Attune NxT Flow Cytometer System

Note: System is shown with optional accessories.

Run samples faster and achieve greater resolution while minimizing sample loss due to clogging. The Invitrogen™ Attune™ NxT Flow Cytometer system combines precision with performance in a true benchtop flow cytometer, with up to 4 lasers and 16 parameters of detection. The Attune NxT Flow Cytometer system was developed with the goal of removing barriers associated with flow cytometry and enabling new research. This includes bringing the power of flow cytometry to the analysis of more sample types, including cancer cells. The addition of the Invitrogen™ CytKick™ Autosampler enables significantly faster high-throughput screening on a multiparametric platform.

- **Time savings**—up to 10x faster data acquisition speeds
- **Reduced clogging**—engineered for even large or sticky cell types
- **Efficient protocols**—rapid no-wash, no-lyse sample prep helps reduce protocol time and minimize cell loss
- **Robust software**—developed to offer user-focused functionality with many automated, user-definable, and administrative features
- **Reduced need for compensation**—spatially separated lasers
- **Elegant fluidics design**—readily accessible, easy to fill, and requires minimal maintenance
- **Rare-event detection**—technology for identifying very rare subpopulations of cells with high efficiency and certainty
- **Flexibility**—choice of lasers and parameters
- **Multiple configurations**—for a broad array of applications

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Table 1. Attune NxT Flow Cytometer specifications.

Instrument specifications

Optics

- **Laser power**

Laser	Wavelength (nm)	Beam-shaping optics (BSO)* (mW)	Diode power** (mW)
Violet	405	50	100
Blue	488	50	100
Green	532	100	140
Yellow	561	50	100
Red	637	100	140

* Amount of measured usable laser power after light has gone through the beam optics and shaping filters.

** Vendor-specified theoretical maximum.

- **Laser excitation:** Optimized excitation for minimized stray laser-line noise and losses to reflection
- **Laser profile:** 10 x 50 µm flat-top laser providing robust alignment
- **Emission filters:** Up to 14 color channels with wavelength-tuned photomultiplier tubes (PMTs); user-changeable, keyed filters
- **Laser separation:** 150 µm
- **Optical alignment:** Fixed alignment with prealigned welded fiber; no user maintenance required
- **Onboard thermoelectric cooler:** No warm-up delay; fiber isn't affected by "on/off"
- **Simmer mode:** Instant "on/off" reduces usage and/or aging by 10x; only keep it "on" when acquiring samples; reports hours of usage
- **Flat top specified at the flow cell:** Coefficient of variation (CV) <3% over width of flat top
- **Upgradable:** Convenient field changes

Fluidics

- **Flow cell:** Quartz cuvette gel coupled to 1.2 numerical aperture (NA) collection lens, 200 x 200 µm
- **Sample analysis volume:** 20 µL to 4 mL
- **Custom sample flow rates:** 12.5–1,000 µL/min
- **Sample delivery:** Positive-displacement syringe pump for volumetric analysis
- **Sample tubes:** Accommodates tubes from 17 x 100 mm to 8.5 x 45 mm
- **Fluid-level sensing:** Active
- **Standard fluid reservoirs:** 1.8 L focusing fluid tank, 1.8 L waste tank, 175 mL shutdown solution tank, and 175 mL wash solution tank
- **Fluid storage:** All fluids stored within instrument
- **Extended fluidics option:** Configuration for 10 L fluid
- **Nominal fluid consumption:** 1.8 L/day
- **Automated maintenance cycles:** ≤15 min start-up and shutdown—deep clean, sanitize, and debubble modes

Performance

- **Fluorescence sensitivity:** ≤80 molecules of equivalent soluble fluorochrome (MESF) for FITC, ≤30 MESF for PE, ≤70 MESF for APC
- **Fluorescence resolution:** CV <3% for the singlet peak of propidium iodide–stained chicken erythrocyte nuclei (CEN)
- **Data acquisition rate:** Up to 35,000 events/sec, 34 parameters, based on a 10% coincidence rate per Poisson statistics
- **Maximum electronic speed:** 65,000 events/sec with all parameters
- **Carryover:** Single-tube format: <1%
- **Forward and side scatter sensitivity:** Able to discriminate platelets from noise
- **Forward and side scatter resolution:** Optimized to resolve lymphocytes, monocytes, and granulocytes in lysed whole blood
- **Forward scatter:** Photodiode detector with 488/10 nm bandpass filter
- **Side scatter:** PMT with default 488/10 nm bandpass filter; optional 405/10 nm bandpass filter
- **Fluorescence detectors:** 14 individual detectors
- **Electronic pulse:** Measured area, height and width pulse for all detectors
- **Violet side scatter resolution:** Can be configured for violet side scatter to better resolve particles from noise
- **Minimum particle size:** 0.2 µm on side scatter using submicron bead calibration kit from Bangs Laboratories
  - 0.1 µm on side scatter under following conditions: Using an Attune NxT Flow Cytometer with standard 0.5 mm blocking configuration, an Attune NxT 488/10 Filter (Cat. No. 100083194), and Attune Focusing Fluid (Cat. No. 4488621, 4449791, or A24904) that has been passed through a 0.025 µm filter.

