

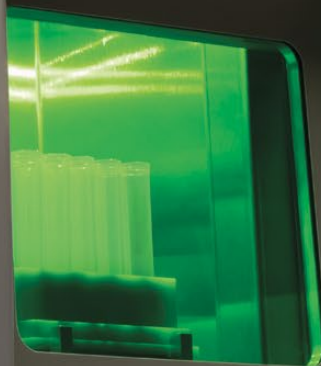
## ZE5 Cell Analyzer

Superior performance and flexibility to align with your flow cytometry needs.



**BIO-RAD**

**ZE5™ Cell Analyzer**



“We wanted a compact, easy, and flexible machine that could produce formidably complex data very quickly and with no behind-the-scenes losses.”

Karen Helm, Flow Cytometry Core Manager, University of Colorado Cancer Center

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When Bio-Rad Laboratories and Propel Labs set out to design the next cell analyzer for research applications, we turned to the most demanding users we could find — flow core managers and directors. We asked them how we could make their work easier and what functionalities a cell analyzer needed to have to advance the research of their flow core users.

Their responses directly resulted in the ZE5 Cell Analyzer.



**Designed by Users for Users**

## Quite possibly the only cell analyzer you will ever need

The ZE5 Cell Analyzer provides the speed and flexibility to optimize your flow cytometry lab. It will change how cutting edge labs like yours operate.

Up to five lasers and 30 detectors allow your lab to run any panel you need. It integrates a universal plate loader that seamlessly accepts single tubes, tube racks, or 96- and 384-well plates so it's ready for any sample with no hardware change or additional equipment needed. With its highly precise sample pump, 96-well plates can be run in less than 12 minutes, generating more data in less time. Easy-to-learn and -use software and proprietary features like the ZE5-EYE lessen the burden of training and monitoring users, prevent costly errors, and give you peace of mind even when multiple users access the optical filters.

The ZE5 Cell Analyzer was designed with an understanding of the importance of your samples and time. Exceptional electronics and optics that you can trust with your most critical experiments generate the highest quality data.



- **Power your research with the ability to run high complexity samples** — up to 5 spatially separated lasers and 30 independent detectors
- **Enjoy the simplicity, for even the most novice user** — easy setup of experiments with Everest Software and the spectral viewer
- **Easily switch between tube, rack, or plates with no hardware changes** — universal integrated sample loader with sample mixing and temperature control
- **Maximize reagent and sample usage** — unused sample can be returned to tube or wells for further analysis

“Give us the ultimate plate sampler — **fast and flexible.** Oh, and a tube rack too.”

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### It is all right here

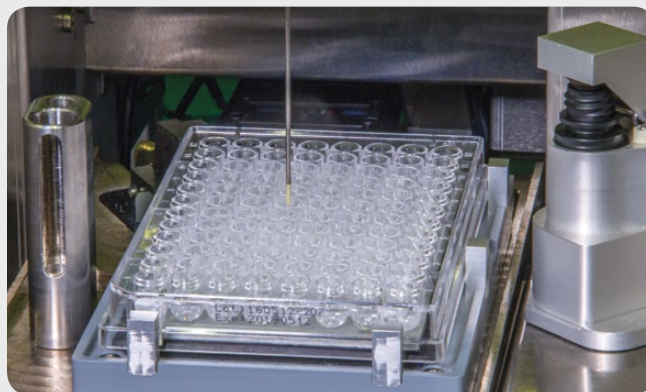
Just like your experiment, the design for the ZE5 Cell Analyzer began with your sample. You wanted one system that could handle all of your sample vessels. And you wanted it as a primary consideration, not an afterthought. You wanted to focus on your science and not on plumbing instruments or integrating complicated accessories. These are at the heart of ZE5.

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### The ultimate flexibility in sample handling – ready for anything

The ZE5 Cell Analyzer has a universal loader that can handle any format of tube, plate, or well. The loader is fully integrated and built in, so there is no labor-intensive hardware change and you can switch from plates to tubes to tube racks, or even run a single tube, with no effort.

