pH, redox and I.S.E. electrodes

Complete and clear offer which makes easy the choice of the suitable model without user’s confusion. pH electrodes: four models for portable instrument, five basic laboratory models and four models for special applications.

Every basic model is also manufactured with built-in temperature probe, T version. The system ContATC (patented) ensures maximum response speed in the temperature measurement.

Redox and new range of last generation I.S.E. electrodes are available too. The I.S.E. do not require internal electrolyte and their solid state membranes have long duration.
High quality sensors to cover all type of applications.
pH combined electrode

**ESSENTIAL PARTS**

**Cable**
The electrodes presented in this catalogue are with fixed cable. Their advantages in front of the classic screw cap electrodes are:
- The electrode replacement guarantees the cable substitution, which is normally "weary" by the use.
- The cost of the electrode is less than the equivalent with screw cap.

**Body**
Normally in glass. For applications requiring robustness, the electrodes are manufactured with a plastic body or stainless steel.

**Reference element**
This is a "cell" that supplies a stable potential (mV). Various types are available:
- **Silver wire (Ag)** Galvanically coated with AgCl. This is the typical reference element for low-cost electrodes.
- **"Sleeved" silver wire** It consists of silver wire coated with AgCl and protected inside a tube. The reference element is protected from possible alterations that may occur in the electrolyte.
- **Encapsulated AgCl crystals, cartridge** The silver wire comes into contact with a portion of Ag/AgCl crystals inside a small glass tube. This reference system ensures the best stability and longest lifespan.
- **Cartridge with Ag+ ion barrier** In some electrodes, the tube with Ag/AgCl is lengthened to house a chemical substance which acts as a barrier to silver ions. This prevents the diaphragm from clogging due to the formation and precipitation of AgCl and Ag₂S.

**Reference electrolyte**
This is a highly-concentrated saline solution into which the reference element is submerged. It comes in 3 forms: liquid, gel or solid (polymer).
- **Gel electrolyte.** Used in nonrefillable, “low-maintenance” electrodes. Most are glycerade gels.
- **Solid electrolyte.** Used in nonrefillable electrodes. Made of a conducting polymer.
- **Liquid electrolyte.** Used for refillable electrodes.

These are various types:
- **CRISOLYT A, KCl 3M** saturated with AgCl. This electrolyte is used in electrodes with reference element of Ag / AgCl wire.
- **CRISOLYT, KCl 3M**. For electrodes with reference element of encapsulated AgCl crystals.
- **CRISOLYT G, KCl + Glycerine.** For electrodes with reference element encapsulated AgCl crystals, suitable for measuring in samples with high protein content, partially organic samples containing oils or at low temperatures.
- **LiCl 1M** in Ethanol. For titrations in non-aqueous media.

**Diaphragm**
This is the point of union between the sample and the electrolyte. This is the most critical part of the electrode as it has a direct influence on the electrode life-span. A wide range of diaphragms are available. They vary according to manufacturer, application, quality and price. This catalogue features electrodes with ceramic, large porous PTFE diaphragms, sleeve and open diaphragms.
- **The ceramic diaphragm** is a porous, chemically inert plate. This is the traditional diaphragm. It allows little electrolyte flow towards the sample.
- **The PTFE ring** consists of a large porous PTFE ring through which contact between the electrolyte and the sample is made. It guarantees a large contact surface, with hardly any change in the level of conductivity of the sample. This has to do with the reduced flow of electrolyte provided by these electrodes, thanks to their gel electrolyte.
- **The sleeve diaphragm** consists of a hole in the body of the electrode, half-closed by a movable PTFE ring. Its main features include a high electrolyte flow and diaphragm that cannot be blocked. It cannot withstand temperatures exceeding 60°C.
- **The open diaphragm**, which should really be called “without diaphragm”, is actually a hole in the body of the electrode which allows the electrolyte to come into direct contact with the sample. There is no electrolyte flow. It is only used in electrodes with solid electrolyte. Two types of open diaphragms are available:
  - Lateral orifice in the body of the electrode.
  - Circular. “Ring-like” groove between the main body, the indicator electrode and the reference electrode. It allows maximum contact with the sample.

