

Nucleofector[®] Technology



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History of Constant Innovation – Major Launches

2025	Next generation 4D-Nucleofector® LV Unit PRO
2021	2nd generation 4D-Nucleofector® Platform, including 96-well Unit TheraPEAK® Nucleofector® Consumables (for GMP manufacturing)
2016	4D-Nucleofector® LV Unit
2011	4D-Nucleofector® Y Unit 384-well Nucleofector® System
2010	4D-Nucleofector® System
2008	Nucleofector® Kits for human stem cells Integration into Lonza research solutions
2006	96-well Shuttle® System More than 100 cell specific Nucleofector® Protocols
2005	Basic Nucleofector® Kits for primary cells
2004	Nucleofector® II System – the second generation
2003	Nucleofector® Kits for primary neurons
2002	Nucleofector® Kits for > 15 primary cells
2001	Market introduction – Nucleofector® Technology
1998	Nucleofector® Technology development

Introduction: Nucleofector® Technology

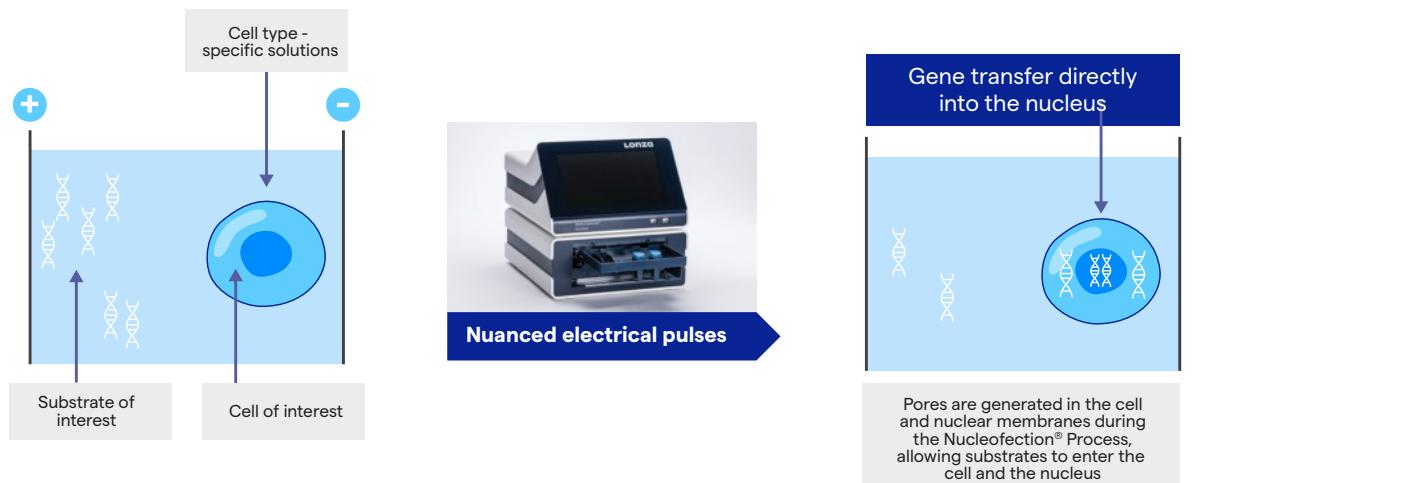
Systems biology and multidisciplinary approaches require that cells and model systems display *in vivo* like cellular functionality. This means that the future of cell transfection is in using primary cell types, and that transfecting these physiologically relevant cell types is typically a very difficult task using traditional methods. Additionally, when using

relevant cell lines as model systems, the critical issues are to achieve reproducibly efficient transfection with high levels of viability while matching throughput capability with the number of transfections required at each project phase – from proof of concept, through to scale-up and screening approaches. With the Nucleofector® Technology primary cells and stem cells, as well as cell lines, can be consistently transfected at high efficiency.

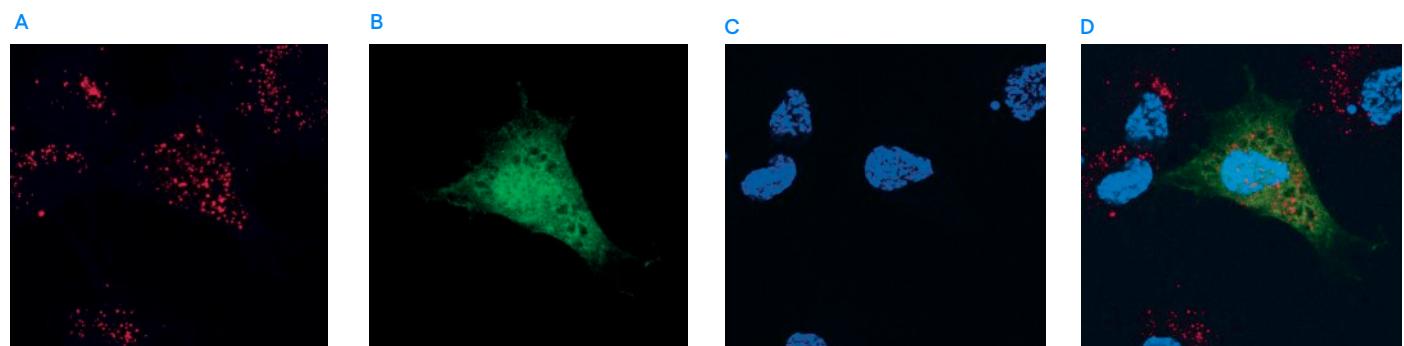
Developed in 1998, the Nucleofector® Technology was introduced to the research market in 2001 as the first efficient non-viral transfection method for primary cells and hard-to-transfect cell lines. Since then the technology has evolved through constant innovation (see history of constant innovation, page 4).

The principle

Nucleofection® is a technology based on the momentary creation of small pores in cell membranes by applying an electrical pulse. The comprehensive way in which Nucleofector® Programs and cell type-specific solutions are developed enables nucleic acid substrates delivery not only to the cytoplasm, but also through the nuclear membrane and into the nucleus (transfection into the nucleus, hence Nucleofector® Technology). This allows for high transfection efficiencies up to 99% and makes the transfection success independent from any cell proliferation.



