

S3™ Cell Sorter





EVOLUTION

Automated. Approachable. Affordable.

Bio-Rad's S3 cell sorter is the first truly walk-up automated cell sorter available to scientists. Expertly engineered with revolutionary precision and automated setup, the S3 cell sorter 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 S3 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, stream-to-laser alignment, droplet break-off monitoring, and feedback to ensure sort accuracy.

Space-Saving Design

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

Reduced Carryover

Ensures the sample line is clean between sort runs with a dual-position loading stage.

Intuitive Interface

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



STREAMLINED

Compact. Clean Design.



65 cm
(2.1 ft)

70 cm
(2.3 ft)



The S3 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 there is no additional fluidics cart or benchspace required. The S3 cell sorter uses a standard 110 V or 220 V plug and has two simple connections to the accompanying computer for easy installation.

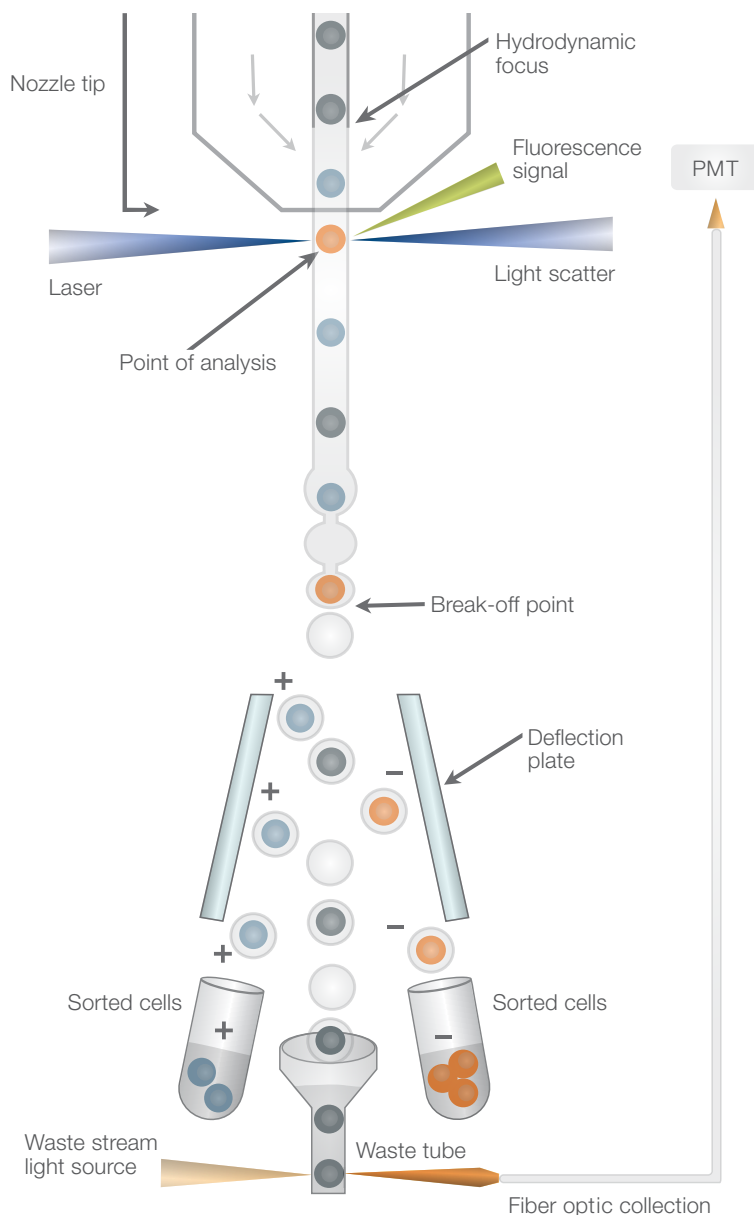


STATE OF THE ART

Simplified Sorting Setup with Automation

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. First, the stream setup and stream-to-laser alignment are automatically handled by the S3 cell sorter. Novel ProDrop™ technology, which enables automated drop delay calculation and patent-pending droplet break-off monitoring, alleviates the complexity that other cell sorters require during the sort setup.

