



S3e™ Cell Sorter





EVOLUTION

Simplified Sorting

The S3e Cell Sorter provides true walk-up and walk-away automated capabilities to scientists. Expertly engineered, the S3e is a benchtop cell sorter equipped with one or two lasers and up to four fluorescence detectors plus forward and side scatter (FSC and SSC). Cells are analyzed using traditional jet-in-air technology. Samples can be sorted at high speeds while maintaining sensitivity and unmatched purity. Cell sorting has never been easier for the most common sorting experiments. Small in footprint, the S3e Cell Sorter brings affordable, dependable, and simplified cell sorting to every researcher.

Walk-Up Cell Sorting

Makes cell sorting accessible to scientists with minimal training.

Automated Setup

Has automated drop delay calculation, real-time droplet break-off monitoring, and feedback to ensure sort accuracy.

Hands-Free Alignment

Uses automatic nozzle tip and stream-to-optics alignment, driven completely by software.

Space-Saving Design

Includes internalized fluidics and temperature control system to fit in any laboratory.

Intuitive Interface

Includes ProSort™ Software for effortless instrument control and sort logic definition.



STREAMLINED

Compact and Clean Design



65 cm
(2.1 ft)

70 cm
(2.3 ft)



The S3e Cell Sorter is only 70 x 65 x 65 cm (W x D x H). This benchtop instrument has fully enclosed fluidics and temperature control system, therefore no additional fluidics cart or benchspace is required. The S3e Cell Sorter uses a standard 110 V or 220 V plug and has two simple connections to the accompanying computer for easy installation.



STATE OF THE ART

True Automation

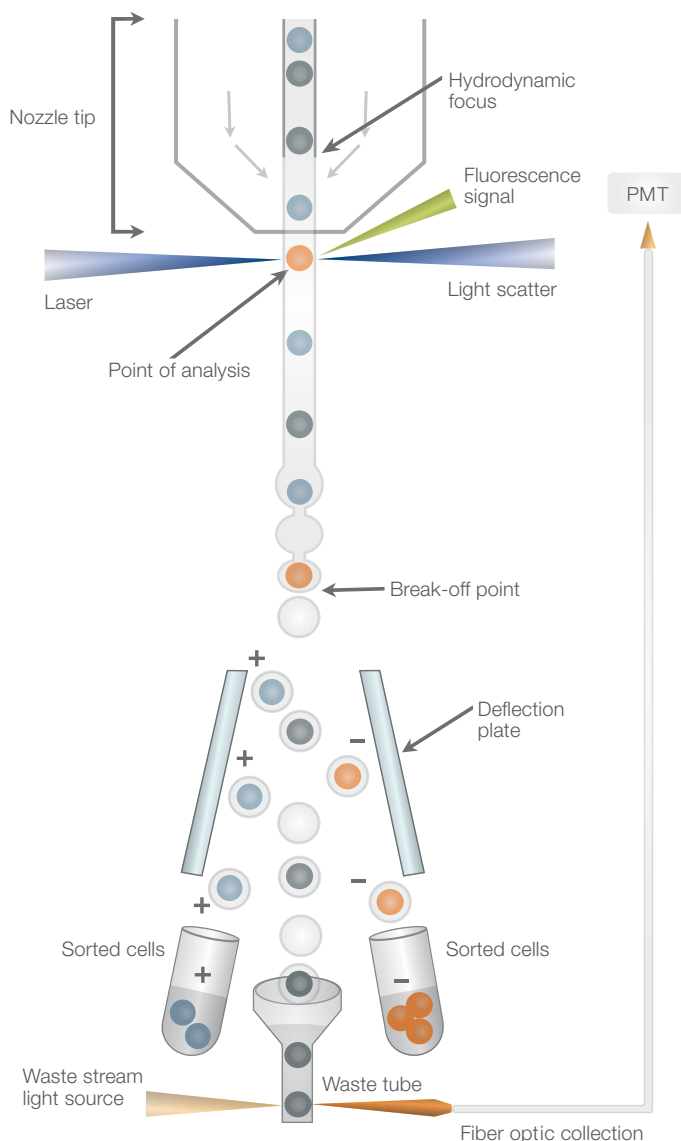
ProDrop™ Technology

Engineered by experts with over 30 years' experience in cell sorting, setup is completed with minimal user input and samples are ready to be sorted in less than 30 minutes. ProDrop technology enables automated drop delay calculation and real-time droplet break-off monitoring, thereby alleviating the complexity that other cell sorters require during the sort setup.