**Glass membrane**
The composition of the glass membrane affects characteristics such as sensitivity, chemical, thermal and mechanical resistance and the scale of measurement. There are specific types of glass e.g. to measure pH in the presence of certain concentrations of HF, at extremely low or high temperatures (i.e. -30°C or 100°C). The shape of the membrane also varies. It could be cylindrical, spherical, flat, pointed or micro…

The electrode response depends directly on the quality of the membrane.

**Temperature sensor (T)**
The new CRISON electrodes, T version, incorporate a temperature sensor, type Pt 1000 class B, inside their membrane. In this way pH and temperature are measured at the same point. This is the most suitable way of pH measurement, according to GLP and ISO.

“ContATC” system, (patented). (see scheme)
In the high performance laboratory models, the Pt 1000 sensor is in direct contact with the membrane and is immersed in thermo-conductive silicone. Hence a pH electrode with ContATC system can be used as a precision temperature probe.
Practical considerations in the pH measurement

**pH range**
The pH measuring range of an electrode depends on the glass membrane composition and on the reference system.
The majority of CRISON electrodes cover the pH range from 0 to 14.
The electrodes with solid electrolyte cannot be used for pH values under pH 2.

**Temperature range**
On the CRISON electrode’s body it is indicated the temperature interval at which can be used. Occasionally they can measure at slightly higher temperature than the indicated but never in continuous way. If usually the measurements are at high temperature, for example 80ºC, it is recommended to use an electrode resistant up to 100ºC because its duration will be longer.

**The binomial pH - temperature**
The effects of temperature in measuring pH are:

- **on the electrode**
  Nernst’s Law says that the electrode slope varies according to temperature in a predictable manner.
  pH-meters automatically compensate for this effect with Automatic Temperature Compensation. To do this, the temperature of the sample must be given to the instrument.
  This can be done by:
  - Connecting a temperature sensor to the pH-meter, in addition to the electrode.
  - Using an electrode with a built-in temperature sensor; the main advantage of this being that it makes handling easier. The two signals – pH and temperature – are transmitted to the instrument using a single sensor and a single cable.
  - Manually entering the temperature. In some applications, temperature does not need to be measured, either because the temperature is constant or because a broad pH value is acceptable, etc.
  In these cases, the temperature of the sample can be entered manually using the keypad on the instrument.

- **on the buffer solutions**
  Temperature makes every solution behave in a certain way. CRISON pH-meters have a built-in table of the pH values of buffer solutions at various temperatures to obtain perfect calibration at any temperature.

- **on a given sample**
  Temperature makes the pH of the products vary in different ways, and the instrument cannot compensate for this variation. Therefore, the pH value and the temperature at which the measurement was taken must always be reported together.
  Under normal working conditions, a pH-meter with automatic temperature compensation allows calibrating at ambient temperature and measuring at different temperatures.
  Nevertheless, if very high precision is required, the buffer solutions used in the calibration and the sample must be at the same temperature or the isopotential point of the electrode must be determined.
  Isopotential, pHiso (isoph) Potential (mV) of a pH electrode that does not vary with the temperature. This is the intersection of the calibration lines obtained at different temperatures. Normally it is accepted that this value corresponds to pH 7. In fact, this value is slightly different.
  With the new CRISON pH-meters GLP+, the pHiso can be adapted to the electrode in use.

- **Minimum sample volume**
This will depend on the shape of the receptacle and the electrode used for the measurement.
When the sample volume is very small, it is recommended to carry out the measurement in a test tube and / or to use a “micro” electrode.

**Immersion depth of the electrode**
To obtain a correct measurement of the pH, the electrode must be immersed at least until the diaphragm is covered (fig A).
If the sample temperature differs from ambient temperature, it is necessary to immerse the electrode until the temperature sensor and the reference element are covered. In this way, fast and precise measurements will be obtained (fig B).

**Storage**
The electrode must always be stored in the protective sleeve with some of the corresponding electrolyte solution. It can be done easily using the CRISON “storage protector”.
The CRISON “storage protector” improves 3 main concepts with regard to the classic “protectors”:
  - easy use thanks to the screw.
  - an o-ring completely seals the protective sleeve to avoid electrolyte spillage (white crystallization).
  - it prevents over-pressures on the electrode diaphragm, that in some cases could quickly obstruct the diaphragm.

