D, 0.1 D and 0.01 D (D = Demal). These standards are prepared by dissolving an amount of dried KCl in 1000 g of demineralised water (correction for air buoyancy must be applied to the weighing):

<table>
<thead>
<tr>
<th>Standards</th>
<th>Amount of KCl (g/1000 g of water)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KCl 1 D</td>
<td>71.1352</td>
</tr>
<tr>
<td>KCl 0.1 D</td>
<td>7.41913</td>
</tr>
<tr>
<td>KCl 0.01 D</td>
<td>0.745263</td>
</tr>
</tbody>
</table>

The conductivity of the demineralised water used must not exceed 2 μS/cm. The OIML "International Organisation of legal Metrology" Recommendation No. 56, June 1980* gives the conductivity values for these standards (in mS/cm):

<table>
<thead>
<tr>
<th>Standards/Temperature</th>
<th>0°C</th>
<th>18°C</th>
<th>25°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>KCl 1 D</td>
<td>65.14</td>
<td>97.81</td>
<td>111.31</td>
</tr>
<tr>
<td>KCl 0.1 D</td>
<td>7.134</td>
<td>11.163</td>
<td>12.852</td>
</tr>
<tr>
<td>KCl 0.01 D</td>
<td>0.7733</td>
<td>1.2201</td>
<td>1.4083</td>
</tr>
</tbody>
</table>

Measurements have been repeated more recently by the NIST for the 0.1D and 0.01D standards. The following results have been published (Journal of Solution Chemistry, Vol.20, No.4, 1991; Y.C. Wu and W.F. Koch):

<table>
<thead>
<tr>
<th>Standards/Temperature</th>
<th>0°C</th>
<th>18°C</th>
<th>25°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>KCl 0.1 D</td>
<td>7.1346</td>
<td>11.162</td>
<td>12.852</td>
</tr>
<tr>
<td>KCl 0.01 D</td>
<td>0.77309</td>
<td>1.2203</td>
<td>1.4086</td>
</tr>
</tbody>
</table>

NIST measurements cover the temperature range of 0 to 50°C. The κₜ conductivity (in mS/cm) expressed as a function of T temperature is as follows:

\[ \kappa_T = a_0 + a_1 \times T + a_2 \times T^2 + a_3 \times T^3 \]

The ai coefficients are:

<table>
<thead>
<tr>
<th>Standards/ai coef.</th>
<th>a0</th>
<th>a1</th>
<th>a2</th>
<th>a3</th>
</tr>
</thead>
<tbody>
<tr>
<td>KCl 1 D (T = 0 to 27°C)</td>
<td>65.14</td>
<td>1.7065</td>
<td>7.066 x 10⁻³</td>
<td>-5.805 x 10⁻⁵</td>
</tr>
<tr>
<td>KCl 0.1 D (T = 0 to 50°C)</td>
<td>7.1346</td>
<td>0.208431</td>
<td>9.55158 x 10⁻⁴</td>
<td>-5.77358 x 10⁻⁶</td>
</tr>
<tr>
<td>KCl 0.01 D (T = 0 to 50°C)</td>
<td>0.77309</td>
<td>2.30993 x 10⁻²</td>
<td>1.07177 x 10⁻⁴</td>
<td>-5.74159 x 10⁻⁷</td>
</tr>
</tbody>
</table>
4.2 KCl Molar standards

The conductivity of these standards as a function of temperature is given by Kolraugh 1940, Handbook of Chemistry p. 1211.

A 1M KCl (solution A) is prepared by dissolving 74.59g of KCl in water and diluting to 1 l at 18°C. The specific gravity of such a solution is 1.0449 at 18°C.

The 0.1M KCl (solution B) is obtained by diluting solution A 10 times.

The 0.01M KCl (solution C) is obtained by diluting solution B 10 times.

