

Ion Electrochemical Reactor

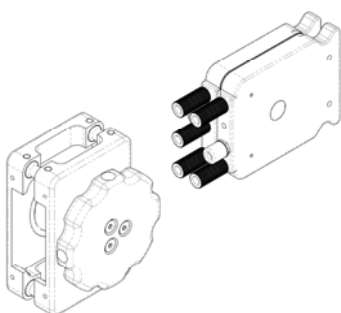
The Ion continuous flow electrochemical reactor has been developed through a collaboration between Vapourtec and Prof. Thomas Wirth of Cardiff University. The goal for this collaboration was to develop an easy to use, highly versatile continuous flow electrochemical for lab scale research.

Ion features:

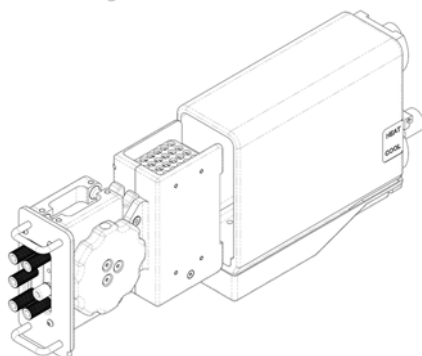


- ✓ Options for integrated or standalone operation
- ✓ Compatible with E-Series and R-Series systems
- ✓ Ability to heat and cool the reactor -10°C to 100°C
- ✓ Operation at pressure up to 5 bar
- ✓ Easy to assemble / disassemble, leak-free operation
- ✓ Broadest range of electrode materials possible
- ✓ Uses flat 5 cm x 5 cm electrodes. This size is readily available
- ✓ Flexibility in electrode spacing, electrode area and reactor volume
- ✓ Option to add a reagent part way through the reactor
- ✓ Capable of divided cell operation with proton exchange membrane
- ✓ Optional connection for a reference electrode

Options for stand-alone or integrated reactor



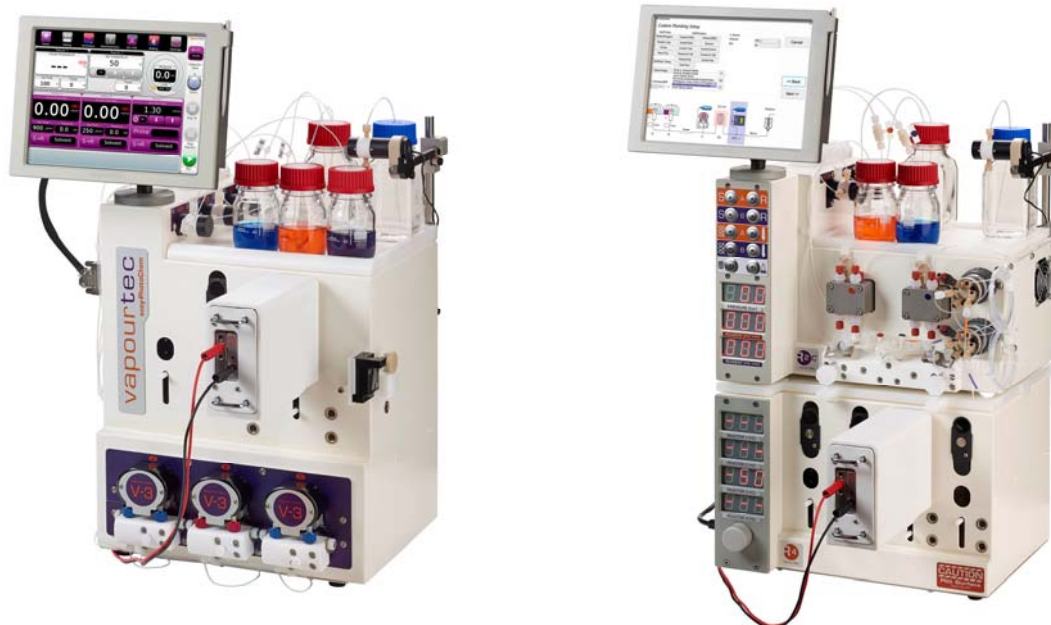
The **Stand-alone** version of the Ion is designed for use in conjunction with your Vapourtec system or with 3rd party pumps and power supply. This version does not include the parts that allow temperature control of the reactor. In other respects, the stand-alone version is identical to the integrated version using identical electrodes and membranes.