**Electrode life expectancy**
The average life expectancy of a pH electrode is approximately 1 year.
This period of time depends on the quality and use: number of samples to measure, measurements at the extremes of the pH scale, temperature and maintenance of the electrode.
If your electrode has a shorter life-span, please enquire; you could be using the incorrect electrode!
Electrodes exposed to high temperatures or very alkaline media do not last as long.
To avoid accidental breakage of the electrodes with glass body, use of a "working protector" is very useful.
The CRISON “working protector”, made of polypropylene, is screwed to the electrode and protects it against knocks during use.

**Quality-price ratio**
The quality of the electrode has a direct bearing on the reliability of measurement. CRISON only supplies top quality electrodes because experience has proven these to be a better investment in the medium and long-term.

**Guarantee**
CRISON electrodes are guaranteed for a six-month period.
The guarantee only covers manufacturing defects.
# pH Electrodes. Application Table

<table>
<thead>
<tr>
<th>Sector</th>
<th>Application</th>
<th>Portable</th>
<th>Laboratory</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water</strong></td>
<td>In general</td>
<td>50 50</td>
<td>50 / 50 / 50 / 14</td>
<td>The diaphragm must ensure big contact between electrolyte and sample.</td>
</tr>
<tr>
<td></td>
<td>Low conductivity</td>
<td>50 52</td>
<td>50 21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Waste water</td>
<td>50 51</td>
<td>50 11</td>
<td>Electrodes with clog-resistant diaphragm.</td>
</tr>
<tr>
<td></td>
<td>Irrigation water</td>
<td>50 50</td>
<td>50 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soils</td>
<td>50 50</td>
<td>50 14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soils with low level of salts</td>
<td>50 52</td>
<td>50 21</td>
<td></td>
</tr>
<tr>
<td><strong>Agriculture</strong></td>
<td>Irrigation water</td>
<td>50 50</td>
<td>50 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soils</td>
<td>50 50</td>
<td>50 14</td>
<td></td>
</tr>
<tr>
<td><strong>Food</strong></td>
<td>Soft drinks</td>
<td>50 52</td>
<td>50 14</td>
<td>The electrodes recommended for the food industry require a special electrolyte, CRISOLYT G, because this type of sample normally contains high levels of proteins. In some cases an electrode with a clog-resistant diaphragm may be necessary. In general, all these electrodes must be regenerated periodically with an electrode-cleaning solution with pepsin. Point-shaped membrane electrodes are appropriate where puncture measurements are taken.</td>
</tr>
<tr>
<td></td>
<td>Cacao and derivatives</td>
<td>50 51</td>
<td>50 11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meats, hams, delicatessen meats</td>
<td>50 53</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beer</td>
<td>50 52</td>
<td>50 14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fruits and vegetables</td>
<td>50 53</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Milk</td>
<td>50 51</td>
<td>50 / 50 / 15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Butter, yoghout and ice-cream</td>
<td>50 51</td>
<td>50 / 50 / 15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cheese</td>
<td>50 53</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bread dough</td>
<td>50 53</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wine, musts and vinegars</td>
<td>50 51</td>
<td>50 / 50 / 21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Juices and canned vegetables</td>
<td>50 51</td>
<td>50 11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brine</td>
<td>50 50 / 50 51</td>
<td>50 / 50 / 14</td>
<td></td>
</tr>
<tr>
<td><strong>Biology and Pharmacy</strong></td>
<td>Agar</td>
<td>*</td>
<td>50 27 / 50 15</td>
<td>50 27 for surfaces. 50 15, semi-liquid samples.</td>
</tr>
<tr>
<td></td>
<td>Small volume of sample</td>
<td>*</td>
<td>50 28 / 50 29</td>
<td></td>
</tr>
<tr>
<td><strong>Colouring</strong></td>
<td>Colourings and dyes</td>
<td>50 52</td>
<td>50 21</td>
<td>The electrode must be cleaned immediately after measure.</td>
</tr>
<tr>
<td></td>
<td>Creams</td>
<td>50 52</td>
<td>50 15</td>
<td>For variable or high temperatures use 50 15.</td>
</tr>
<tr>
<td></td>
<td>Gels, emulsions and soaps</td>
<td>50 51</td>
<td>50 / 50 / 50 / 21</td>
<td>These will normally be viscous samples, or samples with ions which may react with the Ag+ ion. As a result, electrodes with an Ag+-free electrolyte and clog-resistant diaphragm are best.</td>
</tr>
<tr>
<td></td>
<td>Skin</td>
<td>*</td>
<td>50 27</td>
<td></td>
</tr>
<tr>
<td><strong>Cosmetics</strong></td>
<td>Leather</td>
<td>*</td>
<td>50 27</td>
<td>Electrodes with flat membrane.</td>
</tr>
<tr>
<td></td>
<td>Treatment baths</td>
<td>50 51</td>
<td>50 11</td>
<td>Electrodes with clog-resistant diaphragm.</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td>Practices</td>
<td>50 50</td>
<td>50 / 50 / 14</td>
<td></td>
</tr>
<tr>
<td><strong>Photography</strong></td>
<td>Baths</td>
<td>50 52</td>
<td>50 14</td>
<td></td>
</tr>
<tr>
<td><strong>Galvanic</strong></td>
<td>Baths</td>
<td>50 50 / 50 52</td>
<td>50 14</td>
<td></td>
</tr>
<tr>
<td><strong>Paper</strong></td>
<td>Paper, cardboard and fibres</td>
<td>*</td>
<td>50 27</td>
<td>Electrodes with flat membrane.</td>
</tr>
<tr>
<td></td>
<td>Paper pulp or paste</td>
<td>50 51</td>
<td>50 11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dark lyes</td>
<td>50 52</td>
<td>50 21</td>
<td></td>
</tr>
<tr>
<td><strong>Paint</strong></td>
<td>Paint, varnish, emulsions</td>
<td>50 52</td>
<td>50 21</td>
<td>After measure, clean the electrode immediately.</td>
</tr>
<tr>
<td><strong>Resins</strong></td>
<td>Natural (latex, etc) and synthetic</td>
<td>*</td>
<td>50 21</td>
<td>Electrodes with sleeve diaphragm.</td>
</tr>
<tr>
<td><strong>Textile</strong></td>
<td>Fabrics and prints</td>
<td>*</td>
<td>50 27</td>
<td>Electrodes with flat membrane.</td>
</tr>
<tr>
<td></td>
<td>Dyes and colourings</td>
<td>50 52</td>
<td>50 21</td>
<td>Electrodes with clog-resistant diaphragm.</td>
</tr>
<tr>
<td><strong>University</strong></td>
<td>Research</td>
<td>*</td>
<td>50 15</td>
<td></td>
</tr>
</tbody>
</table>