DNA delivery straight into the nucleus (Nucleofector® Technology)



Normal human dermal fibroblasts (neonatal) were transfected with 2.5 µg TMR-labeled plasmid DNA encoding eGFP. After 2 hours, cells were fixed with 3.5% PFA and analyzed by confocal microscopy. TMR label is shown in (A), GFP fluorescence in (B), DAPI nuclear staining in (C) and a merge of all three fluorescent labels in (D).

Benefits for Your Transfection Experiments

High transfection performance

- Electrical parameters are optimized to gain high transfection efficiency and retain high viability
- Excellent preservation of the physiological status of transfected cells

Easy-to-use technology

- More than 750 cell-type specific protocols lead to direct transfection success with a multitude of different cell types
- Easy optimization protocols for cell lines and primary cells allow for quick and streamlined optimization of virtually any cell type

Excellent technical and applicative support

- Highly-skilled Scientific Support Team to assist you in your research
- Many Scientific Support Team members have a masters or PhD level education in biology, biochemistry or biotechnology, many of them with over 10 years experience in transfection, primary cell biology, drug discovery application and microbiology support
- Support in various languages, including English, German, French and Chinese

Proven and innovative technology

- More than 21,500 peer-reviewed publications and thousands of systems installed worldwide. Modularity of the 4D-Nucleofector® System allows easy adaptation to new applications
- Easy transfer of Nucleofection® Conditions by using the same conductive polymer in all Nucleofection® Vessels
- Invention of Nucleofection® Reaction of cells in adherence

Using various cell numbers for different applications

- Nucleofection® Reaction of 2×10^4 to 1×10^9 depending on system
- Transferability of protocol conditions from small to larger cell numbers with the 4D-Nucleofector® System

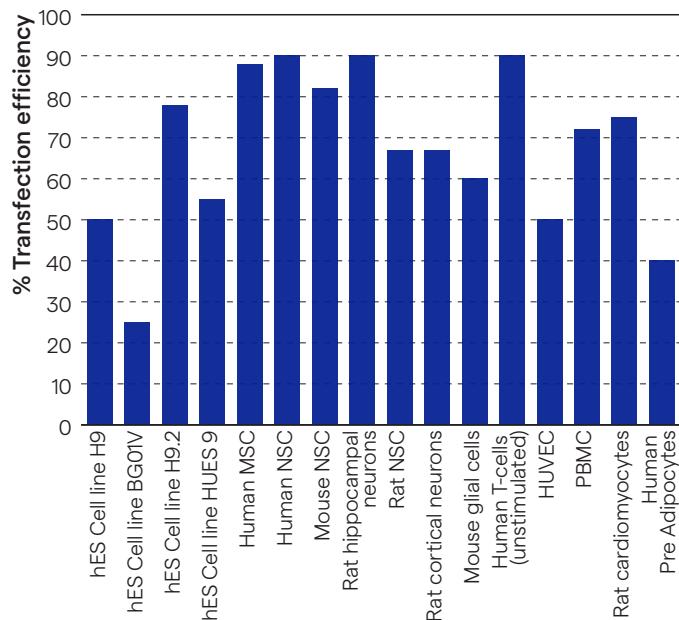
Stretching the dimensions of your research

- Explore complex systems by using the same conditions to deliver DNA, RNA, oligonucleotides, RNPs, peptides or proteins
- Different system platforms fulfill your choice of sample throughput from 1 through 384 transfections per run including automated high throughput

Avoiding cross-contamination

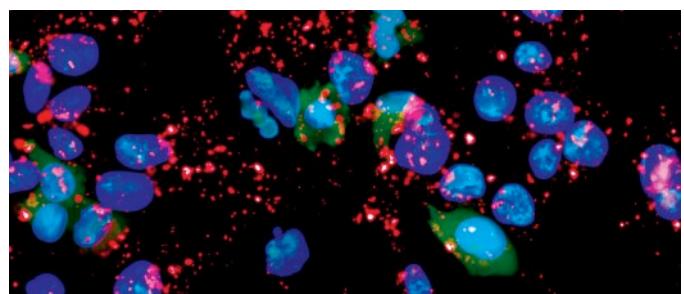
- Disposable, sterile Nucleofection® Vessels minimize the risk of cross-contamination with cell or substrate leftovers

Average transfection efficiency for primary cells and human stem cells



Overview about transfection efficiencies achieved by Nucleofection® Experiments for various primary cells and stem cells.

Conserving functionality – the first step to Meaningful analysis

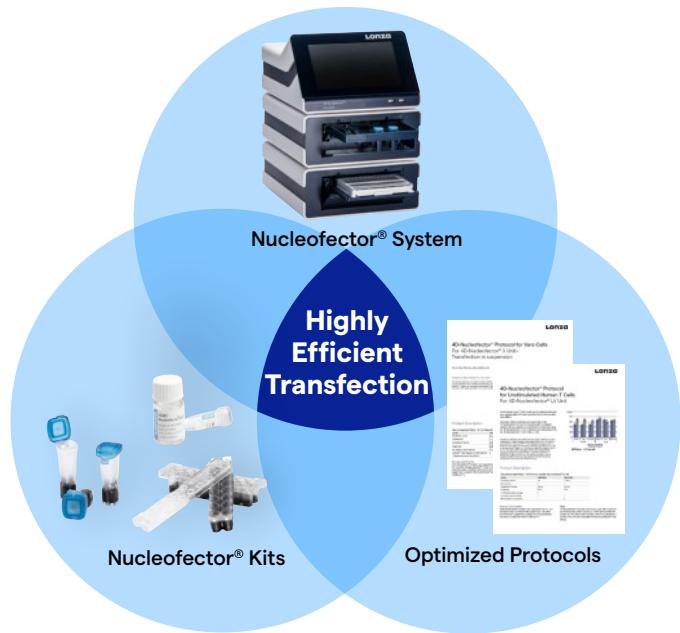


Human H9 ES cells preserve pluripotency post Nucleofection® Reaction. H9 cells were transfected by Nucleofection® Experiment with the pmaxGFP™ Vector. Cells analyzed after 24 hours show expression of GFP (green) as well as of the pluripotency markers SSEA4 (red) and Oct4 (purple). The blue signals refer to nuclear staining by DAPI. (Data kindly provided by Jennifer Moore, Rutgers University, Piscataway, USA.)