The **Integrated** version is supplied together with temperature sensor, heat transfer accessories and housing for mounting the reactor onto your Vapourtec E-Series or R-Series flow chemistry systems.

Compatible with E-Series & R-Series systems

The integrated version of the Ion electrochemical reactor has been designed to interface with both E-Series and R-Series Vapourtec flow chemistry systems. Connecting the Ion reactor takes less than 5 minutes. Once connected, automated electrochemical reactions can be set up and run using your Vapourtec software.



Ability to both heat and cool the reactor

Once integrated with your Vapourtec flow chemistry system, the temperature of the Ion electrochemical reactor can be controlled between -10°C and 100°C . This opens up a vast chemical reaction space to explore. Historically, the vast majority of electrochemical reactions have been carried out at room temperature and there are very few examples of cooling an electrochemical reaction. Some important recent literature examples, published by [Pfizer](#) and [Keio University](#), Japan show improved reaction outcomes when heating electrochemical reactions.

Operation at pressure

The Ion electrochemical reactor has been designed to operate at pressures of up to 5 bar. There are two important benefits from operation at pressure; to take solvents up to temperatures well above their normal boiling points (e.g. using methanol in electrochemical reactions at 100°C) and the ability to control the volume of gaseous reagents within the reactor.

Easy to assemble and disassemble

In electrochemical reactions one of the most important variables is the material and surface properties of the electrodes. In a research environment electrodes will be changed regularly. Vapourtec has paid particular attention in the design of the Ion electrochemical reactor to ensure that the electrodes can be quickly and easily changed. Also to ensure the design is sufficiently robust to guarantee leak-free operation after every change of electrode.

Broadest range of electrodes

In your research environment it is important to you that your electrochemical reactor is capable of undertaking a wide range of different reactions. One of the key variables is the material from which the electrodes are manufactured. Vapourtec can supply a range of 20 different electrode materials; these [range](#) from simple stainless steel through 5 different forms of carbon to exotic materials like boron doped diamond.

Electrodes are simply flat foils 5 cm x 5 cm

The Ion Electrochemical reactor uses electrodes that are flat foils 5 cm x 5 cm in size in thickness from 0.1 mm to 1.0 mm. Electrodes do not have to be purchased from Vapourtec, this size of material is readily available from third party suppliers of research materials such as [Goodfellow](#) or [Alfa Aesar](#). If the material you need to trial is not available from Vapourtec then it can be easily sourced elsewhere.

Flexibility in electrode spacing and reactor volume

In the Ion reactor the electrode spacing and the flow path is defined by an inert plastic membrane. This membrane is easily changed. Vapourtec supply a range of membrane thicknesses allowing you to choose the ideal reactor configuration for your reaction:

- Electrode spacing between 0.13 mm and 1.0 mm
- Reactor volumes from 0.15 ml to 1.20 ml

Add a reagent part way through the reactor

The Ion reactor is equipped with an additional fluid connection. If required, this allows a reagent to be added part way through the reactor. This connection is useful to add a second reagent to react with a radical species that was generated in the first part of the reactor. Or alternatively, to add a quench to stop further reaction.

Optional accessory kit for divided cell

An accessory kit is available for the Ion electrochemical reactor to allow the Ion to operate as a divided electrochemical cell. The kit includes a proton exchange film for separation of the cell. In addition to proton exchange film the kit includes all the additional fluid connections and spare membranes necessary for the divided cell configuration.

Optional connection for a reference electrode

An accessory kit containing a reference electrode is available. A reference electrode can be a valuable addition to understanding the electrochemical reaction. Also, a reference electrode is necessary when undertaking cyclic voltammetry (CV) studies.

Ion electrochemical reaction controller

This is a dedicated power supply designed by Vapourtec specifically for the control of laboratory scale electrochemical reactors. The Ion reaction controller can be used for running reactions in the Vapourtec Ion reactor or with other 3rd party electrochemical reactors.



- ✓ Logging of reaction data including, voltages, current
- ✓ Either constant voltage or constant current whichever is lowest
- ✓ Current range 1 mA to 5 A, resolution 3 SF
- ✓ Voltage range 1.2 V to 36 V, resolution 3 SF
- ✓ Accuracy 0.5% of the set point
- ✓ Connection and logging for a reference electrode
- ✓ Sparking minimised under short circuit conditions
- ✓ Cyclic voltammetry (CV) analysis when integrated with E-Series or R-Series systems
- ✓ Size, 120mm (w) x 165 mm (h) x 345 mm (d)
- ✓ Override switch to remove all power from the reactor