- High alkalinity samples: 50 15
- Detergent, Soaps: 50 52
- Solutions containing HF: 50 26
- HF attacks glass, do not exceed the limit for HF concentration.
- Gels for electrophoresis: 50 27
- Electrodes with flat membrane.
- Solutions with proteins: 50 52
- 50 / 50 / 50 / 15
- Requires CRISOLYT G as electrolyte.
- Solutions with sulphides: 50 14
- 50 15
- Ag+ free electrolytes should be used.
- The electrodes with silver ion barrier are the best.
- Flat, laminate, rough surfaces: 50 27
- A drop of distilled water must be used to ensure contact.
- Preparation of buffers: 50 50
- 50 14
- The TRIS buffers require big-contact diaphragms.
- TRIS: 50 52
- 50 21
- Temperatures higher than 80 °C: 50 52
- 50 15
- Low temperatures, up to -10 °C: 50 14
- Acid-base titration in aqueous media: 50 14
- Choose the electrode in accordance with the sample's type.
- Acid-base titration in food: 50 21 / 50 11
- Non-aqueous electrolyte is required for anhydrous media.
- Acid-base titration in non-aqueous media: 50 21 (LiCl)

* Ask for screw cap electrode range.
These are fixed-cable electrodes with a plastic MP-5 connector, gold-coated contacts and IP 67 protection. Ergonomic and robust, designed for taking measurements in the field. The electrode can be adequately held without harming the cable. All electrodes are low-maintenance. The internal electrolyte inside the membrane is gel preventing the air bubble formation. Every model has a version with integrated temperature probe = T.