The Components of the Nucleofector® Technology

The Nucleofector® Technology relies on the combination of a Nucleofector® System and cell type-specific Nucleofector® Kits.

- The **Nucleofector® System** delivers unique electrical parameters. The electrical settings are pre-programmed for each optimized cell type to deliver the substrate directly into the cell nucleus and the cytoplasm. The different platforms we offer provide different specifications for various applications (see table below)
- The **Nucleofector® Kits** contain a dedicated Nucleofector® Solution and Supplement, platform-specific Nucleofection® Vessels, pipettes, and the pmaxGFP™ Control Vector. All Nucleofector® Solutions provide a protective environment that allows for high transfection efficiency and cell viability, while helping to maintain physiologically relevant cellular functions. A collection of Nucleofector® Kits with optimized protocols for primary cells and cell lines is available
- Besides providing optimal Nucleofection® Conditions, **Optimized Protocols** offer comprehensive guidance, including tips for cell sourcing, passage, growth conditions and media, and post transfection culture



	Small scale, optimization	Large scale	High-throughput/ screening	Small scale
	Suspension		Suspension	
System	4D-Nucleofector® X Unit	4D-Nucleofector® LV Unit PRO	4D-Nucleofector® 96-well Unit	384-well Nucleofector® System
Throughput	Low – Medium	Low	High	Very high
Reaction vessel				
Cell number	20 µL: 10 ⁴ to 10 ⁶ 100 µL: 10 ⁵ to 10 ⁷	10 ⁷ to 10 ⁹	10 ⁴ to 10 ⁶	10 ⁴ to 10 ⁶

The Advanced Platform: 4D-Nucleofector® System Offering Multi-dimensional Flexibility

Based on numerous user feedback, Lonza engineers and scientists have developed the innovative 4D-Nucleofector® System. This system is designed for maximum flexibility and enables Nucleofection® Experiments of cells in several formats combined with advanced performance and convenience.

Due to its modular design the 4D-Nucleofector® System is extremely flexible in regard to the supported applications. The operation software allows you to design and save individual experimental setups. Additionally, a PC editor enables pre-definition of experiments on a PC which can then be uploaded to the 4D-Nucleofector® Core Unit via the integrated USB port.

What benefits are important for your work?

Using different cell numbers for different applications

- Same protocol for small, medium and large scale transfection volumes
- 20 µL Nucleocuvette® Strip for low cell numbers down to 2×10^4
- 100 µL Nucleocuvette® Vessels for high cell numbers up to 2×10^7
- 1 mL or LV Nucleocuvette® Cartridges for large cell numbers up to 1×10^9

Working with various throughputs

- Flexible throughput from 1 to 96 samples
- Pre-programming of settings for up to 50 single 100 µL Nucleocuvette® Vessels or one 20 µL Nucleocuvette® Strip

Transfected different primary cell types

- Five primary cell kits covering a broad range of primary cells
- Primary Cell Optimization Kit for cells lacking an Optimized Protocol
- Easy optimization of Nucleofection® Conditions for primary cells or cell lines using the 16-well Strip or the 96-well Unit

Preserving cell functionality

- Adherent Nucleofection® Experiment of neurons at later developmental stages
- No release of metal ions due to conductive polymer electrodes



Core Unit – Controlling the 4D-Nucleofector® System

- Intuitive operation software for designing and saving experiments with predefined Nucleofection® Parameters and experiments
- PC editor for predefinition of experiments
- Touch screen to operate the system
- Controls up to 3 functional units
- USB port for software update and data transfer

X Unit – Supporting Nucleofection® Experiments in two different formats

- Features positions for 16-well 20 µL Nucleocuvette® Strips and 100 µL single Nucleocuvette® Vessels

96-well Unit - Providing increased throughput

- Transfection of up to 96 samples in one run
- Each of the 96-wells can be transfected individually

Y Unit – Enabling Adherent Nucleofection® Experiments

- Features position for one 24-well Dipping Electrode Array

LV Unit PRO – Scaling up to larger cell numbers

- Scalable from research to GMP manufacturing for up to 1 billion cells, e.g. T cells

The Most Flexible Unit: 4D-Nucleofector® X Unit

The X Unit of the 4D-Nucleofector® System supports Nucleofection® Experiments of various cell numbers in two different formats: single 100 µL Nucleocuvette® Vessels and 16-well 20 µL Nucleocuvette® Strips. Thus, it can be an optimal tool for setting up and optimizing Nucleofection® Experiments.



Single 100 µL Nucleocuvette® Vessels:

- For high cell numbers at low throughput (e.g. for biochemical applications)

16-well 20 µL Nucleocuvette® Strips

- For low cell numbers at medium throughput (e.g. reporter gene assays, small scale RNAi or CRISPR experiments)

Both Nucleocuvette® Vessels are composed out of the same conductive polymer electrode material.

- **Seamless transfer of transfection conditions** between different Nucleofection® Vessels
- **Convenient optimization tool** – Once Nucleofection® Conditions are optimized on X Unit, they can be transferred to higher throughput formats (4D-Nucleofector® 96-well Unit and 384-well Nucleofector® System) or adapted to larger volume reaction (4D-Nucleofector® LV Unit PRO)
- **Simple handling** – Minimal training needs
- **Quick transfection protocol** – Saves time and can speed-up cell-based assay development
- **Established protocols** – Benefit from more than 750 optimized protocols for different cell lines and primary cells

