

LABORATORY HIGH-FREQUENCY ELECTROPORATOR

L-POR EU Version 1.1 Datasheet



L-POR high-frequency electroporator pulse specifications

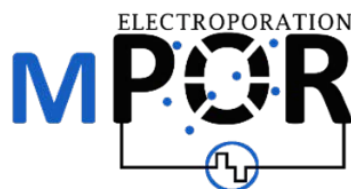
L- POR electroporation device 1.1 is a revolutionary device with 9 adjustable pulse parameters (positive/negative voltage range, positive/negative pulse duration, pause between positive and negative pulse, number of pulses in a burst, number of bursts and pulse/burst repetition rate) and 3 pulse modes (monopolar, bipolar symmetric and bipolar asymmetric). It is perfectly suited for laboratory research as it enables completely new experiments in the electroporation field. It is the first commercially available high-frequency electroporator and the first device that also generates asymmetric bipolar pulses. The user interface is graphical in design to allow input of complex electroporation pulse parameters and control of measured signals. The control unit is built on an FPGA circuit. An external trigger is also integrated. In addition, current protection is integrated, allowing currents up to 70 A without interrupting pulse delivery.

FOR RESEARCH USE ONLY, **NOT FOR HUMAN USE!**

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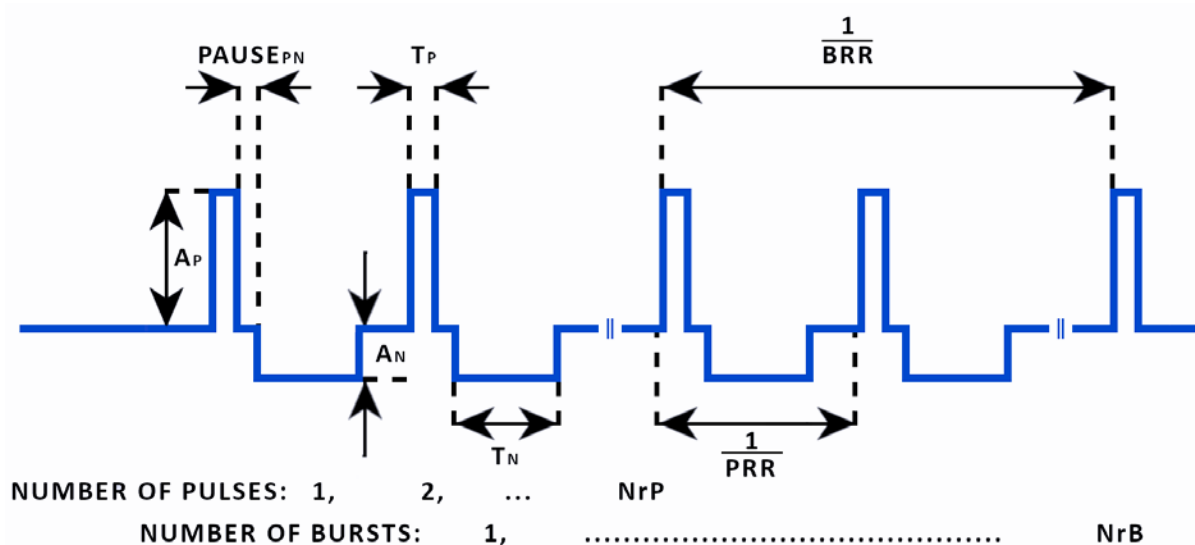


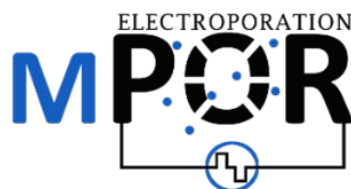
HIGH-FREQUENCY ELECTROPORATION



PARAMETER		min	max
Positive voltage range	A_P	50 V	1400 V
Negative voltage range	A_N	50 V	1400 V
Positive amplitude duration	T_P	500 ns	10 ms
Negative amplitude duration	T_N	500 ns	10 ms
Pause between positive and negative pulse	$PAUSE_{PN}$	500 ns	10 s
Number of pulses in a burst	Nr_P	1	1000
Number of bursts	Nr_B	1	1000
Pulse repetition rate	PRR	100 mHz	1 MHz
Burst repetition rate	BRR	100 mHz	100 Hz
Total treatment time duration		500 ns	40 ms
Total treatment burst duration		500 ns	80 ms

Voltages can be set in 1 V increments. Durations can be set in 10 ns increments.