- Integrated plate loader with adjustable orbital vortex plate shaker
- Single 5 ml tubes, 40 x 5 ml tube racks, 24 x 1.5 ml tube racks, or shallow or deep 96-well and 384-well plates
- 4–37°C active temperature regulation
- Flying collar wash
- Probe crash detection
- Analysis of completed wells/tubes while still acquiring



“Could they design an instrument that would **warn us** about some of those snags we hit every day?”



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### Preserve your precious samples

Samples are precious, and you need to maintain their integrity. The ZE5 Cell Analyzer uses a combination of speed, automation, and innovative design to protect your samples.

Use high-throughput mode to analyze a 96-well plate in less than 12 minutes. Time-specific delivery to the sample allows you to add reagents during a run without needing to start and stop and start again.

With active temperature control to warm and cool samples, with no dead volume requirement, and with the ability to return unused sample volume back to your tube or plate well, your samples stay safe.

The dual peristaltic pump has an inside-out design that requires less sample volume, reduces risk of contamination, and allows for continuous bidirectional running and volumetric sample handling. Two sets of offset rollers pressurize the sample before it is injected into the flow cell, resulting in similar pressure and reduced pulsation for an even sample flow.

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### Never worry about probe crashes again

The ZE5 Cell Analyzer offers two levels of built-in probe crash avoidance. It prevents any plate agitation until the wash station is lowered and the probe is safely encapsulated.

During a run, the ZE5 Cell Analyzer uses a gentle gravity method to protect from probe crashes. If any resistance is detected on the probe, it automatically stops and alerts the user, avoiding probe damage.

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## High-velocity flow cell

The flow cell operates at 8 m/sec, twice the stream velocity of other systems, and analyzes twice the amount of sample at any given concentration.

- Maintains a small sample core with low CVs
- Provides higher resolution data in less time
- Matched to system components for thermal expansion for excellent stability
- Allows a broad range of sample flow with 10 psi sheath pressure

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## State-of-the-art lasers and optics

The ZE5 Cell Analyzer optical bench was specifically designed to give you the highest resolution data.

- Shortest path to the flow cell
- Custom designed steering mirrors
- Integrated beam shaping prisms requiring no adjustment
- Liquid-cooled lasers to maintain optimal temperature for beam pointing stability
- Increased excitation beam stability for better day-to-day data
- Identical distance of each detector from flow cell and focusing lens
- Superior sensitivity with optimal focus for all photomultiplier tubes (PMTs)
- High-performance Hamamatsu H11903 PMTs



Each PMT is placed an equal distance from the flow cell so optimal light can be achieved at all wavelengths without compromise.

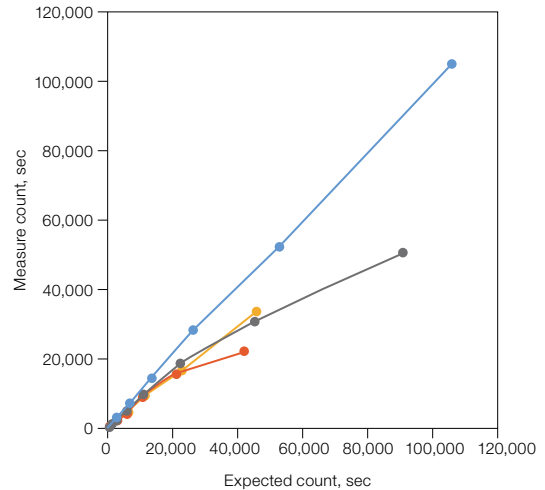


Up to five lasers can be accommodated.