The drop delay is calculated through direct counting of ProLine™ Universal Calibration Beads events in the waste stream during the quality control (QC) process. This technology ensures extraordinarily high accuracy and precision. There is no need for user intervention or to count beads under a microscope for confirmation.



Drop delay calculation. While the ProDrop technology is calculating accurate drop delay values, the green points indicate the number of beads detected in the waste stream during the drop delay determination process. As the best drop delay value is obtained, the orange dashed line will appear. As shown in the schematic, the waste stream light source excites beads that pass through and emission feeds back to the fluorescence detector to calculate drop delay value.



Schematic of sort stream. Schematic depicting the mechanism by which events are sorted. Events are hydrodynamically focused by the sheath fluid before exiting the nozzle tip. With jet-in-air technology, events are interrogated in the stream where the sort decision is made. The stream is then charged at the break-off point prior to electrostatic deflection. Droplets can be deflected in two directions based on predefined sort logic conditions. PMT, photomultiplier tube.

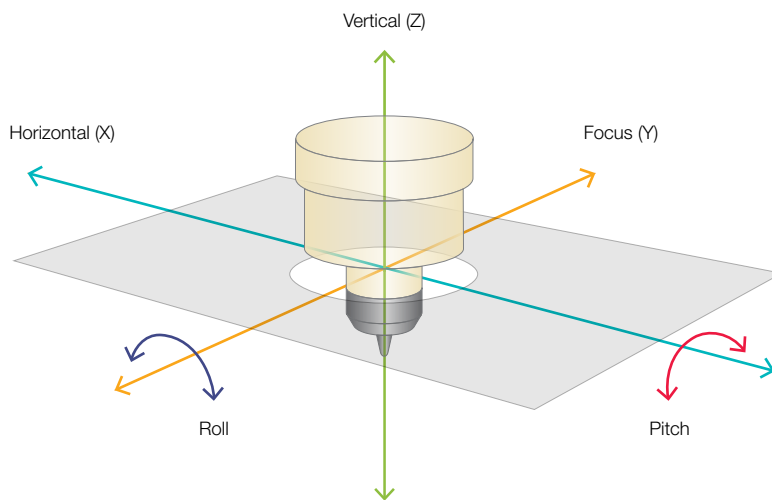
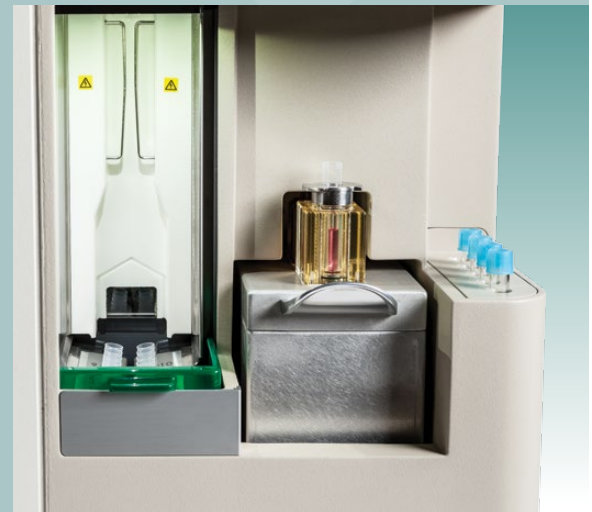
AutoGimbal™ System

The highly sophisticated AutoGimbal System combines picomotor fine motion positioning, imaging, and software to enable hands-free automated alignment of the nozzle tip and stream to optics. Five-axis motorized controllers make micrometer adjustments in response to the software algorithms using camera images.