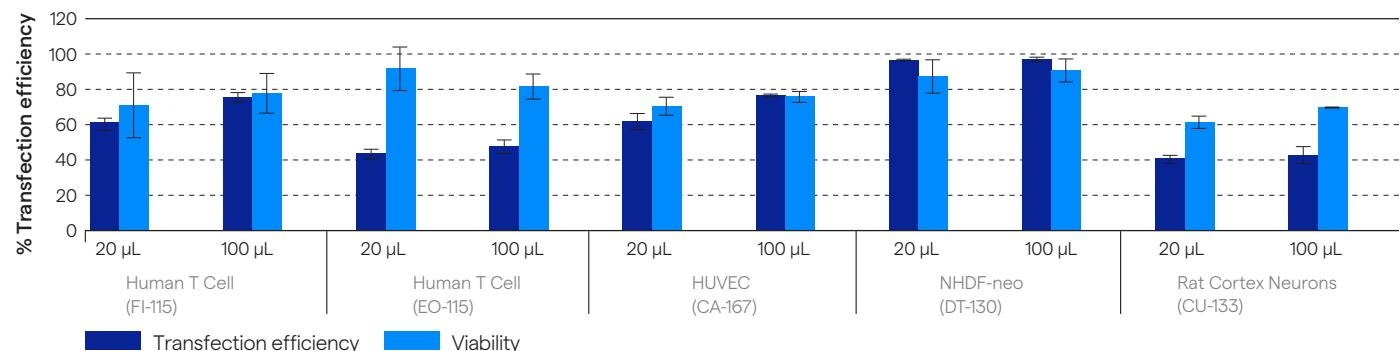
Benefits

- Flexible - Features positions for both 100 µL single Nucleocuvette® Vessels and 20 µL Nucleocuvette® Strips
- Low and medium cell numbers – From 2×10^4 to 2×10^7 cells per reaction

Applications

- Delivery of different substrates: DNA, RNA, RNPs and proteins into various difficult-to-transfet cell lines and primary cells
- Transfection for transient and stable production of potential therapeutic proteins

Transferability of Nucleofection® Conditions between different formats



Various primary cells were transfected in the two Nucleocuvette® Vessel formats (20 µL and 100 µL) using the indicated programs. 24 hours post Nucleofection® Experiments cells were analyzed for transfection efficiency (flow cytometry) and viability (cell number normalized to no program control).

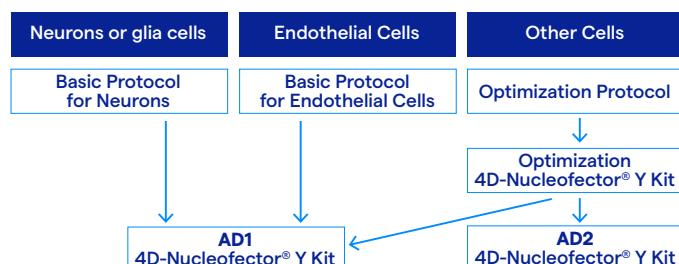
The Adherent Nucleofection® Module: 4D-Nucleofector® Y Unit

The Nucleofector® Technology allows direct transfection experiments of cells in adherence. Cells which typically grow in adherence in cell culture, can be kept and transfected in their physiological state.

The Y Unit works with disposable conductive polymer dipping electrode arrays that can be inserted into standard 24-well culture plates for the Nucleofection® Experiments.



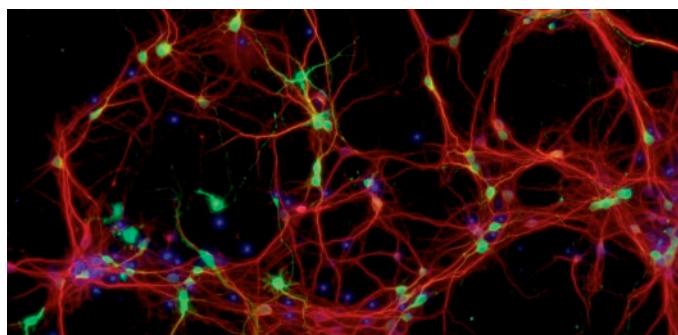
We offer two Nucleofector® Solutions called AD1 and AD2, both available as separate kits or combined to an optimization kit. Each solution may serve different cell types. You can easily find out which solution is optimal for your cell of interest by using the following guideline:



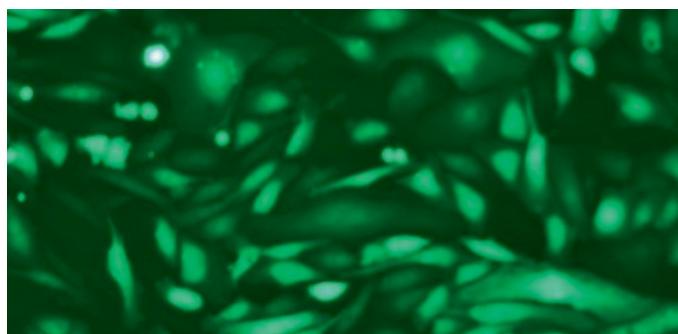
Benefits

- Pre and post Nucleofection® Culture in 24-well culture plates
- Nucleofection® Experiments of cells at any time point during the culture period, i.e. at a later developmental stage
- Transfection efficiencies up to 70% combined with high viabilities
- Compatible with Clonetics® primary animal neurons

Application



Efficient adherent Nucleofection® Reaction of neurons in 24-well culture plates. Mouse cortical neurons were seeded into poly-D-lysine coated 24-well plates (1×10^5 cells/well). After 6 DIV, cells were transfected with pmaxGFP™ Vector using the AD1 4D-Nucleofector® Y Kit. One day post Nucleofection® Procedure, cells were stained by MAP2 antibody (red), DAPI (blue) and analyzed by fluorescence microscopy for maxGFP™ protein expression.



