The conductivity cell. A little theory

There are various types of cell on the market:
- With two electrodes. This is the traditional system.
- With four electrodes. Used in dirty media with high conductivity levels.
- Induction. Used with very high conductivity and in highly-corrosive mediums.

The type of conductivity meter the user has will determine the type of cell he/she will use.
CRISON offers different types of cell with two electrodes, which cover the range usually used for lab measuring.

**Two-electrode cell**
Comprises two, or even three, metal electrodes. The cell is usually displayed as two 1 cm² metal plates with a 1 cm separation between them. This is equivalent to a 1 cm⁻¹ constant.

These days, the number, form, material and size of the plates varies from model to model, but with a single aim: to improve measurement, i.e. the conductivity meter and the cell together display a wide-ranging scale of measurement with a high degree of precision.

**Cells with temperature sensors**
The appearance on the market of cells with integrated temperature sensors means that conductivity and temperature can be measured simultaneously, thus allowing automatic correction of the effect that temperature will have on the conductivity of the sample.

**Cell constant**
The constant is an intrinsic feature of the cell. It will depend on cell geometry and is expressed as cm⁻¹. No single cell is capable of measuring the full range of conductivity with a sufficient degree of precision. That is why cells with different constants are used which will allow the user to take exact measurements on different ranges.

- Cell with a constant of C = 1 cm⁻¹. This is the most universal one because it allows low to relatively-high conductivities to be measured.
- Most CRISON conductivity meters can be calibrated with various standard solutions of low, medium and high conductivity, reducing the number of errors displayed by the cells at the extremes of the scale. See graphs with the behaviour of the cells with the different conductivity meters.

**Cells with other constants.**
When conductivities which fall outside the measurement range of the C=1 cm⁻¹ cell are to be measured, or the errors displayed by this cell are not admitted, cells with other constants must be used.
- C = 0.1 cm⁻¹, for the low-conductivity area.
- C = 10 cm⁻¹ for high-conductivity areas.

**Response from a standard cell with a constant of C=1 cm⁻¹**

**Response from standard cells with constants of C=0.1 and 10 cm⁻¹**
The conductivity cell.
Essential parts and practical considerations

**Connector**
Most lab conductivity cells are fixed-cable with banana connectors. When the cell has an integrated temperature sensor, it must be connected separately. In portable instruments the classic banana connector has been replaced by multiple connectors which include the temperature sensor connection.

**Body material**
It can be made of glass or plastic. Plastic is stronger.

**Measurement plates material**
The material from which the measurement electrodes are made also varies. Traditionally platinum-electrode cells have been used. Platinum is normally electroplated with chloro-platinum acid, giving it a rough finish known as “platinum black”. This increases the measurement surface area and improves cell response. These days platinum cells with a glass body are still being used in the lab. Other materials are used in industry to endow the cells with mechanical and chemical strength. The most frequently-used materials are titanium, stainless steel and graphite.

**Immersion depth**
The liquid must cover the air outlet hole.

**Minimum volume of sample**
This will depend on the shape of the measurement receptacle. Normally a few ml will be sufficient.

**Cell life**
Cells can be used indefinitely, providing the necessary maintenance is given and, of course, that they do not break.

**Re-platinising**
By re-platinising the measurement plates of a platinum cell are coated electrolytically. This increases the speed and precision of the reading. CRISON recommends sending the cells for re-platinising to our after-sales service, since the reagents required are expensive, this operation is not performed very frequently and there is a certain risk involved in handling highly-corrosive reagents.

**Most frequent problems, possible causes and action**
- Conductivity measurement different from the value expected.
  - Check that the cell used is the appropriate one for the measurement range.
  - Check that the cell is not dirty and that there are no air bubbles between the plates.
  - Recalibrate using the appropriate standard solution.
- Slow response or instability
  - Check that the cell is not dirty and that there are no air bubbles between the plates.
  - If a platinum cell is used, it may need re-platinising.
- Unaccepted cell constant.
  - Check that the standard solutions are in good condition and that the value of the cell constant is the same as the one selected on the instrument.

**Price-quality ratio**
In practice, the quality of the instrument and cell used has a direct bearing on the reliability of a measurement. CRISON only supplies top quality conductivity meters and cells because experience has proven them to be a better investment over the mid- to long-term.

**Guarantee**
CRISON cells are guaranteed for 6 months. The guarantee only covers manufacturing defects. The guarantee does not cover defects that may arise from incorrect use, handling, application or maintenance, or as a result of premature wear inherent to certain samples.