Core capabilities of the AutoGimbal System are:

- High-resolution automated alignment driven by software
- Software controlled using image processing and algorithms
- Precise positioning of the nozzle and stream trajectory fine-tuned with 5-axis piezo-driven submicron motion control
- 3 axes (x, y, and z) for optimal positioning of the nozzle stream at the intersection of the lasers and detectors
- 2 axes (roll and pitch) for adjusting the stream trajectory, which is necessary for accurate drop delay determination
- Reproducible and reliable mechanism with full nozzle accessibility

Through AutoGimbal automation, achieve hands-free alignment at all points on the stream and consistency in stream position from day to day and user to user.



Schematic of five-axis movement.



INNOVATIVE

From Sample Input to Sort Collection

Sample Input

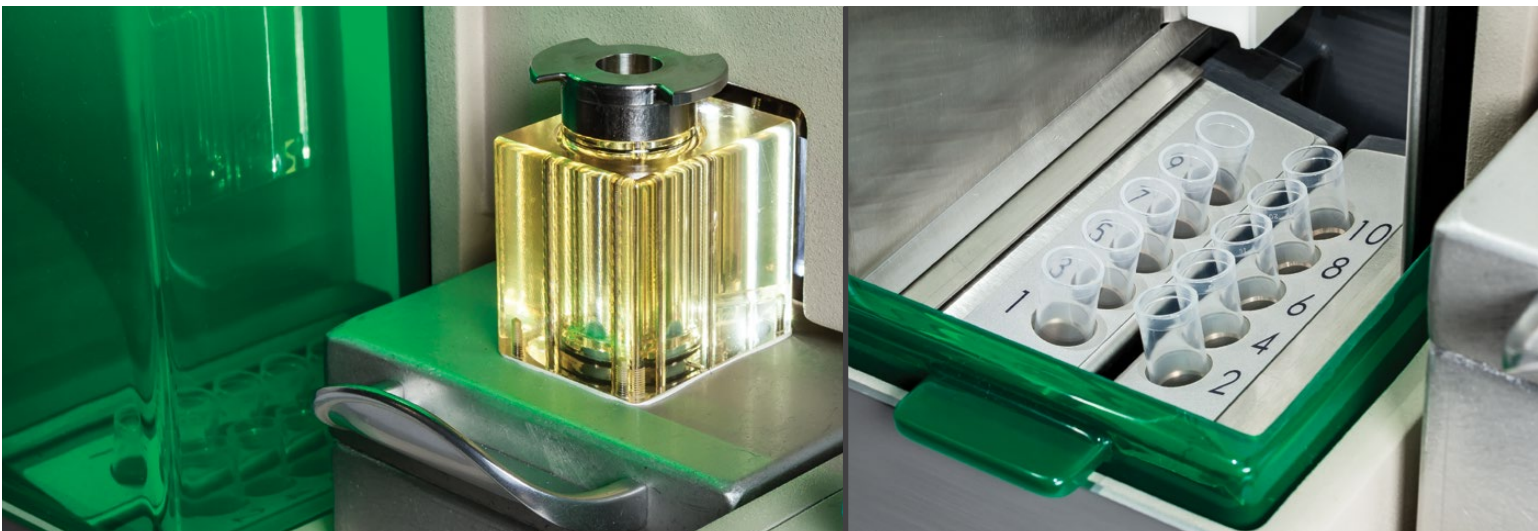
The loading stage is composed of a sample station and a washing station that ensure automatic backflushing of the sample line between sort runs. Once the sample is unloaded from the sample station, the sample line is cleaned inside and out in the washing station. Integrated within the sample station is an agitator that can keep cells resuspended during the sort acquisition. Additionally, a novel locking mechanism enables complete pressurization of the sample chamber, independent of the 5 ml tube, which can reduce sample-to-sample cross-contamination.

Sort Collection

Equally unique is the collection area that supports two-way sorting with up to five samples in each direction, for a total of ten tubes. Sorting becomes fast and more efficient when several samples are sorted one after another. As sort collection tubes fill, the S3e Cell Sorter automatically monitors volume, stopping at the collection volume limit. This can prevent sample spillover loss or sample cross-contamination. Using a click-on adaptor, sort into 8-well strips or onto a microscope slide for an easy transition to downstream assays such as real-time PCR or fluorescence cell imaging.