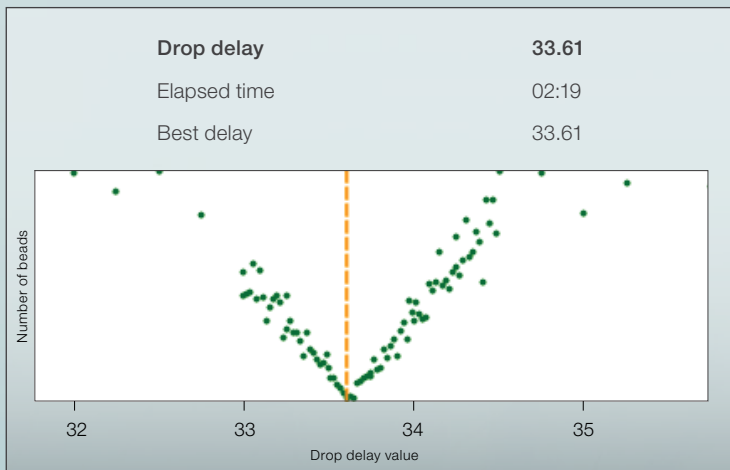
Ensure that events are identified accurately using the proprietary automated alignment method and customized ProLine™ calibration beads for quality control (QC) checks. After performing instrument setup with the ProLine calibration beads, a QC report is automatically generated for documentation. Samples can be consistently sorted with high purity and yield. Start sort experiments more quickly and preserve cellular health.



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.

ProDrop Technology

ProDrop technology accurately calculates the drop delay on the S3 cell sorter by analyzing the waste stream while running ProLine calibration beads. Events are detected at the interrogation point and then again in the waste stream by an additional laser. The drop delay setting is automatically adjusted through a set range — coarsely then finely — while the sort deflection is enabled. When the correct drop delay setting is found, the ProLine beads are no longer detected in the waste stream. At this moment, all the ProLine beads are being accurately deflected. This is the calculated drop delay value. ProDrop technology allows accurate determination of the drop delay value without requiring user intervention or the need 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.



INNOVATIVE

From Sample Input to Sort Collection

Sample Input

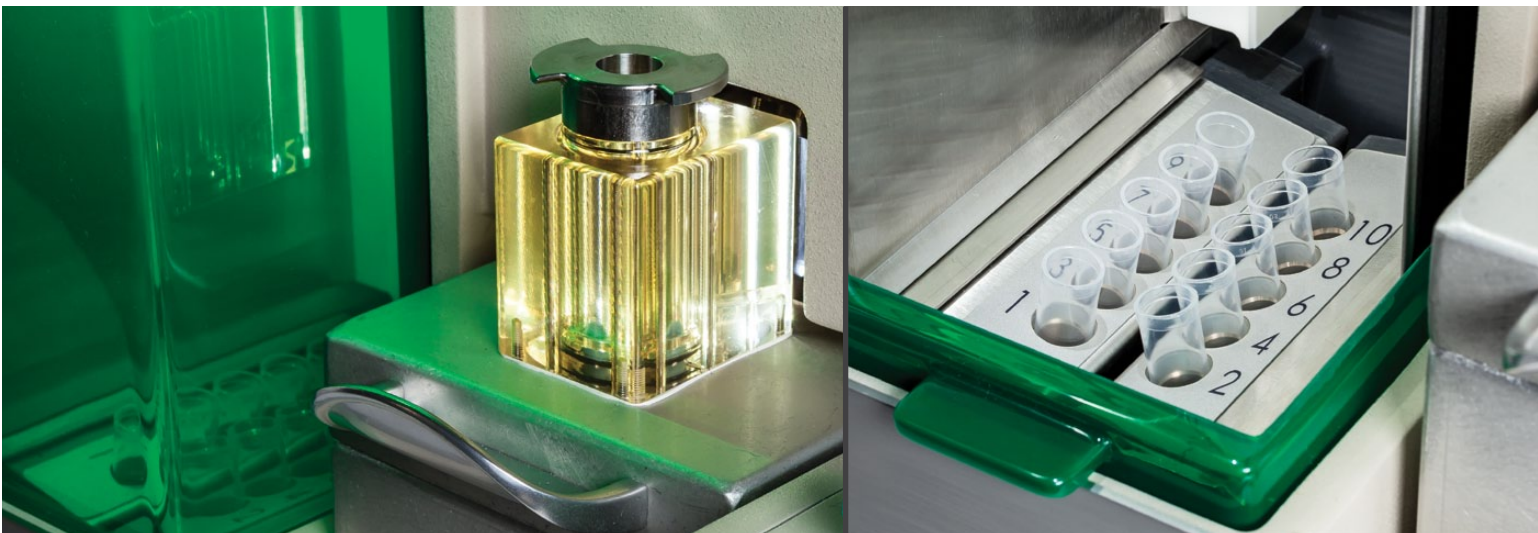
The well-designed dual-position loading stage ensures that the system automatically backflushes the sample input line between sort runs. Once the sample is unloaded from the first position, the sample line is cleaned inside and out in the second position. Additionally, a novel “lock and load” mechanism enables complete pressurization of the sample chamber, independent of the 5-ml tube. This mechanism reduces sample-to-sample cross-contamination by only engaging the tube and sample via the sample input line.