Most significant conductivity values of solutions B and C as a function of temperature are reproduced in the table below from Kolraugh table:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>0.1M KCl standard (µS/cm)</th>
<th>0.01M KCl standard (µS/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>7 150</td>
<td>776</td>
</tr>
<tr>
<td>5</td>
<td>8 200</td>
<td>896</td>
</tr>
<tr>
<td>10</td>
<td>9 330</td>
<td>1 020</td>
</tr>
<tr>
<td>15</td>
<td>10 480</td>
<td>1 147</td>
</tr>
<tr>
<td>18</td>
<td>11 190</td>
<td>1 225</td>
</tr>
<tr>
<td>20</td>
<td>11 670</td>
<td>1 278</td>
</tr>
<tr>
<td>21</td>
<td>11 910</td>
<td>1 305</td>
</tr>
<tr>
<td>22</td>
<td>12 150</td>
<td>1 332</td>
</tr>
<tr>
<td>23</td>
<td>12 390</td>
<td>1 359</td>
</tr>
<tr>
<td>24</td>
<td>12 640</td>
<td>1 386</td>
</tr>
<tr>
<td>25</td>
<td>12 880</td>
<td>1 413</td>
</tr>
<tr>
<td>30</td>
<td>14 120</td>
<td>1 552</td>
</tr>
<tr>
<td>34</td>
<td>15 130</td>
<td>1 667</td>
</tr>
<tr>
<td>36</td>
<td>15 640</td>
<td></td>
</tr>
</tbody>
</table>

A polynomial has been fitted to these values for both standards, giving conductivity \( C_y \) as a function of temperature:

\[
C_y = a0 + a1 \times T_m + a2 \times T_m^2 + a3 \times T_m^3
\]

\( C_y \): µS/cm

\( T_m \): °C

\( a_i \) coefficients:

<table>
<thead>
<tr>
<th>( a0 )</th>
<th>( a1 ) ( \times 10^{-1} )</th>
<th>( a2 ) ( \times 10^{-1} )</th>
<th>( a3 ) ( \times 10^{-3} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>KCl 0.1 M (( T_m = 0 ) to 36°C)</td>
<td>7 150</td>
<td>+209.3</td>
<td>+9.44 ( 10^{-1} )</td>
</tr>
<tr>
<td>KCl 0.01 M (( T_m = 0 ) to 34°C)</td>
<td>776</td>
<td>+23.62</td>
<td>+7.5 ( 10^2 )</td>
</tr>
</tbody>
</table>
4.3 KCl 0.001 M standard

Standard is prepared using demineralised water, the conductivity of this water is known in advance.

<table>
<thead>
<tr>
<th>KCl amount per 1000g of solution (g)</th>
<th>Conductivity at 25°C (µS/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.001M KCl 0.0746</td>
<td>146.9</td>
</tr>
</tbody>
</table>

The equivalent polynomial giving conductivity as a function of temperature is given by the linear equation (issued from the ASTM D1125 (1995) standard):

\[ C_y = a_0 + a_1 \times T_m \]

\( C_y \): µS/cm
\( T_m \): °C in the range 0°C - 30°C

\( a_0 \) coefficient = 77.79
\( a_1 \) coefficient = 2.7696

4.4 NaCl 25µS/cm standard

Standard is prepared using demineralised water, the conductivity of this water is known in advance.

<table>
<thead>
<tr>
<th>NaCl amount per 1000g of solution (g)</th>
<th>Conductivity at 25°C (µS/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NaCl 25 µS/cm 0.0117</td>
<td>25</td>
</tr>
</tbody>
</table>

The equivalent polynomial giving conductivity as a function of temperature follows table B.2 of the CEI 60746-3 :2002 standard (NF EN 60746-3 french version):

\[ C_y = a_0 + a_1 \times T_m + a_2 \times T_m^2 + a_3 \times T_m^3 + a_4 \times T_m^4 \]

\( C_y \): µS/cm
\( T_m \): °C in the range 0°C - 100°C

The \( a_i \) coefficients are:

<table>
<thead>
<tr>
<th>Standards/ai coef.</th>
<th>a0</th>
<th>a1</th>
<th>a2</th>
<th>a3</th>
<th>a4</th>
</tr>
</thead>
<tbody>
<tr>
<td>NaCl 25 µS/cm (Tm = 0 to 100°C)</td>
<td>13.3095</td>
<td>0.422280</td>
<td>1.873349 x 10^{-3}</td>
<td>-2.35999 x 10^{-6}</td>
<td>-3.545746 x 10^{-8}</td>
</tr>
</tbody>
</table>
4.5 NaCl 0.05% standard (w/w)

With this standard, the measurements obtained with the ION570 fit the tables published in October 1960 by G.F. Hewitt, Atomic Energy Research Establishment, Harwell, U.K.