TECHNICAL DATA	
Model	L-POR V 1.1 (and defined with serial number: EU or USA)
Manufacturer	mPOR d.o.o.
Manufacturer e-mail	info@mpor.eu
Weight	11 kg
Dimensions (H x W x D) mm	310 x 510 x 610
Housing colour	White; other colours also available per request
Warranty	1 year
Installation category	CAT II
Certification	LVD 2014/35/EU, EU RoHS
Complies with	EN 61010-1, EN IEC 61010-2-034 , EN 61326-1
Operating Temperature	4°C to 40°C
Voltage drop	Defined in Figure 1
Load resistance	$\geq 20 \Omega$
Pulse rise time	$< 100 \text{ ns}$
Display	10.1 inch colour display
Controls	touch screen
Operative system	Linux
Electrical supply	230 Vac, 50 Hz or 120 Vac, 60 Hz (defined with serial number)
Power Ratings	35 W idle and 235 VA pulsing
External trigger	+5 V, $\geq 2\mu\text{s}$ positive front on BNC connector
Trigger delay	$> 2\mu\text{s}$, has to be defined for specific trigger
Pollution	Degree 1
Storage Temperature	-10°C to 70°C
Operating Temperature	5°C to 40°C
EMC Declarations	IEC 61326-1

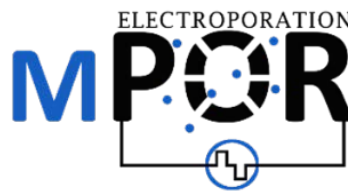
L- POR must NOT be exposed to EM radiation exceeding the levels specified in the standard EN55011. L- POR must NOT be exposed to ionizing radiation exceeding the levels specified in the EU Radiation Protection Regulation, i.e. above 1 $\mu\text{Sv/h}$!



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RECOMMENDED OPERATING RANGE

The pulse parameters for electroporation must be set within the range of load according to Figure 1. For quality assurance of electroporation experiments, the voltage drop should not be higher than 10%. This means that the user must calculate the maximum treatment time, which depends on the load. The load resistance can be roughly estimated from the current and voltage measurements (the resistance is equal to the voltage divided by the current). The treatment time is equal to the product of the number of pulses in a burst and the pulse duration (amplitude) (if asymmetric pulses are used, the higher value of the amplitude duration (TP or TN) should be used).

$$\text{Treatment time} = N_{rP} * T_P \text{ or } N_{rP} * T_N \quad (T_P \text{ or } T_N \text{ is used, whichever is longer})$$

The combination of N_{rP} and amplitude duration (T_P or T_N) should be chosen to be in the green area of the graph in Figure 1. **The load resistance should never be less than 20 Ω .**

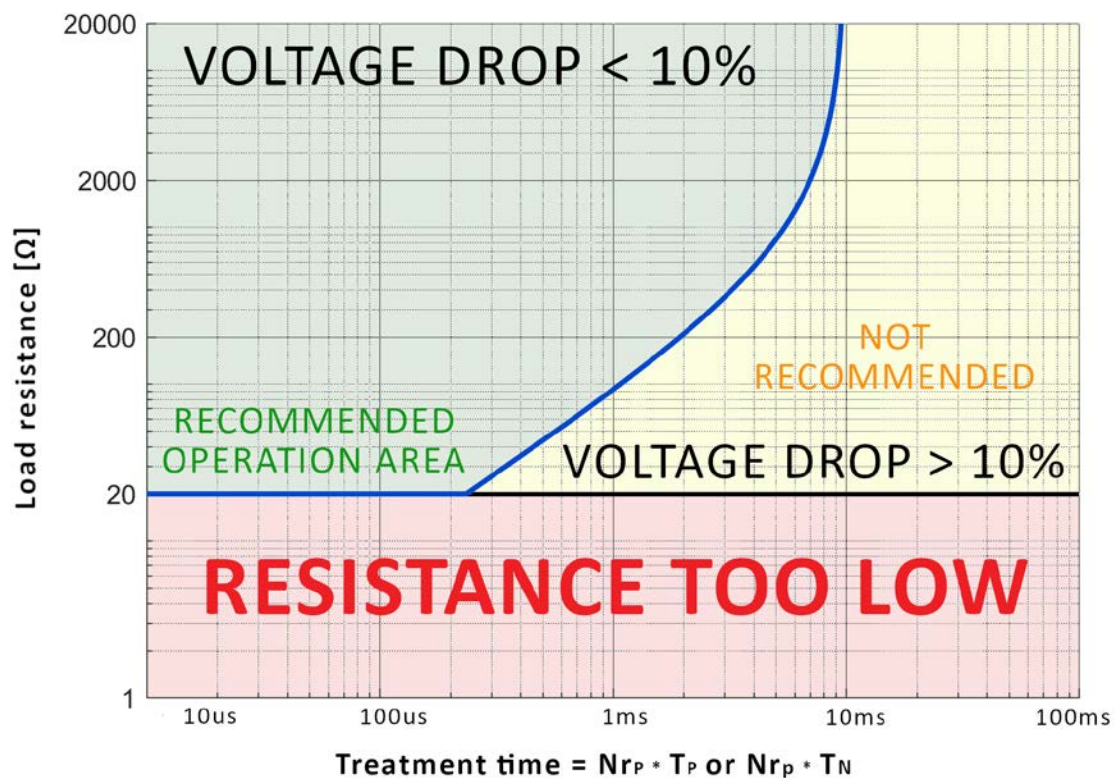
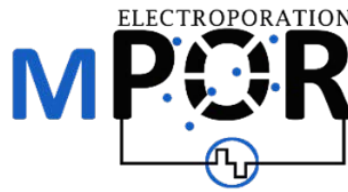


Figure 1: operating range of L-POR electroporator.