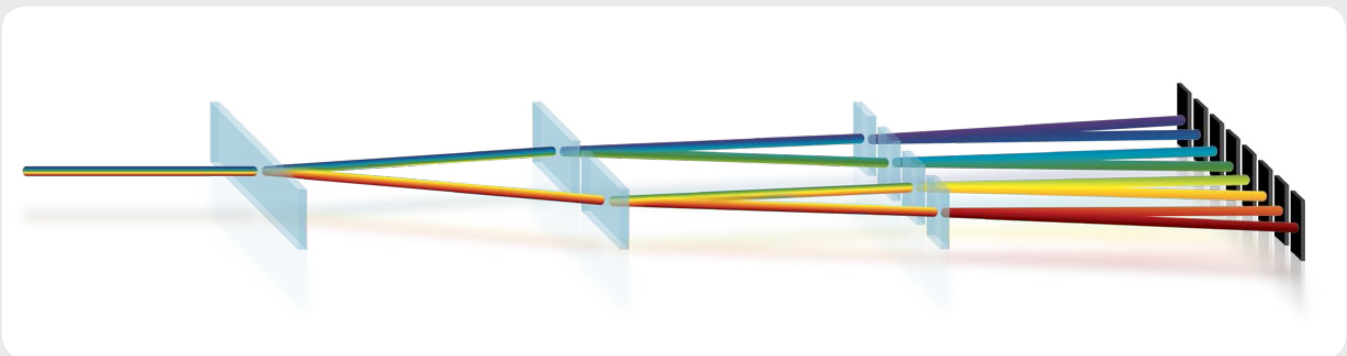
## Low noise electronics

### Get the most out of your data

- High-speed acquisition with no aborts
- No dead time
- Dynamic window extension
- Real-time hardware execution of run list
- Fully reprogrammable for future features and changes
- Completely flexible for additions
- Low noise electronics reduce noise on dim signals



This graph shows the acquisition speed capabilities of the ZE5. Dragon Green Beads (Bangs Laboratories, Inc.) were used in a serial dilution to determine when the observed acquisition rate falls off the theoretical limit. The ZE5 outperforms other systems at higher acquisition speeds as it continues to acquire data into the 100,000 events per second range whereas the other systems fall off around 20,000 events per second. ZE5 Cell Analyzer (—); Cytometer 1 (—); Cytometer 2 (—); Cytometer 3 (—).



An optical filter layout with consistent path lengths yields optimal detection and sensitivity for all wavelengths at each detector.



# “Change that sheath tank **on the fly.**”

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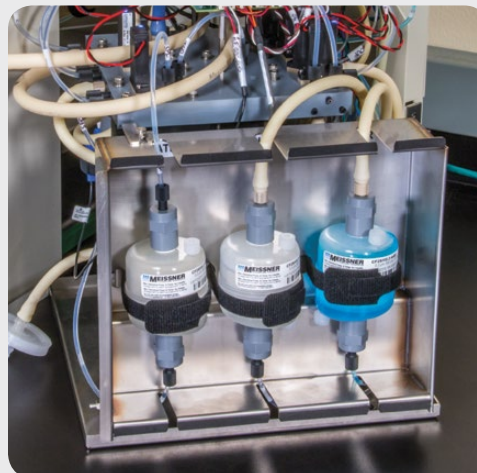
## Get up and running fast, stay up and running

- Instrument fluidics onboard
- Hot swappable sheath and waste tanks with indicator lights
- Sheath additive bottle onboard
- Cleaning solution onboard
- Direct connection to laboratory DI water supply and waste

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## Best-in-class fluidics

- High-pressure operation at 10 psi
- Stable delivery and waste evacuation
- Monitored sheath and air consumption to verify operation
- Very quiet and low vibration



The ZE5 comes with two sets of sheath and waste tanks that are hot-swappable anytime one set is used up. The tanks are driven by a low vibration, high-pressure fluidics module that provides uninterrupted operation throughout the day.

“Tell me that my **filter configuration change** probably won't work.”

### ZE5-EYE: Worry-free operation for the busy core lab

The ZE5-EYE runs an automated check before each run of all PMT filter spots to ensure that no filters have been removed or placed in the wrong spot. A dedicated electronics board implemented as part of the detection path uses ten distinct wavelengths of LEDs that cover the expected spectrum of light to ensure that the correct light is being passed to each PMT filter slot. The innovative ZE5-EYE checks the entire detection path, including the pinhole, filters, PMTs, and electronics, and alerts the user through the software of any issues before starting each run. This eliminates the possibility of misplaced filters and cuts troubleshooting time in half.