The $\kappa_T$ conductivity (in $\mu$S/cm) is given a function of $T$ temperature by the equation stated by IEC draft 1980 (*):

$$\kappa_T = 87332 \times \left[1 + b_T \times (T - 18)\right]$$

Where:

$$b_T = a_0 + a_1 \times T + a_2 \times T^2 + a_3 \times T^3 + a_4 \times T^4$$

With:

- $a_0 = 2.11798 \times 10^{-2}$
- $a_1 = 7.86011 \times 10^{-5}$
- $a_2 = 1.54398 \times 10^{-7}$
- $a_3 = -6.26350 \times 10^{-9}$
- $a_4 = 2.27949 \times 10^{-11}$

Temperature range: 0 to 140°C.

(*) “International Electrochemical Commission”, January 1980, ”Sub-Committee 66 /WG2”.

and:

G. F. Hewitt
Chemical Engineering Division
U.K.A.E.A. Research Group
Atomic Energy Research Establishment
Harwell
October 1960.
5. Standard deviation calculation

For every result obtained on several aliquots, a mean value is calculated with which a standard deviation is associated.

Definitions:

\( R_i = \text{Result of test } i \)

\[
SR_n = \sum_{i=1}^{n} R_i
\]

\[
SR2_n = \sum_{i=1}^{n} R_i^2
\]

Mean result:

\[
R = \frac{SR_n}{N}
\]

Standard deviation on the mean value \( \sigma_\mu \):  
- Number of tests \( N = 2 \to 5 \): estimation of the Q variance for a small number of tests.

\[
\sigma^2_\mu = \frac{\left( \frac{R_{\text{max}} - R_{\text{min}}}{Q} \right)^2}{N}
\]

with \( R_{\text{max}} = \text{maximum value of the } R_i \) and \( R_{\text{min}} = \text{minimum value of the } R_i \):

<table>
<thead>
<tr>
<th>N</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1.128</td>
</tr>
<tr>
<td>3</td>
<td>1.693</td>
</tr>
<tr>
<td>4</td>
<td>2.059</td>
</tr>
<tr>
<td>5</td>
<td>2.326</td>
</tr>
</tbody>
</table>

- Number of tests \( N > 5 \)

\[
\sigma^2_\mu = \frac{SR2_n - SR_n^2}{N} \frac{1}{N(N-1)}
\]

Result is expressed with the mean value \( R \) and the standard deviation \( \sigma_\mu \) on the mean value:

\[
\text{Result} = R \pm \sigma_\mu
\]
Appendix 4: Technical specifications

Potentiometric Methods

pH electrode calibration: up to 5 points using IUPAC standards or 4-7-10 Series buffers with error recognition on buffer used.

Possibility to work with user defined buffer values using the Free buffer mode.

pH with temperature-compensated reading: probe, entered or fixed at 25°C.

Direct pH/mV measurements with recording on stable reading.

Reagent addition: up to 3 simultaneous or consecutive reagent additions.

Sequencing of up to 10 methods including electrode calibrations.

Coupling of 2 to 6 methods in one beaker, including direct ISE and EC measurements.

Conductivity Methods (EC)

Direct conductivity measurements with recording on stable reading.

Conductivity with temperature-corrected display: none, natural water (ISO 7888), linear.

Conductivity cell cable resistance compensation.

Conductivity cell calibration: manual cell constant entry or automatic determination using 1, 0.1, 0.01 Demal KCl standards, NaCl 0.05%, NaCl 25 µS/cm at 25°C low conductivity standard, 1, 0.1 and 0.01 M KCl standard.

Possibility to work with user defined standard values using the Free buffer mode.

Ion Selective Methods (ISE)

ISE measurements using standard additions or direct measurements with recording on stable reading.

Additions or calibration with up to 9 points.

Curves fitted using non-linear regression with C_0 detection limit determination according to IUPAC.

Automatic standard additions: volumes programmed or automatically determined.

Curve plotting:
GRAN plot vs. Volume for standard additions, mV = f(pC) for ISE calibration.

<table>
<thead>
<tr>
<th>Measuring ranges</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>-9 to 23 pH</td>
<td>0.001 pH</td>
</tr>
<tr>
<td>±2000 mV</td>
<td>0.1 mV</td>
</tr>
<tr>
<td>4 µS to 400 mS</td>
<td>1/40000 of the range</td>
</tr>
<tr>
<td>-10°C to +100°C</td>
<td>0.1°C</td>
</tr>
</tbody>
</table>
Printout
Automatic. GLP compliant.
Selectable: no, 80 columns, continuous, page to page.
3 levels of detail.
Laser or dot matrix printer.