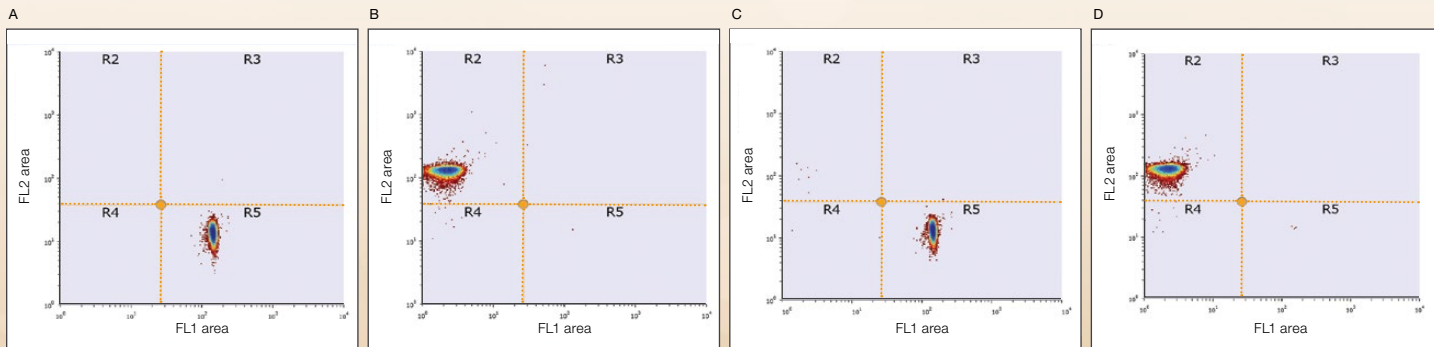
Temperature Control

The S3e Cell Sorter features an onboard temperature control system using Peltier solid-state technology, located at both the sample loading stage and collection area. Temperature can be maintained from 4–37°C to suit a variety of assay needs, such as helping to preserve cell viability. Save precious space and eliminate the need for extra water baths or cumbersome attachments with this built-in system.



Fluidics System

The unique fluidics system dilutes ProFlow™ Sort Grade 8x Sheath Fluid with deionized water in an internal buffer chamber, which feeds 1x sheath fluid into the hydrodynamic focusing region. The fluidic pressure is internally maintained, enabling the ProFlow Sort Grade 8x Sheath Fluid, deionized water, and waste containers to be hot swapped out for uninterrupted sort collection and eliminating the need for additional repressurization setup time. ProFlow Sort Grade 8x Sheath Fluid is preservative free to maintain optimal cell viability and functionality after the sorting process.



Cleaning system. Carryover between samples is minimized using the backflushing system. FITC-labeled beads were run on the instrument (A). Subsequently, PE-labeled beads were run (B), followed by a repeated cycle of FITC-labeled beads (C) and PE-labeled beads (D). Each time, carryover of fluorescently labeled beads was analyzed and showed minimal carryover between samples.