The ZE5 Cell Analyzer also keeps track of your settings, alerts you to any changes, and warns you if a critical parameter has changed.

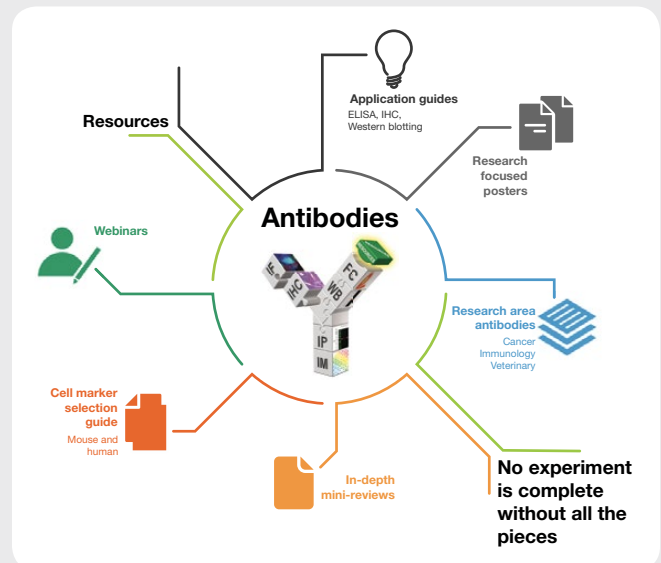
- 10 LEDs directed through the entire optical pathway to the PMTs
- 10 unique wavelengths from <400 to >800 nm
- Individual LED control
- Identification of unique signature for each PMT's optical filter
- Help troubleshooting



A series of LEDs of different wavelengths illuminate the light path. The amount of light reaching each PMT from the different wavelength LEDs is determined by the filters that are in place. The detected PMT signal is compared to a reference to determine whether the expected filter set is in place. If the signals do not match, a warning will be displayed at the relevant PMT(s).

### Ready reagents for your success

To make life even easier, the ZE5 Cell Analyzer and Bio-Rad's fluorescence-based reagents and antibodies have been tested to perform well and ensure your experiment's success. The integrated Everest Software comes preloaded with the spectra of Bio-Rad's flow cytometry products, providing a quick and easy way to start an assay. Thousands of antibody-fluorophore conjugates and their corresponding isotype controls are available for the ZE5 Cell Analyzer, allowing you to design multicolor panels for immunophenotyping and make full use of the 30-detector capability of the instrument. In addition, ready-made apoptosis, cell proliferation, and cell viability kits are available and take advantage of the high sensitivity of the ZE5 instrument.



“Let me **turn it on and off automatically** while I’m on vacation.”

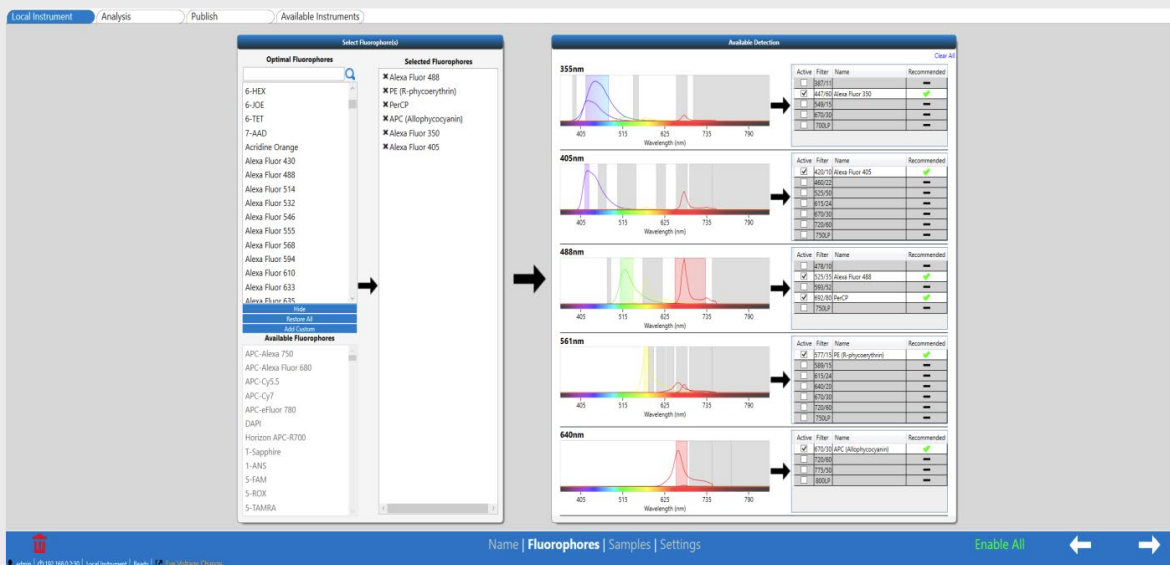
## Everest Software is revolutionary flow cytometry software that is pushing boundaries