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 sorting several samples one after another. As sort collection tubes fill, the S3 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, allowing for an easy transition to downstream assays such as real-time PCR or fluorescence cell imaging.

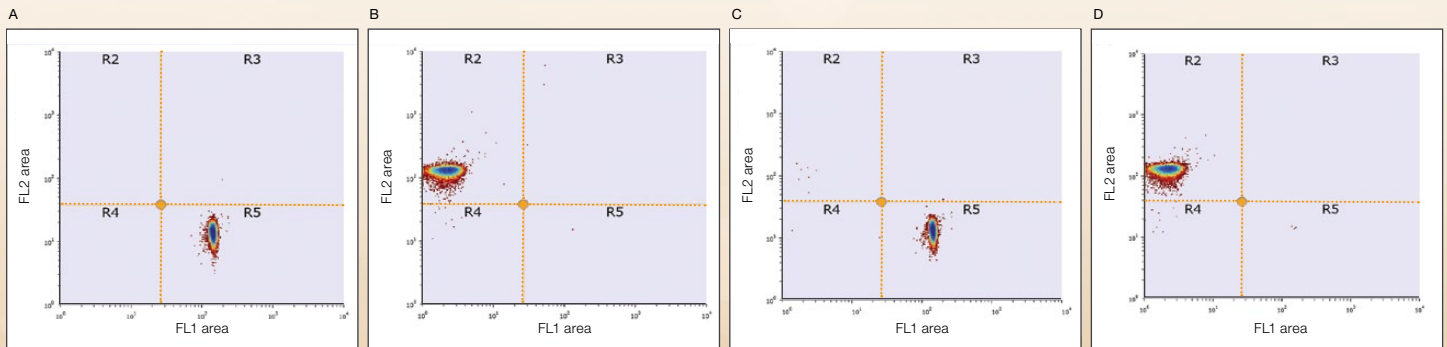
Temperature Control

The S3 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™ 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 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 8x sheath fluid is made preservative free to maintain optimal cell viability and functionality after the sorting process.



Cleaning system. Carryover between samples is minimized using the “lock and load” 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.