SAFE OPERATING RANGE

To avoid sparks and stay within the safe working range, the pulse parameters for electroporation must be set according to Figure 2. The maximum voltage is limited by the distance between the electrodes and the treatment time.

$$\text{Treatment time} = N_{r_P} * T_P \text{ or } N_{r_P} * T_N \quad (T_P \text{ or } T_N \text{ is used, whichever is longer})$$

If the electrodes are closer together, a lower voltage must be used in order to avoid sparks.

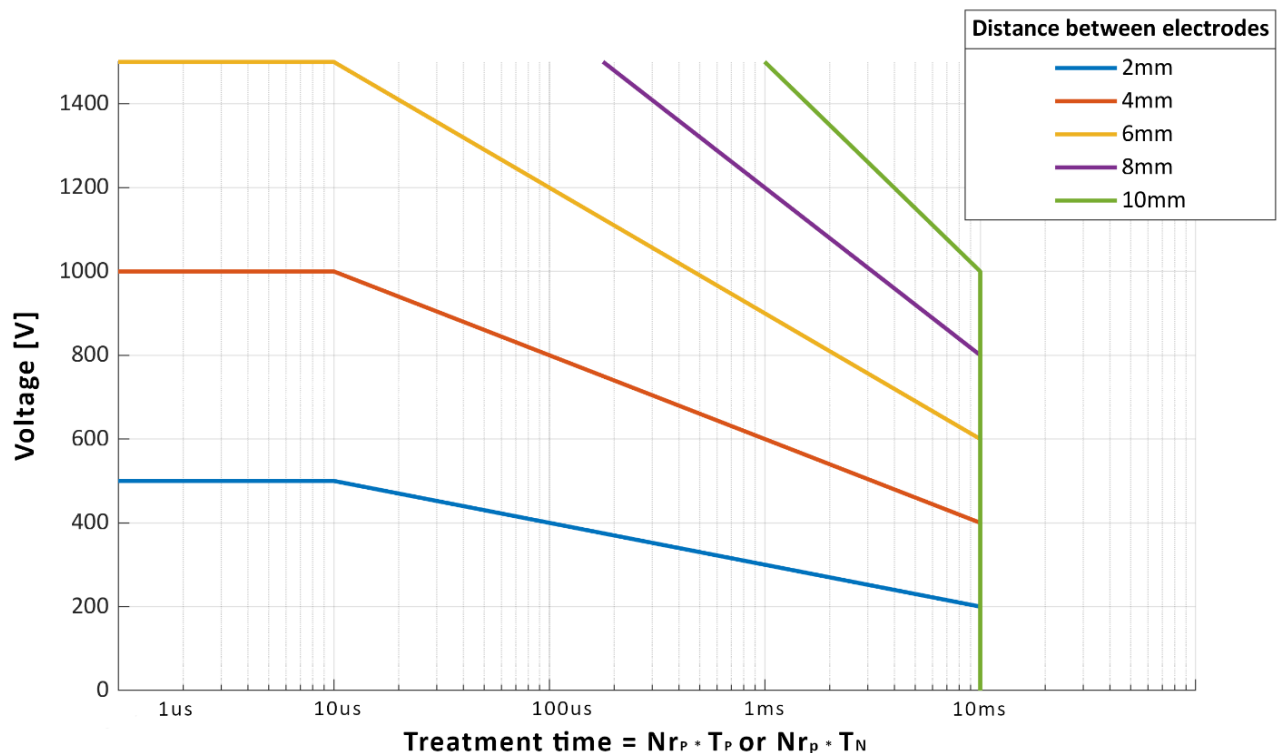


Figure 2: to avoid sparks, the treatment time and voltage have to be set in accordance with this figure.

QUALITY CONTROL

The current should be monitored during all experiments made with L- POR. This is the only way to ensure that you have successfully delivered the pulses to the load. Therefore, an oscilloscope and a current probe are necessary to ensure the quality of your experiments. The current probe should have a bandwidth of at least 50 MHz. However, a higher bandwidth is required for quality measurements (bandwidth = 3.4/rise time). If you have problems with the measurements or need help in choosing the right equipment, you can contact mPOR.



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