Instrument specifications (continued)	
Software	• **Compensation:** Full matrix—automated and manual modes, on-plot compensation tools for fine adjustment; use of tubes and wells • **Flow rate:** Precise flow rate control via software; no hardware adjustments • **Live streaming:** Live update of statistics during acquisition of events up to 35,000 events/sec • **Overlays:** Comparative analysis between samples; 3D view • **Sample recovery:** System able to return unused samples • **Concentration:** Direct concentration measurement without use of counting beads • **Software layout:** Fully customizable for each user account • **Bubble detection technology:** Stops automated run to preserve sample integrity • **Maximum single-event file:** 20 million with option to append • **Heat map:** Set up for definition of plate layout; screening view for analysis for tubes and plates • **Threshold:** Up to 4 individual thresholds with user option to apply Boolean logic • **Gating:** Hierarchal gating with the ability to derive gates • **SmartGate™ labeling:** Option to annotate quad gate names based on fluorophore and target names • **Voltage:** User adjustable • **Window extensions:** User adjustable • **Area scaling factor (ASF):** User adjustable • **Acquisition settings:** Documented in FCS files and maintained upon import • **Templates:** Create from existing experiments—instrument settings, workspaces, run protocols, heat map settings, and compensation settings optimized and defined previously • **Tube-to-plate conversion:** One-click transition from tubes to plates and vice versa; no disassembly, no additional QC, no reboot required for conversion between plates and tubes • **Graphics resolution:** Publication-quality images; support for TIF, PNG, BMP, JPG, GIF, and EMF; quickly copy and paste plots to any external application (e.g., Microsoft™ PowerPoint™ software) • **User account administration:** Administrative creation of individual user accounts with designated roles, advanced setting permissions, management of individual accounts, user time tracking, and sample count
Quality and regulatory	• **Instrument tracking:** Automated daily baseline and performance test with Levey-Jennings plots • **Warranty:** 1 year • **Production verification testing:** Each instrument is tested and verified for assembly integrity and performance to specifications • **Quality management system:** Manufacturing standards comply with the requirements of ISO 13485:2003 • **Robust installation specifications:** Units installed by engineer; preplanning checklist, delivery, and installation; and performance validation compliance with standardized procedure • **For Research Use Only**
Data management	• **Software requirements:** Invitrogen™ Attune™ NxT Software • **Monitor:** 23-inch flat panel (1,920 x 1,080 resolution); dual-monitor capability • **Computer:** Minitower desktop • **Operating system:** Microsoft™ Windows™ 7 64-bit • **FCS format:** FCS 3.1, 3.0 • **Processor:** Intel™ Core™ i7 processor • **RAM:** 32 GB • **Hard drives:** 2 x 2 TB SATA 6.0 Gb/s, 7,200 RPM, 64 MB data burst cache; controller RAID1, integrated

Instrument specifications (continued)

Installation requirements

- **Electrical requirements:** 100–240 VAC, 50/60 Hz, <150 W
  Thermo Fisher Scientific certifies that the Attune NxT Flow Cytometer conforms to relevant directives to bear the CE mark. The instrument also conforms to the UL and CAN/CSA general requirements (61010.1). The Attune NxT Flow Cytometer is a Class I laser product per Center for Devices and Radiological Health (CDRH) regulations and EN/IEC 60825.
- **Heat dissipation:** <150 W
- **Temperature operating ranges:** 15–30°C (59–86°F)
- **Operating humidity:** 10–90%, noncondensing
- **Audible noise:** <65 dBA at 1.0 m
- **Instrument size (H x W x D):** ~40 x 58 x 43 cm (16 x 23 x 17 in.), including fluid bottles
- **Weight:** ~29 kg (64 lb)
- **Available configurations** (as shown in table below)