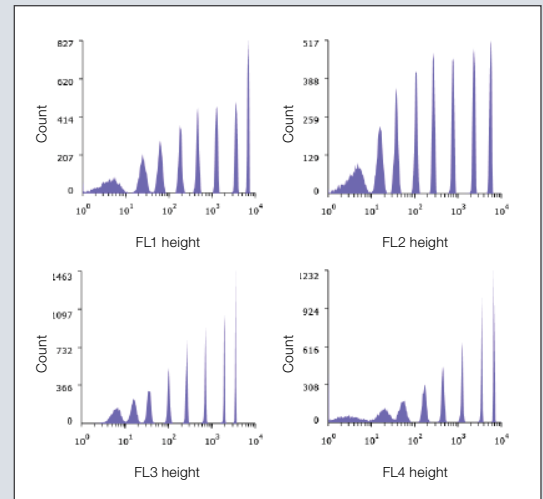


UNCOMPROMISED

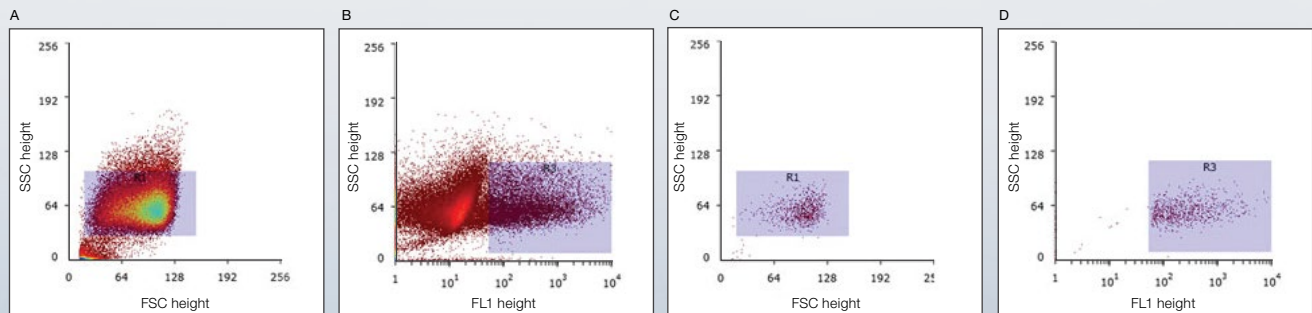
High Performance and Sensitivity

The S3e Cell Sorter is sensitive even at high speeds for uncompromised performance. See fine separation of fluorescent cell markers with high resolution and linearity comparable to other complex sorters. Using jet-in-air technology, the S3e Cell Sorter can sort at high speeds with accurate droplet break-off monitoring. For cells expressing fluorescent proteins, a broad range of expression levels can easily be detected and sorted with confidence. The S3e Cell Sorter can also be used to analyze cells with exceptional sensitivity and performance.

- No hardware limitations for sort rate, which is limited only by droplet frequency and application
- 3 different modes depending on sorting needs: enrich, purity, or single cell
- Automated droplet monitoring guarantees that positive events within the sort logic gates are charged and sorted correctly
- No user input is required to monitor or manipulate the sorting setup during a run
- Provides reliability with high performance for every sort



Sensitive detection of fluorescent microspheres. ProLine Rainbow Beads (eight peaks) were excited by both 488 nm and 640 nm lasers. Emission was measured by all four detectors. Between peaks, all channels displayed a coefficient of variation (CV) <2.5 units. All eight peaks are visible in all four channels.



Performance. HeLa cells were transfected with GFP and sorted by forward and side scatter, singlets, and GFP expression. **A–B**, presort analysis of GFP-positive cells; **C–D**, postsort population was sorted to >98% purity. Postsort analysis revealed that a pure GFP-positive population was successfully sorted.



VERSATILE

User Configurable

Flexible and convenient, the S3e Cell Sorter has a user-changeable optical filter design that is easily accessible in order to optimize filter and fluorochrome combinations. A wide variety of filters that are compatible with the S3e Cell Sorter is available from vendors. These can easily be swapped in and out using the filter blocks and cartridges. Create specialized filter combinations for different experiments using specific fluorophores. The S3e Cell Sorter is designed to handle the most common sorting experiments run in flow cytometry core laboratories today.

Optimized Filter Configuration

A collection of filters and mirrors optimized for transmission of fluorescence signals that are excited by a 100 mW diode-pumped solid-state laser is included. Fluorescein isothiocyanate (FITC), green fluorescent protein (GFP), phycoerythrin (PE), propidium iodide (PI), and other commonly used fluorophores or fluorescent proteins can be excited with the 488 nm laser and detected with this optical configuration. The optional 561 nm 100 mW or 640 nm 100 mW diode-pumped solid-state laser is available for additional excitation of the red fluorescent protein family and other fluorophores in that specific excitation range. The laser power is adjustable to accommodate bright fluorophores and highly expressed fluorescent proteins.