**Details:**

**Universal pH 50 50 T**

Low Cost pH electrode. The plastic body protects the membrane against knocks.

**Applications**  
Measurements in aqueous samples in general.

**Limits**  
Low-conductivity, dirty or viscous solutions. Products with colloids or solids in suspension. Samples containing sulphides, reducing sugars or other substances which react with the silver ions. Temperatures exceeding 80 ºC. Organic solvents.

**Specifications**

<table>
<thead>
<tr>
<th>Electrode code</th>
<th>50 50</th>
<th>50 50 T</th>
<th>50 51</th>
<th>50 51 T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0…14 pH</td>
<td>2…14 pH</td>
<td>0…14 pH</td>
<td>2…14 pH</td>
</tr>
<tr>
<td>Operating temperature (ºC)</td>
<td>0…80 ºC</td>
<td>0…80 ºC</td>
<td>0…80 ºC</td>
<td>0…80 ºC</td>
</tr>
<tr>
<td>Reference element</td>
<td>Ag wire</td>
<td>sleeved Ag wire</td>
<td>ceramic</td>
<td>open circular</td>
</tr>
<tr>
<td>Diaphragm</td>
<td>ceramic</td>
<td>gel</td>
<td>solid</td>
<td>ceramic</td>
</tr>
<tr>
<td>Electrode</td>
<td>Ti</td>
<td>gel</td>
<td>solid</td>
<td>Ti</td>
</tr>
<tr>
<td>Body material</td>
<td>interior glass / exterior polycarbonate (PC)</td>
<td>gel</td>
<td>glass</td>
<td>interior glass / exterior polycarbonate (PC)</td>
</tr>
</tbody>
</table>
## For difficult samples

**pH 50 52**

The large annular porous PTFE diaphragm of these electrodes assures the optimum contact between electrolyte and sample.

**Applications**
Measurements in "difficult" samples, creams, dirty or viscous samples.
Measurements at high temperature up to 100 °C.
Particularly recommended for measuring distilled water.

They are supplied with a "working protector" to avoid accidental breakage.

## Puncture, stainless steel body

**pH 50 53**

The most robust puncture electrodes.
Unique on the market:
- Stainless steel external body.
- Can measure with the membrane in any position.
- With built-in temperature probe 50 53 T. A single puncture is sufficient to measure pH and temperature and to compensate for the temperature effect on the pH measurement.

**Applications**
Measurements in semi-solids: cheeses, meats, fish, fruits, bread dough, etc. These electrodes can also be used for measurements in aqueous samples.

**Limits**
pH < 2.
Temperatures exceeding 60 °C

## For redox measurements

**pH 50 55**

Platinum electrode for oxide-reduction potential (ORP) measurements in aqueous samples.

**Applications**
Chemical waste water treatment, galvanic baths, etc.

**Limits**
Temperatures higher than 80 °C.

## MULTISENSOR FOR MM 40

**pH 50 59**

Developed to measure with CRISON portable MM 40.
Composed by one pH electrode, one conductivity cell and one temperature probe, all in one body.

**Applications**
Agriculture: irrigation water, hydroponic culture, etc.
Industry: process water, gas scrubbing towers, etc.
Education: laboratories at school.

**Limits**
Dirty/viscous samples. Conductivity > 30 mS/cm.

### Specifications

<table>
<thead>
<tr>
<th>50 52</th>
<th>50 52 T</th>
<th>50 53</th>
<th>50 53 T</th>
<th>50 55</th>
<th>50 59</th>
</tr>
</thead>
<tbody>
<tr>
<td>0...14 pH</td>
<td>0...100 °C</td>
<td>2...14 pH</td>
<td>0...60 °C</td>
<td>± 2000 mV</td>
<td>0...14 pH, 5...30000 µS/cm</td>
</tr>
<tr>
<td>sleeved Ag wire</td>
<td></td>
<td>cartridge</td>
<td></td>
<td>Ag wire</td>
<td>Ag wire</td>
</tr>
<tr>
<td>anular of porous PTFE</td>
<td></td>
<td>1 ceramic + 1 open</td>
<td></td>
<td>1 ceramic</td>
<td>1 ceramic</td>
</tr>
<tr>
<td>gel</td>
<td></td>
<td>solid</td>
<td></td>
<td>gel</td>
<td></td>
</tr>
<tr>
<td>glass</td>
<td></td>
<td>interior glass / exterior stainless steel 316</td>
<td></td>
<td>glass / PC</td>
<td>glass / titanium / PC</td>
</tr>
</tbody>
</table>
A selection of five electrodes covering 90% of the pH measurement applications. Two low maintenance models, without electrode re-filling. The rest of them with liquid electrolyte.

