

# NovaSeq™ 6000Dx instrument

Immense discovery power  
in an FDA-regulated, CE-  
marked sequencing platform

- Dual modes of operation for IVD testing and clinical research applications with no system reboot required
- Compatible with Illumina DNA Prep with Enrichment Dx for targeted IVD variant calling workflows
- Paired, on-premise DRAGEN Server and license for run management and accelerated secondary analysis

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## Introduction

The NovaSeq 6000Dx instrument unleashes a new era in the clinical laboratory. Capable of generating more than 6 Tb of data in less than two days, it delivers powerful and scalable high-throughput next-generation sequencing (NGS) in a Food and Drug Administration (FDA)-regulated, Conformité Européenne (CE)-marked platform for *in vitro* diagnostic (IVD) applications (Figure 1). From an integrated, unified interface, users can run the NovaSeq 6000Dx instrument in either IVD Mode or Research (RUO) Mode. In IVD Mode, users can access an ever-expanding menu of clinical applications in the fields of oncology, complex and genetic disease, and more. RUO Mode includes all of the standard features available on the NovaSeq 6000 System and supports nonvalidated methods, including whole-genome sequencing (WGS), whole-exome sequencing (WES), transcriptome profiling, and more. These two modes of operation provide the flexibility to perform IVD testing and clinical research on a single instrument. To maximize the potential of the platform, each NovaSeq 6000Dx instrument includes a paired DRAGEN™ Server and license for accurate, ultrarapid secondary data analysis. For large clinical labs, the NovaSeq 6000Dx instrument opens new possibilities across a range of sample types, sequencing methods, and applications.



Figure 1: The NovaSeq 6000Dx instrument—With a unified user interface that enables seamless control of both IVD and RUO Modes and a dedicated DRAGEN Server for accelerated data analysis, the NovaSeq 6000Dx instrument delivers high-quality results for both clinical and research applications.

## Simplified, three-step workflow

Assays run on the NovaSeq 6000Dx instrument follow an integrated, three-step workflow that includes library preparation, sequencing, and secondary data analysis accelerated by fully automated DRAGEN genomics software (Figure 2).

### Library preparation

The NovaSeq 6000Dx instrument is compatible with the latest Illumina IVD library preparation solution for targeted sequencing, Illumina DNA Prep with Enrichment Dx. This kit features innovative On-Bead Tagmentation using bead-bound transposomes to mediate a uniform tagmentation reaction. When combined with a simplified, single hybridization step, Illumina DNA Prep with Enrichment

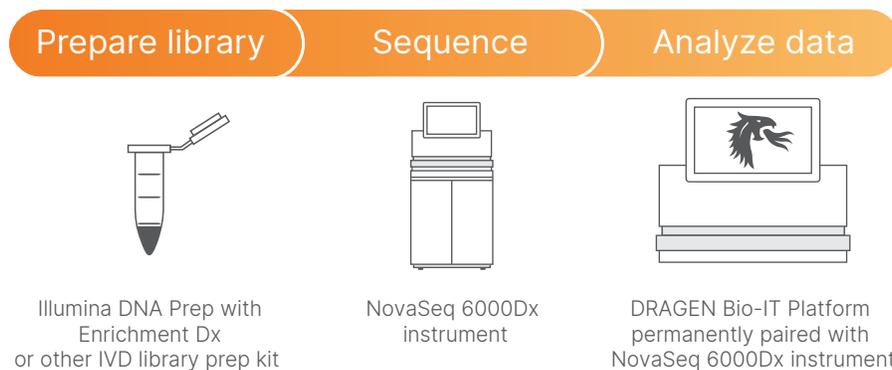


Figure 2: NovaSeq 6000Dx instrument workflow—The NovaSeq 6000Dx instrument is part of an integrated, three-step workflow that includes library preparation, high-throughput sequencing in either IVD or RUO Mode, and accelerated secondary data analysis with a paired DRAGEN Server.

Dx provides a rapid library preparation and enrichment solution. The kit supports genomic DNA (gDNA) extracted from whole blood or formalin-fixed, paraffin-embedded (FFPE) tissue. Illumina DNA Prep with Enrichment Dx is compatible with fixed and custom panels of varying sizes from Illumina or third-parties for increased flexibility.