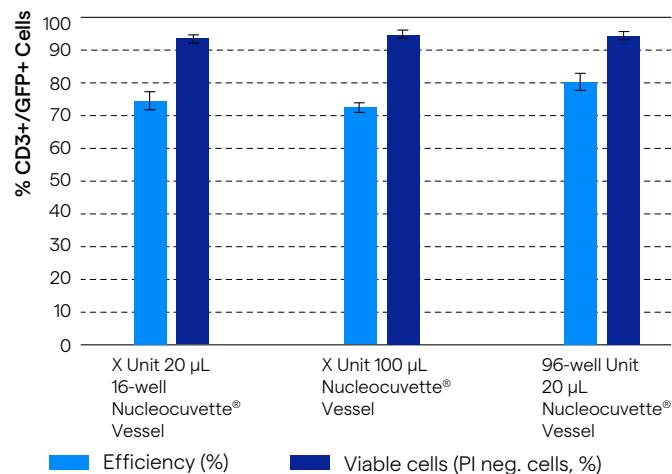
Human umbilical vein endothelial cells (HUVEC) were isolated and plated in passage 1 into collagen-coated 24-well plates at a density of 50,000 cells/well. After 1 DIV cells were transfected with 16 μ g pmaxGFP™ Vector using AD1 4D-Nucleofector® Y Solution and program CA-215. Cells were analyzed for maxGFP™ Protein expression after 24 hours. (Data kindly provided by M. Sauvage, Pharmaceutical Industry, FR)

Increasing Throughput: 4D-Nucleofector® 96-well Unit

The 4D-Nucleofector 96-well® Unit offers a medium-throughput solution suited for screens in 96-well format, the convenient optimization of Nucleofection® Conditions or assay development. For scalable throughput, each of the 96 wells can be addressed and transfected individually. This is useful for optimizing difficult-to-transflect primary cells or cell lines in just one plate, as well as transfecting variable cell numbers from 10^4 – 10^6 cells per reaction. Furthermore all existing 4D-Nucleofector® X Unit Protocols can be used without further optimization.

For integration of the 96-well Unit into a liquid handling workstation we offer a separate [Automation Server Software \(SBA-3001\)](#).

The 4D-Nucleofector® 96-well Kits use existing 4D-Nucleofector® Protocols and contain specific conductive polymer 96-well Nucleocuvette® Plates. The plates fulfill SBS standards to allow handling by automated liquid handling systems. Each of the 96-wells is individually addressable.



Transfection of human T cells with plasmid DNA (pMax-GFP™ Plasmid). Fresh PBMCs were transfected with pmaxGFP® Plasmid in a 100 μ L Nucleocuvette® Vessel or a 20 μ L Nucleocuvette® Vessel using the 4D-Nucleofector® X Unit or the 96-well Unit. Transfection efficiency in CD3-positive T cells was analyzed 24 hours post Nucleofection® Procedure. Plasmid data represent the mean of various independent experiments. Live cell discrimination was done with Propidium Iodide.

Benefits

Does speed count for your screens? Do you want to automate?

- Run up to 96 independent programs per plate, processed automatically in <2 minutes
- Fulfills prerequisites for liquid handling integration

Applications

- Convenient optimization of any difficult-to-transflect primary cell or cell line in just one plate
- Variable cell numbers from 10^4 – 10^6 cells per reaction
- Testing of multiple conditions for assay establishment
- Screening of cDNA, RNAi or CRISPR libraries
- Suited for the transformation of bacteria

The Large-scale Format: 4D-Nucleofector® LV Unit PRO

Experience the next generation 4D-Nucleofector® LV Unit PRO which comes with several new features and can be easily implemented into a GMP manufacturing process:

- Optimized cartridge design for improved performance for CRISPR-based knock-out/in or transposition
- Fixed volume cartridge with different filling volumes (0.5 mL, 1 mL, 1.5 mL and 2 mL) and new port for easy loading and clearing
- Flow-through cartridge with more robust sample processing
- Cartridge insertion support and visual acknowledgement

Transfection protocols can be established in smaller scale using the 4D-Nucleofector® X Unit and subsequently transferred to the LV Unit PRO via testing a selection of cargo-specific recommended programs in 500 µL volume.

Benefits

- Reliable, robust and efficient delivery of complex, clinically relevant cargos
- Easy scale up of the cell engineering process for up to 1 billion T cells
- Two vessel formats for closed transfection of medium or larger cell numbers
- Performance proven for resting and activated T cells
- Corresponding research-grade and GMP-grade consumables to transfer process development into GMP manufacturing
- 4D-Nucleofector® LogWare for operation under 21 CFR part11 compliant software
- Highly-skilled technical support
- Training support and IQOQ service

Applications

- Ex-vivo modification of human primary cells for the development and establishment of cell and gene therapy applications (e.g. genome editing, generation of CAR-T cells)*
- Generation of large numbers of transiently modified primary cells for cell-based assays



4D-Nucleofector® System with Core, LV Unit PRO, and mounted LV Nucleocuvette® Cartridge



Two consumable formats available. (A) 2 mL Nucleocuvette® Cartridge PRO: Fixed-volume samples of 0.5, 1, 1.5 or 2 mL for up to 2×10^8 cells (manual filling via sterile injection port) (B) LV Nucleocuvette® Cartridge PRO: Up to 20 mL processing volume for up to 1×10^9 cells (automatic filling via reservoirs or bags , weldable tubing).

Robust scalability for different applications in activated T cells

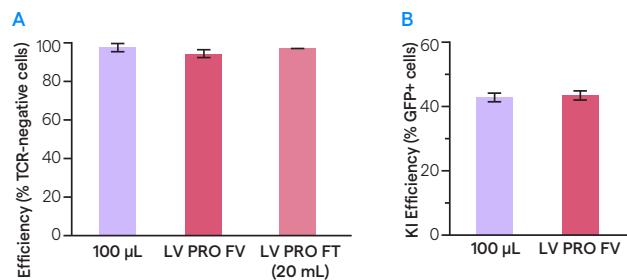


Figure 1.

Comparable engineering efficiency in small- and large-scale vessels for activated T cells. (A) Knock-out of TRAC using Cas9 RNP. (B) Knock-in of GFP into TRAC locus using Cas9 RNP and 3.5 kb dsDNA HDR template. Data are based on several donors and/or technical replicates. Results are from day 4 post transfection. 100 µL = 100 µL Nucleocuvette® Vessel (100 µL); LV PRO FV = fixed-volume 2 mL Nucleocuvette® Cartridge PRO; LV PRO FT = flow-through LV Nucleocuvette® Cartridge PRO.