Results
QC check on results with visual warning.
Statistical calculations.
Sample quantity recalculation before archiving.
Result recalculation.

Units
All standard units for samples/results.
Conductivity: µS/cm or mS/cm.
User-defined result units.

Storage capacity
Global password protection for programming access.
Non-volatile memory
User programmable: 50 methods.
Libraries for 30 electrodes and 30 reagents: more than 30 electrodes and 20 reagents pre-identified with ID and type to help programming.

Storage of 200 results. Results storage can be disabled.
Stored parameters characterised by own ID, location and calibration data.
Embedded operating procedures for electrode and reagent exchange.
Automatic electrode and QC prompt.

Sample list
Up to 126 data with alphanumerical ID.
QC sample definition.

Electrode stand - stirring
Magnetic stirrer, 22 reproducible speeds (0 to 1100 rpm) in 50 rpm steps.
Propeller connection.
Beaker volume: 5 to 400 ml.
**Burette**

1 embedded burette stand:

Burette volumes available: 1, 5, 10, 25, 50 ml.
Burette motor: 18000 steps.
Complies with ISO 8655-3.
Burette extension: 4 (with ABU52)
UV-protected encapsulated glass syringe.
Embedded operating procedures for burette exchange, air bubble removal (Flush). Rinse, Fill, Empty function.

**Inputs/outputs**

2 indicator electrode inputs.
1 reference electrode input.
1 differential input.
1 imposed current input, ± 1 mA ± 1 µA.
1 temperature input.
2/4-pole conductivity cell input.
0-5 V and 0-12 V TTL output.
0-5 V TTL input.
Serial connections for printer/PC and additional Ion analyser.
Burette and electrode input extension with ABU52
Serial connection for sample changer fitted with 10 to 126-position tray.
PS/2 port for PC keyboard and/or barcode reader.

**Languages**

English, German, Danish, French, Italian, Spanish, Swedish.
### General specifications

Casing: Fully splashproof polypropylene. Graphic 128x128 dot LCD and alphanumeric keypad.

Dimensions (H x W x D): 380 x 230 x 450 mm (excl. tubing).

Weight: 5 kg (excluding reagent bottles).

Power requirements: 47.5 – 63 Hz

115/230 Vac +15 -18%.

Environmental operating conditions: 5 to 40°C temperature.

20 to 80% relative humidity.

### Secondary fuses

Secondary fuses are mounted on the printed circuit board. If necessary contact a Radiometer Analytical representative for replacement of the fuses, as the instrument casing must be opened.

### International standards

*Refer to "International Standards", page 218.*

CE marking: Complies with EMC directive 89/336/EEC

Complies with LV directive 73/23/EEC
cETLus certification issued by ITS/SEMKO

UL standard 61010A-1

CSA standard C22 2 No.1010.1-92

### Burette specifications according to ISO 8655-3

<table>
<thead>
<tr>
<th>Burette stand</th>
<th>Nominal volume</th>
<th>Maximum permissible systematic errors</th>
<th>Maximum permissible random errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>ml</td>
<td>± %</td>
<td>± µl (a)</td>
</tr>
<tr>
<td>B501</td>
<td>&lt; 1</td>
<td>0.6</td>
<td>6</td>
</tr>
<tr>
<td>B505</td>
<td>5</td>
<td>0.3</td>
<td>15</td>
</tr>
<tr>
<td>B510</td>
<td>10</td>
<td>0.2</td>
<td>20</td>
</tr>
<tr>
<td>B525</td>
<td>25</td>
<td>0.2</td>
<td>50</td>
</tr>
<tr>
<td>B550</td>
<td>50</td>
<td>0.2</td>
<td>100</td>
</tr>
</tbody>
</table>

(a) Expressed as the deviation of the mean of a tenfold measurement from the nominal volume or from the selected volume (see ISO 8655-6:---, 8.4).

(b) Expressed as the coefficient of variation of a tenfold measurement (see ISO 8655-6:---, 8.5).

(c) Expressed as the repeatability standard deviation of a tenfold measurement (see ISO 8655-6:---, 8.5).