## Sequencing

With integrated reagent cartridges, starting a run on the NovaSeq 6000Dx instrument is as easy as thaw, load, and go with less than 30 minutes of total hands-on time. Run management in IVD Mode is application-based to provide complete control of both sequencing and data analysis in a locked and validated clinical workflow. As with the NovaSeq 6000 System, the NovaSeq 6000Dx instrument delivers high-quality data with  $\geq 85\%$  of bases sequenced with a quality score of Q30 or higher (Table 1).

The NovaSeq 6000Dx instrument is easily configured, providing researchers with scalability to handle low- to high-throughput projects. RUO Mode supports all available NovaSeq flow cell configurations (SP, S1, S2, S4), while IVD Mode supports validated S2 and S4 flow cells, enabling labs to shift easily from higher to lower throughputs as needed.

### Integrated system software

The NovaSeq 6000Dx instrument features Illumina Run Manager, a fully integrated operating system. Accessed either on-instrument or remotely, this intuitive interface enables control of user and instrument management, application configuration, run setup, and secondary analysis modules on the DRAGEN Server. Through Illumina Run Manager, users can plan and stagger multiple sequencing runs in either IVD Mode or RUO Mode (run staggering between modes is not possible), track libraries with audit trails, and monitor run progress.

## Data analysis

After a sequencing run is completed, Illumina Run Manager automatically starts data analysis using the application-specific analysis module selected during run setup. Illumina Run Manager employs various digital measures to ensure data security and privacy.

### Available Dx applications

In IVD Mode, the NovaSeq 6000Dx instrument supports secondary analysis on-premise for applications performed with Illumina DNA Prep with Enrichment Dx:

- **Somatic variant calling**—Libraries prepared from FFPE-derived gDNA are sequenced on the NovaSeq 6000Dx instrument to deliver qualitative results for somatic variant calling.
- **Germline variant calling**—Libraries prepared from whole blood-derived gDNA are sequenced on the NovaSeq 6000Dx instrument to deliver qualitative results for germline variant calling.

### Variant calling performance

To evaluate variant calling accuracy with the NovaSeq 6000Dx instrument, libraries were prepared using DNA extracted from whole blood and FFPE tissue with the Illumina DNA Prep with Enrichment Dx. Sequencing data were analyzed on the NovaSeq 6000 Dx DRAGEN Server using the DRAGEN for Illumina DNA Prep with Enrichment Dx App to determine variant calling metrics. Results show exceptionally accurate variant calling for both germline and somatic variants sequenced with both the NovaSeq 6000Dx S2 and NovaSeq 6000Dx S4 Reagent v1.5 Kits (300 cycles) (Table 2).

\* Based on a representative assay, sample plexities for variant calling workflows range from 12 to 192 samples.

Table 1: NovaSeq 6000Dx instrument performance parameters—IVD mode<sup>a,b</sup>

Flow cell type	Read length	Output	Paired-end reads per flow cell	Run time	Data quality <sup>c</sup>
S2	2 × 150 bp	$\geq 1$ Tb	$\geq 6.67$ B	$\leq 40$ hr	$\geq 85\%$ Q30
S4	2 × 150 bp	$\geq 3$ Tb	$\geq 20$ B	$\leq 45$ hr	$\geq 85\%$ Q30

a. Libraries generated with Illumina DNA Prep with Enrichment Dx.

b. For performance parameters in RUO Mode, see NovaSeq 6000 System specifications.

c. A quality score of Q30 corresponds to an error rate of 1 in 1000 bases called.

Table 2: NovaSeq 6000Dx instrument variant calling

Metric	Acceptance criteria	Germline variant calling				Somatic variant calling			
		S2 flow cell		S4 flow cell		S2 flow cell		S4 flow cell	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
Total yield (Tb)	≥ 1.0 / ≥ 3.0	1.45	1.51	3.87	3.90	1.423	1.53	3.97	4.07
Total Q30	≥ 85	94.5	94.6	94.2	94.4	94.4	94.5	94.4	94.4
SNV PPA (%)	≥ 95	99.92	99.91	99.91	99.91	99.73	99.77	99.86	99.78
INS PPA (%)	≥ 85	99.96	100	99.80	100	96.60	100	99.57	100
DEL PPA (%)	≥ 85	99.88	100	99.82	100	99.97	100	100	100
NPA (%)	≥ 99	> 99.99	> 99.99	> 99.99	> 99.99	> 99.99	> 99.99	> 99.99	> 99.99
OPA (%)	≥ 99	> 99.99	> 99.99	> 99.99	> 99.99	> 99.99	> 99.99	> 99.99	> 99.99