Lasers	Laser configuration (Cat. No.)	Violet 405 nm	Blue 488 nm	Yellow 561 nm	Green 532 nm	Red 637 nm	Total detection channels*
1	Blue (Cat. No. A24864)	Available as upgrade	4	Available as upgrade	Available as upgrade	Available as upgrade	6
2	Blue/green (Cat. No. A28995)	Available as upgrade	3	–	4	Available as upgrade	9
	Blue/yellow (Cat. No. A24861)	Available as upgrade	3	4	–	Available as upgrade	9
	Blue/violet (Cat. No. A24862)	4	4	Available as upgrade	Available as upgrade	Available as upgrade	10
	Blue/red (Cat. No. A24863)	Available as upgrade	4	Available as upgrade	Available as upgrade	3	9
	Blue/violet 6 (Cat. No. A29002)	6	3	Available as upgrade	–	Available as upgrade	11
3	Blue/green/red (Cat. No. A28997)	Available as upgrade	3	–	4	3	12
	Blue/green/violet (Cat. No. A28999)	4	3	–	4	Available as upgrade	13
	Blue/red/yellow (Cat. No. A28993)	Available as upgrade	3	4	–	3	12
	Blue/violet/yellow (Cat. No. A24859)	4	3	4	–	Available as upgrade	13
	Blue/red/violet (Cat. No. A24860)	4	4	Available as upgrade	Available as upgrade	3	13
	Blue/red/violet 6 (Cat. No. A29003)	6	3	Available as upgrade	–	3	14
4	Blue/red/violet/green (Cat. No. A29001)	4	3	–	4	3	16
	Blue/red/yellow/violet (Cat. No. A24858)	4	3	4	–	3	16
	Blue/red/yellow/violet 6 (Cat. No. A29004)	6	2	3	–	3	16

* Includes forward scatter (FSC) and side scatter (SSC).

Autosamplers for Attune NxT Flow Cytometer

Choose the option that best suits your throughput and experimental needs. Based on the proven performance of the Invitrogen™ Attune™ NxT Autosampler, the CytKick Autosampler and CytKick™ Max Autosampler models offer walk-away automation seamlessly integrated with your Attune NxT Flow Cytometer for increased productivity and added choice. All autosampler models offer:

- **Broad compatibility**—compatible with many different plate formats, including 96-well, 384-well, and deep-well plates on all models
- **Intelligent probe design**—helps minimize clogging
- **Automated cleaning**—performs automated cleaning when the instrument is shutting down
- **Consistent data**—designed to provide minimal variation regardless of sampling method (tube vs. plate) and collection rate
- **Mixing by aspiration**—mixing the sample by aspiration instead of shaking helps ensure homogeneity of the sample and maintains cell viability
- **Plate and tube compatibility with one-click transition**—no disassembly, no additional QC, no reboot required for conversion between plates and tubes

For highest throughput and broadest flexibility options, choose the CytKick Max Autosampler:

- **Expanded sample vessel compatibility**—accommodates 1.5 mL and 2 mL microcentrifuge tube racks (up to 24 tube racks per vessel)
- **Passive cooling**—available for 96-well U-bottom plates and microcentrifuge tube racks
- **Short acquisition time**—22 min for 96-well plate (Boost mode) (using one rinse and one mix, and full analysis of a 20 µL sample)

Choose from the models shown in Table 2 based on your throughput and experimental needs.

Table 2. Technical specifications of different autosamplers for the Attune NxT Flow Cytometer.

Specification	Attune NxT Autosampler	CytKick Autosampler	CytKick Max Autosampler
Acquisition time	• <45 min for 96-well plate using high-throughput mode • <70 min for 96-well plate using standard mode, 2 wash cycles • <260 min for 384-well plate using standard mode, 2 wash cycles	• <42 min for 96-well plate using high-throughput mode • <70 min for 96-well plate using standard mode, 2 wash cycles • <145 min for 384-well plate using standard mode, 500 µL/min using one mix, one rinse and full analysis of a 20 µL sample	• 22 min for 96-well plate (Boost mode) (using one rinse and one mix, and full analysis of a 20 µL sample at 1,000 µL/min) • 88 min for 384-well plate (Boost mode, 1000 µL/min (using one rinse and one mix, and full analysis of a 20 µL
Carryover	• <0.5% in plate-loader format (standard mode, 2 wash cycles); multiple-rinse capability for ultralow carryover	• <0.5% carryover for 100 µL, 200 µL, 500 µL, and 1,000 µL using one mix, one rinse (no Boost mode) • <1.0% carryover for 12.5 µL and 25 µL • <1.0% carryover for 500 µL and 1,000 µL using Boost mode, one mix, one rinse	• <0.5% carryover for 100 µL, 200 µL, 500 µL, and 1000 µL using one mix, one rinse (Boost mode) • <1.0% carryover for 12.5 µL and 25 µL • <1.0% carryover for 500 µL and 1,000 µL using Boost mode, one mix, one rinse
Mixing optimization	Mixing optimized to preserve cell viability; number of mixing cycles optimized to match sample analysis volume		