**Details:**

<table>
<thead>
<tr>
<th>Electrode Code</th>
<th>Diagram</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 10</td>
<td>![Diagram of 50 10 Electrode]</td>
<td>Gel electrolyte (non-refillable) Wire reference element Ceramic diaphragm</td>
</tr>
<tr>
<td>50 11</td>
<td>![Diagram of 50 11 Electrode]</td>
<td>Polymer electrolyte (non-refillable) Sleeved reference element Open diaphragm</td>
</tr>
<tr>
<td>50 14</td>
<td>![Diagram of 50 14 Electrode]</td>
<td>Electrolyte: Crisolyt Diaphragms 2, ceramic Silver ion barrier Encapsulated reference element</td>
</tr>
<tr>
<td>50 15</td>
<td>![Diagram of 50 15 Electrode]</td>
<td>Electrolyte: Crisolyt G Diaphragms 3, ceramic Encapsulated reference elements</td>
</tr>
<tr>
<td>50 21</td>
<td>![Diagram of 50 21 Electrode]</td>
<td>Electrolyte: Crisolyt Sleeved diaphragm</td>
</tr>
</tbody>
</table>

50 15 has 2 equal reference elements, placed close to the sample. It improves the response time with temperature variation.

**Specifications**

<table>
<thead>
<tr>
<th>Electrode Code</th>
<th>50 10</th>
<th>50 10 T</th>
<th>50 11</th>
<th>50 11 T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring interval</td>
<td>0…14 pH</td>
<td>2…14 pH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working temperature</td>
<td>0…80 °C</td>
<td>0…80 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference element</td>
<td>Ag wire</td>
<td>sleeve Ag wire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diaphragm</td>
<td>ceramic</td>
<td>open circular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrolyte</td>
<td>gel</td>
<td>solid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body material</td>
<td>interior glass / exterior polycarbonate (PC)</td>
<td>glass</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Low Cost**

**pH 50 10**

Low maintenance electrodes. The plastic body protects the membrane against knocks.

**Applications**

Measurements in aqueous media in general.

**Limits**

Low conductivity, dirty or viscous samples. Products containing colloids or solids in suspension. Samples containing sulphides, reducing sugars or other substances which react with the silver ion. Temperatures exceeding 80°C.

**With open diaphragm**

**pH 50 11**

With solid electrolyte (polymer conductor). The open diaphragm around the membrane facilitates the measuring in some media where other electrodes have certain difficulties. This is the laboratory version of an electrode used in the industry with great success. The improvements in front of the classic 52 21 are no electrolyte consumption, easier to use, clean and store.

**Applications**

Food, viscous media, dirty samples, etc.

**Limits**

Samples with pH < 2. Temperatures exceeding 80°C. Distilled water.
**High performance**

**pH 50 14**

They offer better performance compared with other similar electrodes due to their membrane, encapsulated reference system with silver ion barrier and the two diaphragms.

**Applications**

For aqueous media in general. Suitable for samples containing sulphurs, reducing sugars or other substances which react with silver ions.

**Limits**

Viscous solutions or with colloids.

**pH 50 14 T**

**High Tech**

**pH 50 15**

The most robust laboratory electrode against high alkalinity and temperature (special membrane HA). Fast response to temperature changes. Three diaphragms ensure stable electrolyte flow.

Crisolyt, an electrolyte with glycerine, avoids the reaction between KCl and proteins.

**Applications**

Samples with proteins. Measurements with rapid changes in temperature and/or highly alkaline samples.

The perfect electrode for investigation.

**Limits**

Viscous solutions or products with colloids.