Abbreviations: SNV, single nucleotide variant; INS, insertion; DEL, deletion; PPA, positive percent agreement; NPA, negative percent agreement; OPA, overall percent agreement

## Summary

The FDA-regulated, CE-marked NovaSeq 6000Dx instrument represents the future of high-throughput NGS IVD applications. Clinical labs can access a simplified three-step workflow that includes a growing menu of Illumina and third-party clinical assays, proven Illumina sequencing, and hardware-accelerated data analysis with a DRAGEN Server. The NovaSeq 6000Dx instrument provides clinical labs with innovation-driven performance for high-throughput IVD testing and immense discovery power to pursue the latest questions in diagnostics and clinical research.

## Learn more

NovaSeq 6000Dx instrument, [illumina.com/systems/sequencing-platforms/novaseq-6000dx.html](https://illumina.com/systems/sequencing-platforms/novaseq-6000dx.html).

## Ordering information

Product	Catalog no.
NovaSeq 6000Dx instrument	20068232
NovaSeq 6000Dx S2 Reagent v1.5 Kit (300 cycles)	20046931
NovaSeq 6000Dx S4 Reagent v1.5 Kit (300 cycles)	20046933
NovaSeq 6000Dx S2 Buffer Cartridge	20062292
NovaSeq 6000Dx S4 Buffer Cartridge	20062293
NovaSeq 6000Dx Library Tube	20062290
NovaSeq 6000Dx Library Tube, 24 pack	20062291

## Intended use statements

### NovaSeq 6000Dx instrument intended use (United States)

The NovaSeq 6000Dx instrument is intended for targeted sequencing of DNA libraries from human genomic DNA extracted from peripheral whole blood or formalin-fixed, paraffin-embedded (FFPE) tissue when used with *in vitro* (IVD) diagnostic assays. The NovaSeq 6000Dx instrument is not intended for whole-genome or *de novo* sequencing. The NovaSeq 6000Dx instrument is intended for use with specific registered, certified, or approved IVD reagents and analytical software.

### NovaSeq 6000Dx instrument intended use (European Union/other)

The NovaSeq 6000Dx instrument is intended for sequencing of DNA libraries when used with *in vitro* diagnostic (IVD) assays. The NovaSeq 6000Dx instrument is intended for use with specific registered, certified, or approved IVD reagents and analytical software.



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M-GL-00766 v3.0

## NovaSeq 6000Dx instrument specifications

### Specifications

#### Instrument configuration

Computer and touch screen display  
Installation setup and accessories  
Data collection and analysis software

#### Instrument control computer

Base unit: Axiomtek MANO525 with i7-8700T CPU  
Memory: 2 × 8 GB DDR4 SODIMM. Hard drive: None  
Solid-state drive: 256 GB 2242 M.2  
Operating System: Windows 10  
Note: Computer configurations will be upgraded regularly; contact your local account manager for current configuration.

#### Operating environment

Temperature: 19°C to 25°C (22°C ±3°C), < 2°C change per hour  
Humidity: noncondensing 20–80% relative humidity  
Altitude: below 2000 meters (6500 feet)  
Ventilation: maximum of 8530 BTU/h and average 6000 BTU/h  
For indoor use only

#### Laser

Class 1 laser product embedded with class IV lasers: 532 nm, 660 nm, 780 nm, 790 nm

#### Dimensions

W × D × H: 80.0 cm (31.5 in) × 94.5 cm (37.2 in) × 165.6 cm (65.2 in) with monitor.  
Weight: 481 kg (1059 lb), includes 3.5 kg (7.8 lb) for leak tray and 0.9 kg (2 lb) for keyboard and mouse, Crated weight: 628 kg (1385 lb)

#### Power requirements

200–240 VAC 50/60Hz, 16A, single phase, 2500 W  
Illumina provides a region-specific uninterruptible power supply

#### Radio frequency identifier (RFID)

Frequency: 13.56 MHz  
Power: supply 3.3 volts DC ± 5%, current 120 mA, RF output power 200 mW

#### Network connection

Dedicated 1 Gb connection between the instrument and data management system. Connect directly or through network.

#### Bandwidth for network connection

200 Mb/s/instrument for internal network uploads  
200 Mb/s/instrument for BaseSpace Sequence Hub uploads  
5 Mb/s/instrument for Instrument Operational Data uploads