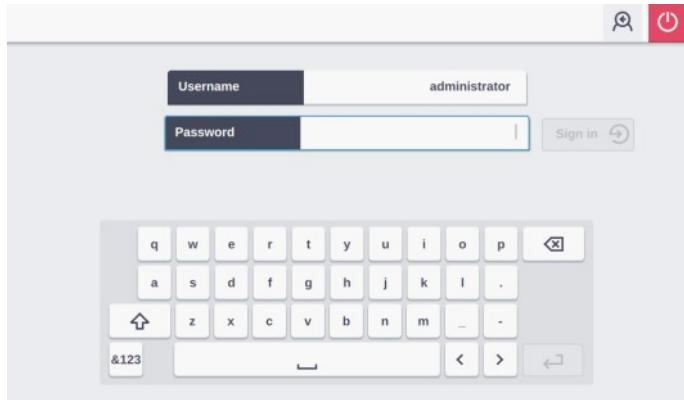
*TheraPEAK® Nucleofector® Products are produced according to applicable GMP raw material standards and are intended to support GMP manufacturing. TheraPEAK® Nucleofector® Products are not intended for *in vivo* and/or diagnostic purposes. All other Nucleofector® Products are for research use only.

4D-Nucleofector® Logware

For the 4D-Nucleofector® System, Lonza offers accessory products which provide higher quality standards for transfection applications in upstream GMP manufacturing environments.

Benefits

- Compliance with Title 21 CFR part 11/annex 11
- User administration
- Electronic signatures with user name and password
- Logging of any modification, creation of data or user interaction with time stamp
- Reporting of result failures with failure description
- Data export according to Title 21 CFR part 11
- Generation of audit trails
- No data deletion possible



4D-Nucleofector® LogWare Gen 2 - Login screen



Components of the 4D-Nucleofector® LogWare Gen 2: USB Sticks for LogWare installation and administrator reset and supportive external keyboard

The High-throughput Platform: 384-well Nucleofector® System

The 384-well Nucleofector® System is an independent platform for high-throughput Nucleofection® Experiments in 384-well format. With an extremely fast plate processing time of one minute and high reproducibility it is the ideal tool for screening applications. Furthermore all existing 4D-Nucleofector® X Unit and 96-well Unit Protocols can be used without further optimization.

The 384-well Nucleofector® System consists of three components:

- A **power supply** generating the high voltage pulses.
- The **plate handler** with an electrically driven carousel that comprises two plate positions
- An intuitive **PC-based operation software** which allows easy setup of 384-well Nucleofection® Experiments and can be seamlessly integrated into liquid handling systems*

Consumables

The 384-well Nucleofector® Kits use existing 4D-Nucleofector® Protocols and contain specific conductive polymer 384-well Nucleocuvette® Plates. The plates fulfill SBS standards to allow handling by automated liquid handling systems. Each of the 384-wells is individually addressable. Due to the use of conductive polymer cuvettes there is no contamination of cell suspension with metal ions.



Benefits

Fast processing

- Processes a 384-well plate in about one minute
- Carousel handling two plates

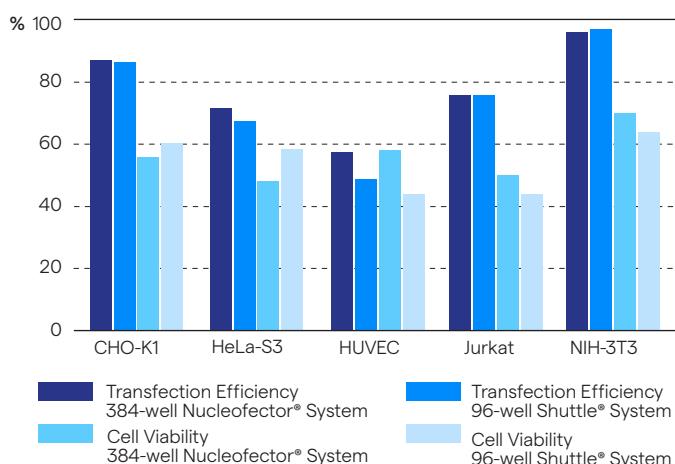
Combining high performance with minimum material consumption

- Nucleofection® Reactions of low cell numbers down to 2×10^4 cells
- Enables high-throughput CRISPR Screens

Easy-to-use and automatable system

- Uses existing 4D-Nucleofector® Protocols
- Operated by intuitive PC-software
- Designed to seamlessly integrate into automated liquid handling systems*

* Integration into a liquid handling system may create additional costs due to necessity of support by supplier of the liquid handling system. Contact your local representative for further details.



Same conditions used for the 96-well Shuttle® System and the 384-well Nucleofector® System. The 384-well Nucleofector® System works with parameters from the 96-well Shuttle® System and the 4D-Nucleofector® 96-well Unit, thus the full spectrum of already optimized protocols is available for the 384-well Nucleofector® System.

Nucleofector® Kits Tailored to Your Needs

Kits for 4D-Nucleofector® System and 384-well Nucleofector® System

As Nucleofection® Vessels for the 4D-Nucleofector® System and the 384-well Nucleofector® System utilize the same conductive polymer electrode material, Nucleofection® Conditions are transferable between the different vessels or platforms offering maximum flexibility and convenience.

Nucleofector® Kits for primary cells

For transfection of primary cells

- A total of 5 dedicated primary cell Nucleofector® Kits P1 – P5, each suited for several primary cell types
- Primary cell optimization Nucleofector® Kits for primary cells lacking an optimized protocol



Nucleofector® Kits for cell lines

For transfection of cell lines

- Selection of 3 cell line Nucleofector® Kits SE, SF and SG
- Cell line optimization Nucleofector® Kits for cell lines lacking an optimized protocol

See next page for overview on available consumables.

4D-Nucleofector® Kits for Adherent Nucleofection® Experiments

For Adherent Nucleofection® Experiments using the 4D-Nucleofector® Y Unit, specific kits are required including an optimized 24-well Dipping Electrode Array made with conductive polymer electrodes.

Nucleofector® Kits for primary cells

- Two 4D-Nucleofector® Y Kits (AD 1 and AD2) that may serve different cell types
- An Optimization 4D-Nucleofector® Y Kit for primary cells or cell lines lacking an Optimized Protocol

Note: Kits may also be used for cell lines

In addition to the specific Nucleofector® Solution, Supplement, pmaxGFP™ Control Vector, each kit contains a 24-well Dipping Electrode Array and a Nunclon™ Δ Surface 24-well plate (Nunc).