Specification	Attune NxT Autosampler	CytKick Autosampler	CytKick Max Autosampler
Mixing method	• Each well mixed via aspiration and dispensation of sample (no shaking)	• Each well mixed via aspiration and dispensation of sample (no shaking)	• Each well mixed via aspiration and dispensation of sample (no shaking)
No. of wash cycles	User-defined number of wash cycles (up to 10)		
Minimum dead volume (single draw)	30 µL for 12.5–200 µL/min, 50 µL for 1,000 µL/min		
Sample window	Protectively coated window allows visibility to well progress while preventing exposure to ambient light during acquisition		
Autocalibration	Regular 30-day interval with system-initiated function		
Plate and tube compatibility	One-click transition from tubes to plates and vice versa; no disassembly, no additional QC, no reboot		
Compatible plate types	• 96 deep–well (flat, U-bottom, and V-bottom) • 96-well standard depth (flat, U-bottom, and V-bottom), • 384-well standard depth (flat, U-buttom, and V-bottom) • 384 deep–well (flat, U-bottom, and V-bottom)	• 96 deep–well (flat, U-bottom, and V-bottom) • 96-well standard depth (flat, U-buttom, and V-bottom), • 384-well standard depth (flat, U-buttom, and V-bottom) • 384 deep–well (flat, U-buttom, and V-bottom)	• 96 deep–well (flat, U-bottom, and V-bottom) • 96-well standard depth (flat, U-buttom, and V-bottom), • 384-well standard depth (flat, U-buttom, and V-bottom) • 384 deep–well (flat, U-buttom, and V-bottom) • Customizable to accept other plate types • 1.5 mL and 2 mL microcentrifuge tube rack (up to 24 tube racks per vessel) • Foil-covered 96-well (U-bottom) and 384-well (U- and V-bottom)
Cleaning cycles	Automated daily and monthly cleaning protocols		
Fluidics requirements	**Fluid storage:** Within instrument, with level sensing **Total fluid volume:** 800 mL per container; capable of running four 96-well plates in standard mode with 2 washes/well	**Fluid storage:** External **Total fluid volume:** Two 2 L tanks	**Fluid storage:** External **Total fluid volume:** Two 2 L tanks
Extended fluidics	Available with Invitrogen™ Attune™ NxT External Fluid Supply (EFS)—optional external fluid tank with 10 L fluid capacity		
Size (W x D x H)	~29 x 29 x 40 cm (11 x 11 x 16 in.)	~43 x 33 x 41 cm (17 x 13 x 16 in.)	~43 x 33 x 41 cm (17 x 13 x 16 in.)
Space requirements	• **Minimum width:** 40 cm (15.7 in.); when attached to the Attune NxT Flow Cytometer, the total width is 84 cm (33 in.) • **Minimum depth:** 39.5 cm (15.6 in.); provides 33 cm (13 in.) for the cytometer unit and 6.5 cm (2.6 in.) behind the unit for ventilation • **Minimum clear height:** 74 cm (29.1 in.) above the mounting	• **Minimum width:** 43 cm (17 in.); when attached to the Attune NxT Flow Cytometer, the total width is 99 cm (39 in.) • **Minimum depth:** 39.5 cm (15.6 in.); provides 33 cm (13 in.) for the cytometer unit and 6.5 cm (2.6 in.) behind the unit for ventilation • **Minimum clear height:** 74 cm (29.1 in.) above the mounting	• **Minimum width:** 43 cm (17 in.); when attached to the Attune NxT Flow Cytometer, the total width is 99 cm (39 in.) • **Minimum depth:** 39.5 cm (15.6 in.); provides 33 cm (13 in.) for the cytometer unit and 6.5 cm (2.6 in.) behind the unit for ventilation • **Minimum clear height:** 74 cm (29.1 in.) above the mounting
Mounting	Flanks to the Attune NxT Flow Cytometer		
Weight	~16 kg (35 lb)	• 16.9 kg (37.2 lb) with empty focus and waste bottles • 20.9 kg (46 lb) with focus and waste bottles at full capacity	• 16.9 kg (37.2 lb) with empty focus and waste bottles • 20.9 kg (46 lb) with focus and waste bottles at full capacity
Operating range (environmental conditions)	15–30°C (50–95°F)		
Operating humidity	<80% noncondensing		
Electrical requirements	100–240 VAC, 50/60 Hz, <300 W		
Sample cooling	NA	NA	Passive cooling available for 96-well U-bottom plates and microcentrifuge tube racks
Evaporation protection (foil cover)	NA	NA	Yes
Service	Rapid Exchange	Field service or Rapid Exchange option	Field service or Rapid Exchange option
Warranty	1-year standard warranty, extended warranty options available		