INTUITIVE

Effortless Operation

Designed with researchers in mind, the ribbon-based ProSort Software is intuitive. A comprehensive instrument control interface is streamlined, allowing users to effortlessly interact with the instrument or to create sorting protocols. Set all sorting parameters and make sample-specific adjustments with clear and concise instrument parameter options.

Several types of user options are available, including an administrative mode, which provides access to global setup parameters and maintenance controls for the cell sorter. QC reports containing bead lot information, setup parameters, and sort logs are captured and maintained by the software for accurate record-keeping.

ProSort Software creates files that follow current flow cytometry standard (FCS) 3.1 so data can be analyzed by any compatible third-party software.

Fully integrated with ProSort Software, the S3e Biosafety System Class I is monitored in real time. The software manages the fan speed of the containment system to allow for two operational modes: idle mode, running with low airflow, and sort mode, running with Class I airflow.

S3e™ Biosafety System Class I
 Serial#: 779BR0002
 Firmware: 000A
 Status: OK
On
 Exhaust
 Filter Life : 100.00 %
 Temperature : 29.30°C

ProSort™
 Instrument Control
 300
 100 L/min
 Cycle Mode
 Filter Life : 100.00 %
 Temperature : 29.30°C
 Ready

Sort Logic
 Tube (LmL)
 Sort Priority
 Left Sort Right Sort
 Prevent Overflow
 Initial Volume (mL) 0.50
 R1 & R2 & R3
 None Limits
 None Limits
 None Limits
 None Limits
 Purity Limits 100,000

Sort Statistics
 Show Aggregate Statistics
 Sort Logic R1 & R2 R1 & R3
 Mode None None
 Current Target 1 2
 Sort Count 20,000 20,000
 Sort Volume (mL) 0.0663 0.0663
 Abort Count 21427 21499
 Sorts Per Second 56 69
 Aborts Per Second 60 74
 Sort % 9.97 % 9.97 %
 Abort % 10.69 % 10.72 %
 Efficiency 48.28 % 48.25 %
 Event Rate Total Events
 0 200,533
 Sort Time 00:00:00



Connected Workflow

Bio-Rad provides a wide variety of workflow solutions for diverse areas of focus. Gaining reliable and reproducible results is integral to each step to ensure confidence in experimental end results. Cell sorting can work seamlessly with other Bio-Rad products by isolating homogeneous populations to achieve more specific results and by reducing background noise or false positives.

The S3e Cell Sorter can be used upstream to real-time and digital PCR, such as with the QX200™ Droplet Digital™ PCR System, in proteomics studies using Bio-Rad's V3 Western Workflow™, or as a downstream step to transfection for sorting cells expressing fluorescent proteins of interest. Combining the S3e Cell Sorter with Bio-Rad's fluorescence kits will offer superior performance for reliable results. The TC20™ Automated Cell Counter can be used to count cells prior to or after cell sorting for genomics or proteomics studies.



Safety – Minimizing Risks

While the S3e Cell Sorter has an interlocked sort chamber door to protect from aerosols formed by the sort stream in the collection area, safety is always a key concern. Adhering to National Institutes of Health (NIH) biosafety standards, a biosafety cabinet is the primary containment system recommended. The S3e Cell Sorter fits seamlessly in the custom-designed S3e Biosafety System Class I. Fully integrated with the ProSort Software, the system airflow is controlled and the HEPA filter is monitored in real time. The S3e Biosafety System Class I is uniquely designed with four magnetically attached vinyl walls, which allows easy access to the instrument inside for service or routine maintenance. This option is available to be compliant with NIH standards. Feel confident in protecting both the user and the surrounding environment when performing sort experiments in an S3e Biosafety System Class I.

Support – Technical and Service Care

Bio-Rad's experienced service engineers will provide either on-call or on-site product and instrument support for instruments under warranty or service contract. It is Bio-Rad's long-term commitment to science and the scientific community that stands behind each Bio-Rad-labeled product.

Instrument support includes:

- Instrument installation
- Installation qualification and operational qualification
- Service contracts and preventive maintenance plans
- Technical application support
- Time and material billable services

Technical support scientists can be reached via our support hotline at **1-800-424-6723**.