To find out which kit is the optimal one for your cell type of interest please check out our cell database for most up-to-date information knowledge.lonza.com.

See next page for overview on available consumables.

	100 μ L Nucleocuvette [®] Vessel	16-well Nucleocuvette [®] Strip	2 mL Nucleocuvette [®] Cartridge PRO	LV Nucleocuvette [®] Cartridge PRO
System	4D-Nucleofector [®] X Unit	4D-Nucleofector [®] X Unit	4D-Nucleofector [®] LV Unit PRO	4D-Nucleofector [®] LV Unit PRO
				
Application	High cell numbers at low throughput e.g. for biochemical applications or Western Blots	Low cell numbers at medium throughput e.g. reporter gene assays, RNAi	Larger cell numbers, e.g. cell-based assays or establishing cell therapies	Larger cell numbers, e.g. cell-based assays or establishing cell therapies
Cells/sample	2×10^5 to 2×10^7 cells	2×10^4 to 1×10^6 cells	2×10^7 to 1×10^8 cells	1×10^8 to 1×10^9 cells
Reaction volume	100 μ L	20 μ L	0.5, 1, 1.5 or 2 mL	up to 20 mL
Size(s) available	12 or 24 reactions	32 reactions	1 reaction (RUO) or 5 reactions (GMP)	1 reaction (RUO) or 5 reactions (GMP)

	24-well Dipping Electrode Array	96-well Nucleocuvette [®] Plate	384-well Nucleocuvette [®] Plate
System	4D-Nucleofector [®] Y Unit	4D-Nucleofector [®] 96-well Unit	384-well Nucleofector [®] System
			
Application	Transfected cells in adherence (e.g. neurons).	Low cell numbers at higher throughput e.g. reporter gene assays, RNAi, optimization	Low cell numbers at high throughput e.g. screening
Cells/sample	$0.5 - 3 \times 10^5$ cells	2×10^4 to 1×10^6 cells	2×10^4 to 1×10^6 cells
Reaction volume	350 μ L	20 μ L	20 μ L
Size(s) available	24 reactions	96 or 960 reactions	768 or 3840 reactions

Ordering information

Cat. no.	Product name	Description			
Nucleofector® Systems					
4D-Nucleofector® System					
AAF-1003B	4D-Nucleofector® Core Unit				
AAF-1003X	4D-Nucleofector® X Unit	Requires Core Unit to build complete system			
AAF-1003Y	4D-Nucleofector® Y Unit	Requires Core Unit to build complete system			
AAF-1003S	4D-Nucleofector® 96-well Unit	Requires Core Unit to build the complete system			
AAF-1003L	4D-Nucleofector® LV Unit PRO	Including 2 LV Reservoir Racks. Requires Core Unit to build complete system			
AWA-3001-B	4D-Nucleofector® Core Unit Warranty Extension	Valid for 1 year			
AWA-3001-X	4D-Nucleofector® X Unit Warranty Extension	Valid for 1 year			
AWA-3001-Y	4D-Nucleofector® Y Unit Warranty Extension	Valid for 1 year			
AWA-3001-LV	4D-Nucleofector® LV Unit Warranty Extension	Valid for 1 year			
AWA-3001-96	4D-Nucleofector® 96-well Unit Warranty Extension	Valid for 1 year			
AWF-1002	Nucleofector® Commercial License	Required for commercial use			
AXP-1003	Inspection Equipment 4D-Nucleofector® Single Cuvette				
AXP-1004	Inspection Equipment 4D-Nucleofector® 16-well Strip				
AXP-1009	Inspection Equipment 4D-Nucleofector® Y Unit				
AXP-1007	Inspection Equipment 4D-Nucleofector® 96-well Unit				
AXP-1008	Inspection Equipment 384-well Nucleofector® System				
384-well Nucleofector® System					
AAU-1001	384-well Nucleofector® System	Includes power supply, plate handler, laptop, and software			
AWA-3001-HT	4D-Nucleofector® 384-well System Warranty Extension	Valid for 1 year			
AWT-1001	384-well Nucleofector® System Installation and Training				
On-site Training / Installation					
SBA-1005	Nucleofection® Basic Installation and Training				
SBA-1006	Nucleofection® Wet Lab Training				
SBA-1007	Nucleofection® Virtual Training				
Software					
SAAF-1002	4D-Nucleofector® LogWare Gen 2	21CFR part 11 compliant software for Gen 2 systems			
SBA-3001	4D-Nucleofector® Automation Package	Automation Server Software for liquid handling integration			
Primary Cell Kits					
4D-Nucleofector® X Unit Kits					
V4XP-1012	P1 Primary Cell 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	12 reactions		
V4XP-1024	P1 Primary Cell 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	24 reactions		
V4XP-1032	P1 Primary Cell 4D-Nucleofector® X Kit S	20 µL Nucleocuvette® Strip	32 reactions (16-well)		
V4XP-2012	P2 Primary Cell 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	12 reactions		
V4XP-2024	P2 Primary Cell 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	24 reactions		
V4XP-2032	P2 Primary Cell 4D-Nucleofector® X Kit S	20 µL Nucleocuvette® Strip	32 reactions (16-well)		
V4XP-3012	P3 Primary Cell 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	12 reactions		
V4XP-3024	P3 Primary Cell 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	24 reactions		
V4XP-3032	P3 Primary Cell 4D-Nucleofector® X Kit S	20 µL Nucleocuvette® Strip	32 reactions (16-well)		
V4XP-4012	P4 Primary Cell 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	12 reactions		
V4XP-4024	P4 Primary Cell 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	24 reactions		
V4XP-4032	P4 Primary Cell 4D-Nucleofector® X Kit S	20 µL Nucleocuvette® Strip	32 reactions (16-well)		
V4XP-5012	P5 Primary Cell 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	12 reactions		
V4XP-5024	P5 Primary Cell 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	24 reactions		
V4XP-5032	P5 Primary Cell 4D-Nucleofector® X Kit S	20 µL Nucleocuvette® Strip	32 reactions (16-well)		
V4XP-9096	Primary Cell Optimization 4D-Nucleofector® X Kit	20 µL Nucleocuvette® Strip	96 reactions (16-well)		