**pH 50 15 T**

**For difficult samples**

**pH 50 21**

The sleeve diaphragm is impossible to be clogged and ensures high electrolyte flow. Electrode suitable for the most difficult samples.

**Applications**

Samples with very low conductivity. e.g. distilled water.

Samples with colloids, wines, paint, etc.

Very viscous samples, emulsions, creams, etc.

**Limits**

Samples with temperatures exceeding 60 °C.

**pH 50 21 T**

<table>
<thead>
<tr>
<th>50 14</th>
<th>50 14 T</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…14 pH</td>
<td>0…14 pH T</td>
</tr>
<tr>
<td>-10…100 °C</td>
<td>-5…100 °C</td>
</tr>
<tr>
<td>cartridge with Ag⁺ barrier</td>
<td>cartridge with Ag⁺ barrier</td>
</tr>
<tr>
<td>2 ceramic</td>
<td>3 ceramic</td>
</tr>
<tr>
<td>CRISOLYT</td>
<td>CRISOLYT G</td>
</tr>
<tr>
<td>glass</td>
<td>glass</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>50 15</th>
<th>50 15 T</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…14 pH</td>
<td>0…14 pH T</td>
</tr>
<tr>
<td>-5…100 °C</td>
<td>-5…100 °C</td>
</tr>
<tr>
<td>cartridge with Ag⁺ barrier</td>
<td>cartridge with Ag⁺ barrier</td>
</tr>
<tr>
<td>3 ceramic</td>
<td>3 ceramic</td>
</tr>
<tr>
<td>CRISOLYT</td>
<td>CRISOLYT G</td>
</tr>
<tr>
<td>glass</td>
<td>glass</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>50 21</th>
<th>50 21 T</th>
</tr>
</thead>
<tbody>
<tr>
<td>0…14 pH</td>
<td>0…14 pH T</td>
</tr>
<tr>
<td>0…60 °C</td>
<td>0…60 °C</td>
</tr>
<tr>
<td>cartridge with Ag⁺ barrier</td>
<td>cartridge with Ag⁺ barrier</td>
</tr>
<tr>
<td>sleeve</td>
<td>sleeve</td>
</tr>
<tr>
<td>CRISOLYT</td>
<td>CRISOLYT</td>
</tr>
<tr>
<td>glass</td>
<td>glass</td>
</tr>
</tbody>
</table>
**Special pH electrodes**

For applications that require some special feature of the electrode. For example, small sample amount, solutions containing hydrofluoric acid, etc.

### Details:

**50 26**
- Electrolyte: CRISOLYT
- Membrane resistant to HF

**50 27**
- A drop of distilled water makes easy the measurement.

**50 28**
- During measurements the diaphragm should be covered.

**50 29**
- During measurements the diaphragm should be covered.

**50 56 / 57 / 58**
- Gel or liquid electrolyte

**I.S.E.**
- WITHOUT internal electrolyte

**50 44**
- Internal electrolyte, gel
- External electrolyte, lithium acetate

### Specifications

<table>
<thead>
<tr>
<th>Electrode code</th>
<th>50 26</th>
<th>50 27</th>
<th>50 28</th>
<th>50 29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring interval</td>
<td>1…11 pH</td>
<td>0…14 pH</td>
<td>0…14 pH</td>
<td></td>
</tr>
<tr>
<td>Working temperature</td>
<td>0…80 ºC</td>
<td>0…80 ºC</td>
<td>0…80 ºC</td>
<td></td>
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<tr>
<td>Reference element</td>
<td>cartridge</td>
<td>cartridge</td>
<td>cartridge</td>
<td></td>
</tr>
<tr>
<td>Diaphragm</td>
<td>ceramic</td>
<td>anular in PTFE</td>
<td>ceramic</td>
<td></td>
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<tr>
<td>Electrolyte</td>
<td>CRISOLYT</td>
<td>CRISOLYT</td>
<td>CRISOLYT</td>
<td></td>
</tr>
<tr>
<td>Body material</td>
<td>glass</td>
<td>glass</td>
<td>glass</td>
<td></td>
</tr>
</tbody>
</table>

### For samples with HF

**50 26**
- The membrane is resistant to HF in the conditions shown in the table.
- Higher content or at lower pH values the membrane is destroyed in very short period of time.