Services and support

Flow cytometry learning center: Find a range of targeted resources for flow cytometry, from webinars that cover the basics of this technology to application notes that demonstrate the utility of flow cytometry for high-content analysis applications. Go to **thermofisher.com/flowlearning**

Training: We offer a combination of virtual and in-person classroom instruction and hands-on learning in your lab to match your schedule, budget, and learning preferences. Whichever course style you choose, you'll learn from one of our 300 highly skilled application scientists who are available to lead sessions online, at your location, or at one of our 12 training centers located worldwide. Explore courses at **thermofisher.com/educationservices**

Services and plans: Extended coverage service plans are available at the time of instrument purchase. Our service plans will help you maximize system uptime, reduce overall repair costs, get fast repair turnaround time from a manufacturer-trained and certified field service engineer (FSE), extend the life of your instrument, and help keep it running at peak performance. Choose from a variety of service options that balance your budget, productivity, uptime, and regulatory requirements. To build your personalized service quote, go to **thermofisher.com/serviceselector**

Remote monitoring and diagnostics service: The Smart Monitor™ tool is a real-time, remote instrument performance monitoring service* that incorporates an instrument management dashboard, remote diagnostics, and aggregated performance data tracking.

Table 3. Service plans at a glance.

	Attune Nxt Flow Cytometer, CytKick Autosampler, and CytKick Max Autosampler	Attune NxT Autosampler, CytKick Autosampler, and CytKick Max Autosampler
	AB Assurance	**Rapid Exchange**
Standard on-site response time	2 business days**	Replacement shipped out in 1 business day
Priority access to technical support (Monday–Friday, standard business hours)	✓	✓
Scheduled on-site planned maintenance	✓	Optional add-on
Parts, labor, and travel for repair	✓	Off-site repair service including shipping, parts, and labor
Remote instrument diagnostics	✓	
Priority access to remote service engineer	✓	

** Varies in some geographic areas.

* Availability limited in some geographic areas.

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Workflow portfolio to support your research goals

At Thermo Fisher Scientific, we are committed to accelerating your research by providing a comprehensive suite of solutions for the analysis of cells and their functions. Behind this commitment is a dedicated and talented team of scientists developing and supporting our innovative instrumentation and products such as the Attune NxT Flow Cytometer, Invitrogen™ eBioscience™ antibodies for flow cytometry, and Invitrogen™ cell health reagents.

Antibodies—The Invitrogen™ portfolio offers over 15,000 flow cytometry–specific conjugated antibodies with multiple fluorophore options, including the Invitrogen™ Super Bright violet-excitable polymer dyes. Our antibodies enable you to build and expand your panels as your research demands.

Buffers—The use of appropriate buffers is crucial to the success of your flow cytometry experiments. We offer a wide variety of buffers to suit your research needs, whether your experiment calls for extracellular, intracellular, and/or nuclear staining.

Reagents—At the forefront of invention and development of fluorescent probes for over 40 years, we offer a comprehensive variety of functional assays for studying cell viability, apoptosis, cell cycle, and cell proliferation.

Flow support products—Compensation beads are essential when performing flow cytometry using multiple channels, markers that are poorly expressed, or limited sample. The one-vial, one-drop approach enabled by our Invitrogen™ OneComp and UltraComp eBeads™ products provides remarkable ease of use for compensating your antibody.

We are focused on advancing meaningful discoveries and partnering to make tools for cellular analysis widely accessible, affordable, and powerful for all life scientists.

Find your reagents at **thermofisher.com/flowcytometry**

Find out more about our flow cytometry products and services at **thermofisher.com/attune**

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