Electroporation

05

Protocol optimisation support – no matter who's instrument you use

Order a free protocol passport and we will help you get the results you require – no matter who's instruments you use.

We aim to provide a total solution for your electroporation needs, we not only supply instruments and consumables we give you protocol support tailored to your specific application.

The service we offer will help you to get results first time or trouble shoot protocols already implemented in your laboratory.

Thermo offers an easy to use comprehensive range of electroporators. The Celljet electroporation systems are able to perform all transformation applications, from the simple to the complex.

Do not forget to request your free protocol passport!
See page 42 for details.

Electroporation is the only universal technique that works with virtually any type of molecule on virtually any type of cell:

Cells
- Primary cell culture
- Established cell lines
- Bacterial cells
- Yeast and plant cells

Molecules
- DNA
- RNA
- Peptides and proteins
- Dyes and drugs

Thermo
ELECTRON CORPORATION

CelljecT Uno

Benefits
- **Bacterial and yeast cells**
- **Dual voltage output**
- **Small, inexpensive, easy to use**
- **1, 2 or 4mm cuvettes**

The CelljecT Uno is a simple, easy to use electroporator for producing optimum efficiencies in bacterial applications. The user simply selects one of two voltages and either 1mm, 2mm or 4mm cuvettes.

On pressing the pulse button the electroporator charges, then automatically releases the pulse. The Uno has many safety features including a safety interlocking lid that does not allow operation until the lid is fully in the cuvette covering position.

At each stage of this process both visual and sound indicators show exactly the charging or discharging status of the Uno.

CelljecT Uno Specification	
Cell type	Bacteria
Cuvette type	1,2, or 4mm
Output voltage	1800 or 2500 Volts
Input voltage	90 or 250 Volts
Pulse time	5 mseconds

CelljecT Uno Ordering Information

Product	Catalogue Number
CelljecT Uno for Bacterial and Yeast cells (Complete with instruction manual, optimisation guide and 10 cuvettes)	EPEJ004
Cuvette chamber for CelljecT Uno	EPES002

CelljecT Duo

Benefits
- **Suitable for all cell types**
- **Highly user friendly programming by cell type or parameter value**
- **1, 2, 4 or 10mm cuvettes**
- **The CelljecT Duo has a highly compact footprint size 180 x 285mm which minimises the use of valuable bench space**

The CelljecT Duo efficiently electroporates Embryo, Mammalian, Plant, Yeast and Bacterial cells. The design facilitates ease of operation without compromising the unique specification. Duo has a number of innovative features including a choice of menu levels to suit your familiarity with electroporation.

For the scientist using the CelljecT Duo for the first time, or perhaps on an occasional basis, the user simply selects the assisted program. This menu led program by-passes some of the more common parameter value input programming for voltage, capacitance and resistance values, etc., by proposing a specific and pre-optimised set of parameters for the cell line you have selected.

The pre-optimised values have been built up over many years from our own in-house word database of optimised values for end user cell lines using Thermo or other manufacturers' electroporators.

Where the user has existing parameter values the standard program can be selected at the start and the known values can be entered manually prior to electroporation.

CelljecT Duo

Alternatively the assisted program can be initially selected and then changed manually as further optimisation is required for the cell line.

Safety features include an interlock for the cuvette lid that stops the discharge whilst the lid is not in place. There is also a pre and post monitoring system coupled to a fail safe facility in the software to prevent incorrect parameter value programming.

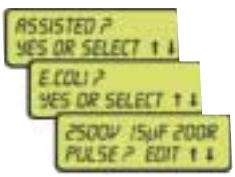
Accessories
The CelljecT Duo is primarily designed to operate as a stand alone unit; however it can also be used with remote accessories for more individual applications, for example in laminar flow hoods where you require the cuvette holder to be installed within the hood for sterility reasons.

Accessories available include cuvette holders, remote keypad (with integral cuvette chamber) for external programming the Duo, and printer output to hard copy or rs232 input to computer facilities.

CelljecT Duo Specification	
Cell type	Embryo, Mammalian, Bacteria, Plant, Yeast and other cells
Cuvette type	1,2,4 and 10mm, also *In situ*
Output voltage	20 - 2500 Volts in 2 volt steps
Capacitance range	5 - 1500µf in 75µf steps after 75µf
Shunt resistor	335 ohm infinite 2 values
Pulse time	1.5 mseconds - 7 seconds (auto)
Dimensions (w x d x h)	Main unit 180mm x 165mm x 283mm
Waveform	Decaying exponential

CelljecT Duo Ordering Information

Product	Catalogue Number
CelljecT Duo Electroporation Unit for Embryo, Mammalian, Bacteria, Plant & Yeast cells (Complete with remote key pad (EPES900), instruction manual, optimisation guide and 10 cuvettes)	EPEJ003
Standard cuvette chamber for 1, 2, 4, and 10mm cuvettes	EPES002
External remote keypad including cuvette chamber	EPES900
Printer for CelljecT Duo Electroporator	EPES102
Paper for printer	EPES007
Printer ribbon	EPES005



Thermo ELECTRON CORPORATION

CelljecT Pro

Benefits

- **Suitable for all cell types**
- **Advanced set-up and programming facilities**
- **3 pulse types available – Single Pulse, Double Pulse and OptiPulse**
- **Pre-arc detection**
- **Pre-pulse impedance measurement linked to a fully enclosed electroporation chamber**

Flexible approach to your cell line

The CelljecT Pro further enhances conventional electroporation equipment by using improved set-up and programming facilities derived directly from electroporation research work. The unit has been designed to electroporate most cell lines and ultimately enables precise optimisation and reproducibility of transformation.