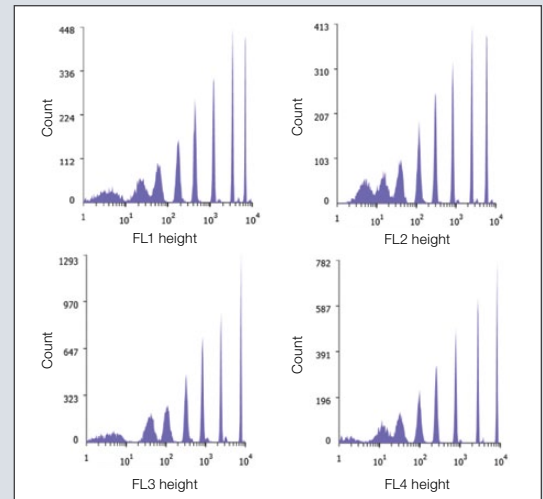


UNCOMPROMISED

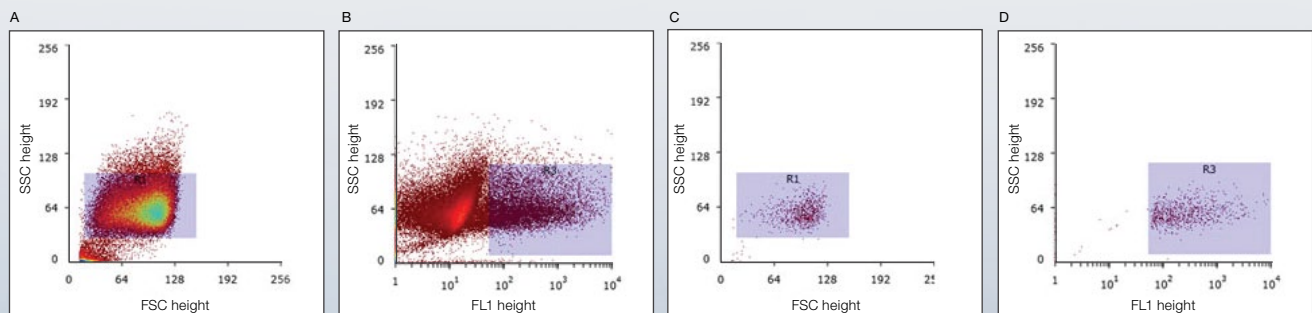
High Performance and Sensitivity

The S3 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 S3 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 S3 cell sorter can also be used to analyze cells with exceptional sensitivity and performance.

- Acquisition rate is 100,000 events/sec with sort rates up to 30,000 events/sec
- 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



Sensitivity of fluorescent microspheres. SPHERO rainbow calibration particles (8 peaks) were excited by both 488 nm and 561 nm lasers. Emission was measured by all four detectors. Between peaks, all channels displayed a coefficient of variation (CV) <2.5 units. The FL3 channel displays the seven lowest peaks. The eighth peak is offscale due to the brightness of the signal intensity.



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 S3 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 are available from vendors that are compatible with the S3 cell sorter. 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 S3 cell sorter is designed to handle the most common sorting experiments run in flow core laboratories today.

Optimized Filter Configuration

An optimized collection of filters and mirrors is included for transmission of fluorescence signals excited by a 100 mW diode-pumped solid state laser. 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 diode-pumped solid state laser is available for additional excitation of the red fluorescent protein family and other fluorophores in that specific excitation range.





INTUITIVE

Effortless Interface

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 available to maintain 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.

BIO-RAD S3 Cell Sorter

ProSort Instrument Control

Sort Logic

Sort Priority: Left Sort ← Right Sort

Prevent Overflow

Initial Volume (mL): 0.5

R1 & R2		R1 & R2 & R3	
None	9 10	None	0
None	7 8	None	0
None	5 6	None	0
None	3 4	None	0
None	1 2	Purity	50000

Sort Statistics

	Left Sort	Right Sort
Sort Logic	R2 & R3	
Sort Count	20000	0
Sort Volume (mL)	0.1004	0.0000
Abort Count	1196	0
Sorts Per Second	0	0
Aborts Per Second	0	0
Sort %	9.99 %	0.00 %
Abort %	0.60 %	0.00 %
Efficiency	0.00 %	0.00 %
Event Rate	0	Total Events
		200165
Sort Time	00:02:08	



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 S3 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 S3 cell sorter with Bio-Rad's upcoming 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.



Support — Technical and Service Care

Rest assured that Bio-Rad's recognized technical and product service support is focused on customer needs. 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**.

Safety — Minimizing Risks

While the S3 cell sorter has a sliding door to protect from aerosols formed by the sort stream in the collection area, safety is a key concern. Adhering to National Institutes of Health (NIH) biosafety standards, a biosafety cabinet is the primary containment system recommended. The S3 cell sorter can fit into a custom biological safety cabinet (BSC) or in alternative customized biocontainment enclosures. These options are available to be compliant with NIH standards. Feel confident performing sort experiments in a biosafety cabinet for the added containment technology.

Specifications

Acquisition rate	Up to 100,000 events/sec
Sorting rate	Up to 30,000 events/sec
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	Primary: 488 nm 100 mW Optional: 561 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 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
145-1001	S3 Cell Sorter , 488 nm 100 mW laser, includes 2 fluorescence detectors with filters, 2 fluidic containers with connectors and tubing (sheath, water, waste), power cord, ProSort software
145-1002	S3 Cell Sorter , 488 and 561 nm 100 mW lasers, includes 4 fluorescence detectors with filters, 2 fluidic containers with connectors and tubing (sheath, water, waste), power cord, ProSort software
145-1065	S3 Cell Sorter 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
145-1081	ProLine Calibration Beads , 3 x 5 ml bottles
145-1082	ProFlow 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
145-1084	S3 Fluidic Containers , 3 x 4 L containers, gamma-irradiated, sterile
145-1085	ProLine Rainbow Beads , 1 x 5 ml bottle, mixture of 3.0–3.4 µm beads dyed with 8 different fluorescence intensities

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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.

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