<table>
<thead>
<tr>
<th>pH@20°C</th>
<th>F' limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>300 ppm</td>
</tr>
<tr>
<td>3</td>
<td>1000 ppm</td>
</tr>
<tr>
<td>≥4</td>
<td>6000 ppm</td>
</tr>
<tr>
<td>≥5</td>
<td>without limit</td>
</tr>
</tbody>
</table>

### For flat surfaces

**50 27**
- Its main characteristic is that its diaphragm and the membrane are on the same plane.

**Applications**
- Paper, fabric, leather, agar, leaves, etc.

### For microsamples

**50 28, Ø 3**
- pH

**50 29, Ø 6**
- pH

Electrodes suitable to measure pH in very small sample volumes.
- The 50 26 can measure in volumes from 100 µl.

**Applications**
- Biology and clinics.

**Limits**
- Fragile, especially 50 28.

---

A drop of distilled water makes easy the measurement.

During measurements the diaphragm should be covered.

During measurements the diaphragm should be covered.

Gel or liquid electrolyte

Electrolyte

Ceramic diaphragm

PTFE diaphragm

Flat membrane

Sample

Encapsulated reference element

<table>
<thead>
<tr>
<th>Electrode code</th>
<th>50 26</th>
<th>50 27</th>
<th>50 28</th>
<th>50 29</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH, redox and I.S.E. electrodes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10
For redox measurements

- 50 56, gel
- 50 57
- 50 58, micro

Platinum electrodes for oxide-reduction potential (ORP) measurements in aqueous samples in general.

50 56 is a low maintenance electrode and does not require electrolyte refilling.

**Applications**

Oxide-reduction titration.

**Limits**

Temperature exceeding 80 °C.

---

**Ion Selective Electrodes**

- 96 50, 96 51, 96 52, etc.

New range of electrodes of the latest technology:

- Compact electrodes without maintenance.
- Without internal electrolyte nor spare membranes.
- New more sensitive and long-lasting membranes than the classic ones.
- With fixed cable and BNC connector.

**Important:** The I.S.E. electrodes are indicator and for measurements require a reference electrode.

- **Code**
- **Ion**
- **Meas. interval**
- **Conditions**
- **50 50** Na⁺ 0.05 mg/l…23 g/l pH 3…10
- **50 51** Br⁻ 0.4 mg/l…80 g/l pH 1…12
- **50 52** Cl⁻ 1 mg/l…35 g/l pH 1…12
- **50 53** CN⁻ 0.03 mg/l…0.26 g/l pH 11…13
- **50 54** I⁻ 0.06 mg/l…130 g/l pH 2…12
- **50 55** F⁻ 0.05 mg/l…100 g/l pH 1…9
- **50 56** Ag⁺ 0.05 mg/l…100 g/l pH 1…9
- **50 57** S²⁻ 0.03 mg/l…32 g/l pH 13…14
- **50 58** Cu²⁺ 0.5 mg/l…64 g/l pH 2…7
- **50 59** Cd²⁺ 0.1 mg/l…11 g/l pH 3…7
- **50 60** Ca²⁺ 0.04 mg/l…4 g/l pH 3.5…11
- **50 61** K⁺ 0.4 mg/l…39 g/l pH 1…9
- **50 62** NO₃⁻ 0.4 mg/l…62 g/l pH 3…9
- **50 63** NH₄⁺ 0.9 mg/l…1.8 g/l pH 3…8.5
- **50 64** NO₂⁻ 0.5 mg/l…460 mg/l pH 4.5…8

---

**Reference electrode**

- 50 44

**Features:**

- Internal gel electrolyte, difficult to contaminate.
- It is supplied with lithium acetate as electrolyte in the salt bridge. This is the suitable electrode for all CRISON I.S.E. electrodes.
- Big ceramic diaphragm, easily dismounted.
- This electrode can be used for general applications too.

**Spare Part**

52 43, ceramic diaphragm.
Other sensors: for E.C., D.O., etc.

Sensors manufactured under specifications and design of CRISON INSTRUMENTS, S.A.

www.crisoninstruments.com