Advanced Control

The CelljecT Pro is fully microprocessor controlled via a bench top remote control unit, featuring an LCD display, membrane keypad and Smart Card reader/recorder.
This unique storage method means experimental development can easily be carried out, even when constantly changing conditions are being used. Hard copies of the parameters and initiated pulse values can be taken using the CelljecT printer (included in CelljecT Pro). This information is invaluable in confirming your experimental procedure and provides 'results assured' information.

Safety

The CelljecT Pro includes a multitude of safety and operating detection features to enable safe operation without compromising the experimental procedure. The programming gives visual and audible alarms if unsafe or incorrect information is measured or programmed.

Results Assured

The CelljecT Pro is designed to output all relevant experimental results to hard copy including certain measured parameters. The CelljecT printer reports each electroporation by date, time and number, as well as programmed volts, capacitance, resistor and pulse (or double pulse) values.

CelljecT Pro Specification	
Cell type	Embryo, Mammalian, Bacteria, Plant, Yeast
Output voltage	100-3500 Volts (50v Steps) in high voltage mode or 20-450 Volts (2v steps) in low voltage mode
Shunt resistor	20 ohms – infinite 10 values
Capacitance range	0.5/25µf in high voltage or 150-3000µf In low voltage
Pulse time	10µs - 7 secs
Double pulse time	Yes
Inter pulse time	0 - 30 secs
Programe storage	Internal 8, external 8 per smart card
Open & short circuit detection	Yes
Detection of unusual	Yes – Warning of arc risk
Sample conductivity	Open circuit/short circuit
Pre-Pulse impedance measurement	Yes
Microprocessor contr.	Yes
Visual & audible alarms	Yes
Printer included	Yes
Printer output	Serial port RS232
Dimensions (w x d x h)	Main unit 425mm x 220mm x 510mm, Remote keypad 100mm x 190mm x 60mm, chamber 260mm x 67mm x 92mm
Waveform	Decaying exponential waveform with R/C time constant dependent upon capacitor and sample selected

CelljecT Pro

In addition the ACTUAL pulse time and sample impedance is measured. This printed information confirms your set-up parameters and precisely documents each electroporation experiment.

Single, Double or OptiPulse
The CelljecT Pro is designed to be used in either simple single pulse methodologies or for complete method development programs suited directly to your cell lines.
The CelljecT Pro has 'DOUBLE PULSE' and OPTIPULSE technology. This has been beneficial in certain cases where single pulse experiments have resulted in unsuccessful or disappointing transformations.

Double Pulse
Pulse 1 – Pore Formation
CelljecT Pro creates a high voltage discharge pulse that is calibrated to maximise the number of pores formed while minimising the cell mortality.

Pulse 2 – Coupled Electroinjection
The second pulse is programmed to follow from 0 to 30 seconds later and is designed to be low voltage with a long decay period. This pulse type actively counteracts the negative effects of electro-magnetic repulsion that naturally occur, when setting up an electroinjection process to move the DNA into the cell.

OptiPulse
While the double pulse offers advantages over single pulse techniques, a new discharge method, OptiPulse, can be used in addition to, or as a replacement to, single or double pulse methodologies.

The OptiPulse is essentially a tuned double pulse discharge, the second pulse being released before the first charge is completely dissipated. This fast discharge process reduces any pore re-sealing that may occur between the double pulses, again improving the efficiency and possibly improving cell survival by further reducing energy dissipation levels.

CelljecT Pro Ordering Information

Product	Catalogue Number
CelljecT Pro main unit (includes double pulse facility) containing power supply, control circuitry and capacitance bank, separate keypad, printer, smart cards (2), chamber, cuvettes (10 x 2mm, 10 x 4mm) instruction manual and optimisation guide	EPEJ002
Smart card for CelljecT	EPES001
Electroporation chamber for EPEJ002	EPES002
Paper for CelljecT printer (1)	EPES007
Printer ribbon for CelljecT printer (1)	EPES005
Printer for EPEJ002, EPEJ003	EPES102

Protocol Passport

Do not forget to request your protocol passport!
We have built up a vast database of electroporation protocols for scientists working with all systems. The protocol passport enables us to help you with protocol design and also troubleshooting existing protocols you may be working with.

You will be able to directly receive a customised protocol for most units on the market from a member of the Thermo team.