### Automation

- Eliminates mundane tasks such as startup and shutdown by automating and allowing for programmable scheduling
- Onboard QC beads allow the system to complete QC before you walk up to the ZE5 Analyzer
- The Fluorochrome Selector assists with experimental design and work list setup

### Analysis

- Acquire and store files with up to 100 million events with all parameters enabled at high speed, reducing rare event detection time
- Features such as multichannel triggering and the heat map provide an extra edge in analysis of complex experiments
- Analyze saved files while acquiring new data to improve your workflow and experimental efficiency
- A report function takes your analysis to a reports page, where you can refine and add notes for your audience of choice



## Specifications

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### System

Fluorescence sensitivity	<100 MESF for FITC, PE, APC
Scatter sensitivity	<0.3 $\mu\text{m}$ FSC resolution with small particle detection module
Loader	Integrated sample loader with agitation and temperature control. Up to 384-well plates; 40-tube rack for 5 ml 12 x 75 mm tube loading. Stat tube position for single 5 ml tube loading
Throughput	<15 min for 96-well plate in high-throughput mode

### Optics

Excitation	Up to five spatially separated lasers. Standard options include: 355 nm, 50 mW    488 nm, 100 mW    640 nm, 100 mW 405 nm, 100 mW    561 nm, 50 mW
Detection	Up to 30 detectors, including FSC and SSC; optional second FSC detector (for small particle detection)
Cuvette	Fused silica with 145 x 265 $\mu\text{m}$ channel

### Electronics

Speed	Up to 100,000 events per second with all parameters enabled
Data processing	Simultaneous measured peak, area, and width for every channel. 24-bit data for peak and area. 17-bit data for width with high-resolution linear interpolation at the half height

### Fluidics

Sample flow rates	0.025–3.5 $\mu\text{l}/\text{sec}$
Bulk fluids	4 x 4 L bulk fluid tanks on board for sheath and waste. Onboard additive concentrate and cleaner

### Installation

Power	100–240 VAC, 50/60 Hz
Dimensions (W x D x H)	29 x 27 x 26 in.; 74 x 69 x 66 cm
Weight	<240 lbs; <110 kg
Temperature and humidity	18–28°C; 20–60% RH
Air and vacuum supply	Included, onboard

### Software

Flow Cytometry Standard (FCS) format	FCS 3.1
QC	Automated quality control with onboard calibration beads
Acquisition and analysis	Everest Software

### Workstation

Dell Precision Workstation	
Processor	Intel Core i7-7700 (Quad Core, 3.6 GHz, 4.2 GHz Turbo, 8 MB)
Operating system	Windows 10 Pro
Language pack	English
Graphics	Intel 630 integrated
Memory	DDR4; 32 GB RAM
Networking	Intel Gigabit LAN
Monitor	29" w/ speakers
SSD Boot Drive	256 GB
HDD Data Drive	4 TB

### Regulatory Compliance

Regulation	CE, Class I (1) laser product Research use only
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**Bio-Rad  
Laboratories, Inc.**

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