Specifications

Droplet frequency	37–43 kHz
Sorting type	True jet-in-air for high-performance sorting
Sorting rate	No hardware limitations for sort rate, limited only by droplet frequency and application
Sorting purity	>99% pure
Nozzle size	100 µm
Sorting direction	2-way sorting
Sorting collection	Up to 5 x 5 ml sample tubes each direction Up to 5 x 1.5 ml tubes each direction Microscope slides 8-well strip each direction
Lasers	Single laser: 488 nm 100 mW Single-laser upgrade: 488 nm 100 mW plus 561 or 640 nm 100 mW Dual laser: 488 and 561 nm 100 mW; 488 and 640 nm 100 mW
Detection	Forward scatter (FSC) with PMT Side scatter (SSC) with PMT Up to 4 fluorescence detectors with PMT Minimum resolution: 0.5 µm
Sensitivity	<125 MESF for FITC and PE
Temperature range	Sample and collection temperature control system: 4–37°C Peltier solid-state system
Fluidics	Onboard fluidics and dilution of ProFlow Sort Grade 8x Sheath Fluid with deionized water
Data format	FCS 3.1
Dimensions (W x D x H)	70 x 65 x 65 cm (2.3 x 2.1 x 2.1 ft)

Ordering Information

Catalog #	Description
Instrumentation	
145-1005	S3e Cell Sorter , 488 nm 100 mW laser, includes 2 fluorescence detectors with filters, AutoGimbal System, 2 fluidic containers with connectors and tubing (sheath, water, waste), power cord, ProSort Software
145-1006	S3e Cell Sorter , 488 and 561 nm 100 mW lasers, includes 4 fluorescence detectors with filters, AutoGimbal System, 2 fluidic containers with connectors and tubing (sheath, water, waste), power cord, ProSort Software
145-1008	S3e Cell Sorter , 488 and 640 nm 100 mW lasers, includes 4 fluorescence detectors with filters, AutoGimbal System, 2 fluidic containers with connectors and tubing (sheath, water, waste), power cord, ProSort Software
145-1078	S3e Biosafety System Class I
145-1029	S3e Cell Sorter (488 nm) with S3e Biosafety System Class I
145-1030	S3e Cell Sorter (488/561 nm) with S3e Biosafety System Class I
145-1032	S3e Cell Sorter (488/640 nm) with S3e Biosafety System Class I
Consumables	
145-1086	ProLine Universal Calibration Beads , 3 x 5 ml bottles
145-1082	ProFlow Sort Grade 8x Sheath Fluid , 5 x 4 L containers, preservative free
145-1083	ProFlow Sort Grade Water , 5 x 4 L containers, sterile-filtered, endotoxin-tested water
145-1085	ProLine Rainbow Beads , 1 x 5 ml bottle, mixture of 3.0–3.4 µm beads dyed with 8 different fluorescence intensities
Accessories	
145-1065	S3e Accessory Kit , includes 100 µm nozzle tip, 2 nozzle O-rings, 2 nozzle alignment disks, 1 ml syringe, 2 neutral density filters (1.0), 2 mm hex driver, spanner wrench
145-1084	S3e Fluidic Container , 3 x 4 L containers, gamma-irradiated, sterile

Visit www.bio-rad.com/web/S3emore for more information.

Bio-Rad's thermal cyclers and real-time thermal cyclers are covered by one or more of the following U.S. patents or their foreign counterparts owned by Eppendorf AG: U.S. Patent Numbers 6,767,512 and 7,074,367.

The QX200 Droplet Digital PCR System and/or its use is covered by claims of U.S. patents, and/or pending U.S. and non-U.S. patent applications owned by or under license to Bio-Rad Laboratories, Inc. Purchase of the product includes a limited, non-transferable right under such intellectual property for use of the product for internal research purposes only. No rights are granted for diagnostic uses. No rights are granted for use of the product for commercial applications of any kind, including but not limited to manufacturing, quality control, or commercial services, such as contract services or fee for services. Information concerning a license for such uses can be obtained from Bio-Rad Laboratories. It is the responsibility of the purchaser/end user to acquire any additional intellectual property rights that may be required.



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