Protocol Passport Ordering Information

Product	Catalogue Number
Protocol passport	EPECD001

Thermo ELECTRON CORPORATION

Precision Universal Cuvettes

Benefits

- **Universal Cuvettes – compatible with most common electroporation machines**
- **Cap Design – designed to give improved aseptic handling and reduced aerosol contamination**
- **Smaller Sample Size – Thermo cuvettes are designed to include a 'V' form in the base so that 50% less sample is needed compared to other makes of cuvette**
- **Bio-Tested – all materials used have been tested to optimise transformation efficiencies. In some specific cases further washing and treating is performed to maximise bio-compatibility for improved gene transfer**
- **Highly Engineered – the aluminium electrodes have been chemically and physically cleaned to obtain a uniform electrode surface for consistent pulse generation.**

Furthermore the cuvettes are manufactured using high quality polycarbonate material

- **Precision Built – the 'V' form in the base of the cuvette enables easy sample pick-up, which in turn may provide a cost saving**
- **Colour Coded – the cuvette caps are all individually colour coded for size**
- **Guaranteed Sterile – each cuvette is individually wrapped and gamma irradiated. Specifically designed sterile pipettes can also be used to further improve aseptic procedures**

The Thermo cuvettes have been manufactured to strict quality control criteria whilst maximising design features for ease of use and improved results.

Precision Universal Cuvette Specification

Cuvette Size	Colour	Application
1mm	Black	Bacteria that require a high electric field such as some gram positive bacteria
2mm	Yellow	All types of Bacteria, Yeast, Fungi
4mm	Purple	Mammalian cells
10mm	Green	Embryo cells, plant buds and large cells such as fish eggs

Precision Universal Cuvette Ordering Information

Product	Catalogue Number
50 Sterile individually wrapped 1mm cuvettes	EPECU101
50 Sterile individually wrapped 2mm cuvettes	EPECU102
50 Sterile individually wrapped 4mm cuvettes	EPECU104
50 Sterile individually wrapped 10mm cuvettes	EPECU110
25 Sterile individually wrapped disposable plastic pipettes 25 Sterile individually wrapped 1mm cuvettes	EPECU201
25 Sterile individually wrapped disposable plastic pipettes 25 Sterile individually wrapped 2mm cuvettes	EPECU202
25 Sterile individually wrapped disposable plastic pipettes 25 Sterile individually wrapped 4mm cuvettes	EPECU204
25 Sterile individually wrapped disposable plastic pipettes 25 Sterile individually wrapped 10mm cuvettes	EPECU210
50 Sterile individually wrapped disposable plastic pipettes	EPECU300

OptiBuffer

Benefits
- **Reduces cell shock**
- **Increases transfection and survival rates**
- **Complete and easy to use**

OptiBuffer is a fully optimised medium, designed for the electroporation of eukaryotic cells. OptiBuffer improves both transfection efficiencies and survival rates over PBS or other standard culture media.

The composition of OptiBuffer has been carefully formulated to help protect cells during the electroporation process, also providing additional salts and critical molecules that help in the regeneration process following the destabilisation caused by the electrical discharge through the cell.

The OptiBuffer Kit is ready to use and contains enough material for approximately 24 experiments (minimum). The kit is shipped at ambient temperature; however, it is important that some of the components are stored at either 4°C or – 20°C on arrival. OptiBuffer comprises 1 x 200ml of washing solution, 4 x 2.5ml of OptiBuffer, 4 x ATP and 4 x Glutathione.

Influence of OptiBuffer on transformation efficiency and cell viability 24 hours following electroporation. COS-7 cells were electroporated with 30µg of luc plasmid DNA at 250v and 1500µf in 0, 30, 60, 100%, OptiBuffer.

References
Chemomordik, L V, Sukharev. B. I., Popov, S. V., Pastushenko, V.F., Sorkirko, A. V., Abidor, I. G. and Chizmadzhev, Y. A. (I987 The electrical breakdown of cell and lipid membranes: the similarity of phenomenologies. Biochim. Biophys. Acta 902, 360-373 Tsong. T. Y. (1991) Electroporation of cell membranes. Biophys. J. 60, 297-306 van den Hoff, M. J. B., Labruyère, W. T., Moorman, A. F. M. and Lamers, W. H. (1990) The osmolarity of the transient expression of genes. Nucl. Acids Res. 18, 6464 van den Hoff, M. J. B., Moorman, A. F. M. and Lamers, W. H. (1992) Electroporation in intracellular buffer increases cell survival. Nucl. Acids Res. 20, 2902 Audus, K. L., Bartel, R. L. and Brochardt, R. T. (1990) Pharm. Res., 7, 435-451

OptiBuffer Ordering Information

Product	Catalogue Number
OptiBuffer Kit for eukaryotic cells contain media for approximately 24 experiments (minimum)	EPEKITE1

SOC

SOC is a complex growth medium containing all the necessary components to aid recovery following electroporation. Practically, it has been shown that the speed of transfer and type of medium can be crucial in reducing cell shock therefore improving the molecular uptake while stabilising the cells rapidly.

The protocol supplied gives full instructions and tips on cell transfer and the productive use of SOC. Contents include bacto trytone, yeast extract, salts and glucose; and are supplied sterile and easy to use.

SOC Ordering Information

Product	Catalogue Number
SOC Kit for bacterial cells Contains 1 x 50ml sterile with instructions	EPEKITB1