Cat. no.	Product name	Description	Size
4D-Nucleofector® LV Unit Kits – Research-grade consumables			
V4LP3-02250	P3 Primary Cell Nucleofector® Solution LV Set		2.25 mL + 0.5 mL
V4LP3-22500	P3 Primary Cell Nucleofector® Solution LV Set		22.5 mL + 5 mL
V4LN-8002	2 mL Nucleocuvette® Cartridge PRO	Fixed-volume	1 piece
V4LN-8020W	LV Nucleocuvette® Cartridge PRO, weldable tubing	Flow-through	1 piece
V4LR-1001W	4D-Nucleofector® LV Reservoirs, weldable tubing		2 pieces
4D-Nucleofector® LV Unit Kits – GMP-grade consumables			
G4LP3-22500	TheraPEAK® P3 Nucleofector® Solution Set		22.5 mL + 5 mL
G4LP3-126000	TheraPEAK® P3 Nucleofector® Solution Set		126 mL + 28 mL
G4LN-8502	TheraPEAK® 2 mL Nucleocuvette® Cartridge PRO (available end of 2025)	Fixed-volume	5 pieces
G4LN-8520W	TheraPEAK® LV Nucleocuvette® Cartridge PRO, weldable tubing (available end of 2025)	Flow-through	5 pieces
G4LR-1501W	TheraPEAK® 4D-Nucleofector® Reservoir, weldable tubing		5 pieces
4D-Nucleofector® 96-well Unit Kits			
V4SP-1096	P1 Primary Cell 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	96 reactions (96-well)
V4SP-1960	P1 Primary Cell 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	960 reactions (96-well)
V4SP-2096	P2 Primary Cell 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	96 reactions (96-well)
V4SP-2960	P2 Primary Cell 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	960 reactions (96-well)
V4SP-3096	P3 Primary Cell 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	96 reactions (96-well)
V4SP-3960	P3 Primary Cell 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	960 reactions (96-well)
V4SP-4096	P4 Primary Cell 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	96 reactions (96-well)
V4SP-4960	P4 Primary Cell 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	960 reactions (96-well)
V4SP-5096	P5 Primary Cell 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	96 reactions (96-well)
V4SP-5960	P5 Primary Cell 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	960 reactions (96-well)
V4SP-9096	Primary Cell Optimization 96-well Nucleofector® Kit	20 µL 96-well Nucleocuvette® Plate	160 reactions (96-well)
384-well Nucleofector® System Kits			
V5SP-1002	P1 Primary Cell 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	768 reactions (384-well)
V5SP-1010	P1 Primary Cell 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	3840 reactions (384-well)
V5SP-2002	P2 Primary Cell 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	768 reactions (384-well)
V5SP-2010	P2 Primary Cell 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	3840 reactions (384-well)
V5SP-3002	P3 Primary Cell 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	768 reactions (384-well)
V5SP-3010	P3 Primary Cell 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	3840 reactions (384-well)
V5SP-4002	P4 Primary Cell 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	768 reactions (384-well)
V5SP-4010	P4 Primary Cell 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	3840 reactions (384-well)
V5SP-5002	P5 Primary Cell 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	768 reactions (384-well)
V5SP-5010	P5 Primary Cell 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	3840 reactions (384-well)
V5SP-9001	Primary Cell Optimization 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	384 reactions (384-well)
4D-Nucleofector® Y Unit Kits			
V4YP-1A24	AD1 4D-Nucleofector® Y Kit	24-well Dipping Electrode	24 reactions
V4YP-2A24	AD2 4D-Nucleofector® Y Kit	24-well Dipping Electrode	24 reactions
V4YP-9A48	Primary Cell Optimization 4D-Nucleofector® Y Kit	24-well Dipping Electrode	48 reactions

Cat. no.	Product name	Description	Size
Cell Line Kits			
4D-Nucleofector® X Unit Kits			
V4XC-1012	SE Cell Line 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	12 reactions
V4XC-1024	SE Cell Line 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	24 reactions
V4XC-1032	SE Cell Line 4D-Nucleofector® X Kit S	20 µL Nucleocuvette® Strip	32 reactions (16-well)
V4XC-2012	SF Cell Line 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	12 reactions
V4XC-2024	SF Cell Line 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	24 reactions
V4XC-2032	SF Cell Line 4D-Nucleofector® X Kit S	20 µL Nucleocuvette® Strip	32 reactions (16-well)
V4XC-3012	SG Cell Line 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	12 reactions
V4XC-3024	SG Cell Line 4D-Nucleofector® X Kit L	100 µL Nucleocuvette® Vessel	24 reactions
V4XC-3032	SG Cell Line 4D-Nucleofector® X Kit S	20 µL Nucleocuvette® Strip	32 reactions (16-well)
V4XC-9064	Cell Line Optimization 4D-Nucleofector® X Kit	20 µL Nucleocuvette® Strip	64 reactions (16-well)
4D-Nucleofector® 96-well Unit Kits			
V4SC-1096	SE Cell Line 96-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	96 reactions (96-well)
V4SC-1960	SE Cell Line 96-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	960 reactions (96-well)
V4SC-2096	SF Cell Line 96-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	96 reactions (96-well)
V4SC-2960	SF Cell Line 96-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	960 reactions (96-well)
V4SC-3096	SG Cell Line 96-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	96 reactions (96-well)
V4SC-3960	SG Cell Line 96-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	960 reactions (96-well)
V4SC-9096	Cell Line Optimization 96-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	96 reactions (96-well)
384-well Nucleofector® System Kits			
V5SC-1002	SE Cell Line 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	768 reactions (384-well)
V5SC-1010	SE Cell Line 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	3840 reactions (384-well)
V5SC-2002	SF Cell Line 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	768 reactions (384-well)
V5SC-2010	SF Cell Line 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	3840 reactions (384-well)
V5SC-3002	SG Cell Line 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	768 reactions (384-well)
V5SC-3010	SG Cell Line 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	3840 reactions (384-well)
V5SC-9001	Cell Line Optimization 384-well Nucleofector® Kit	20 µL Nucleocuvette® Plate	384 reactions (384-well)

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