| Part 1 of 4 | **Illumina**<br>info@illumina.com<br>**San Diego, CA**<br>**858-202-4500** www.illumina.com | **Illumina**<br>info@illumina.com<br>**San Diego, CA**<br>**858-202-4500** www.illumina.com | **Illumina**<br>info@illumina.com<br>**San Diego, CA**<br>**858-202-4500** www.illumina.com |
|---|---|---|---|
| Name of system | iSeq 100 | MiniSeq System | MiSeq System |
| System application/FDA cleared or approved | research use/not required | research use/not required | research use/not required |
| Country where designed/Manufactured | U.S./Singapore | U.S./Singapore | U.S./Singapore |
| First year sold in U.S./First year installed in U.S. | 2018/2018 | 2016/2016 | 2011/2011 |
| System sold internationally | yes | yes | yes |
| Dimensions of sequencer (H × W × D)/Footprint of sequencer | 16.8 × 12 × 13 in./1.1 sq. ft. | 20.4 × 18 × 18.9 in./2.4 sq. ft. | 20.6 × 27 × 22.2 in./4.2 sq. ft. |
| Accessory equipment supplied with sequencer at no cost/Total footprint with accessory equipment | system test cartridge/— | system test cartridge/— | system test cartridge/— |
| Type of computer supplied with sequencer | computer for analysis and operations combined | computer for analysis and operations combined | computer for analysis and operations combined |
| Analysis options provided with sequencer | onboard, cloud based | onboard, cloud based | onboard, cloud based |
| Where library preparation is performed | wet bench | wet bench | wet bench |
| Bioinformatics tools provided with sequencer | Local Run Manager, BaseSpace | Local Run Manager, BaseSpace | Local Run Manager, MiSeq Reporter, BaseSpace |
| Sequencer supplied with UPS (uninterruptible power supply) | no | no | no |
| Electrical connection required for sequencer | 90–264 VAC at 47–63 Hz | 100–240 VAC at 50–60 Hz | 100–240 VAC at 50–60 Hz |
| List price of entire sequencer and necessary components | $19,900 | $49,500 | $99,000 |
| Purchase options | purchase | purchase, lease, reagent rental | purchase, lease, reagent rental |
| Warranties offered | first year included with purchase; extended warranty available | first year included with purchase; extended warranty available | first year included with purchase; extended warranty available |
| Training included/Total time for basic training per operator | no (customer installable)/<1 day | yes/<1 day | yes/<1 day |
| Training location/Follow-up training available | at customer site/yes (extra charge) | at customer site/yes (extra charge) | at customer site/yes (extra charge) |
| Maximum No. of samples amplified in a single amplification event | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) |
| Read length/Percent bases >Q30 | 2 × 150 bp/80% | 2 × 150 bp/80% | 2 × 300 bp/70% |
| Paired-end capability/Tag lengths/Spans | yes/2 × 150 bp/— | yes/2 × 150 bp/— | yes/2 × 300 bp/— |
| Fragment/Tag lengths/Spans | yes/2 × 150 bp/— | yes/2 × 150 bp/— | yes/2 × 300 bp/— |
| Mate pair/Tag lengths/Spans | yes/2 × 150 bp/— | yes/2 × 150 bp/— | yes/2 × 150 bp/— |
| Single end/Tag lengths/Spans | yes/1 × 300 bp/— | yes/1 × 300 bp/— | yes/1 × 300 bp/— |
| RNA sequencing/Tag lengths/Spans | yes/2 × 150 bp/— | yes/2 × 150 bp/— | yes/2 × 300 bp/— |
| ChIP sequencing/Tag lengths/Spans | yes/2 × 150 bp/— | yes/2 × 150 bp/— | yes/2 × 300 bp/— |
| Bisulfite sequencing/Tag lengths/Spans | yes/2 × 150 bp/— | yes/2 × 150 bp/— | yes/2 × 300 bp/— |
| Maximum No. of reads or fragments sequenced per single-end run | >4 million | up to 25 million | up to 25 million |
| Maximum No. of reads or fragments sequenced per paired-end run | >8 million | up to 50 million | up to 50 million |
| Total No. of nucleotides (bases) sequenced per run | up to 1.2 Gb | up to 7.5 Gb | up to 15 Gb |
| Wet lab bench time for sequencing preparation | 10 minutes | 10 minutes | 10 minutes |
| Sequencing run time | <19 hours | ~5–24 hours | ~5–56 hours |
| Total time for generating standard gDNA library | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) |
| • Paired end | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) |
| • Fragment | <7 hours (with AmpliSeq for Illumina); <6.5 hours (with Illumina DNA Prep with Enrichment) | <7 hours (with AmpliSeq for Illumina); <6.5 hours (with Illumina DNA Prep with Enrichment) | <7 hours (with AmpliSeq for Illumina); <6.5 hours (with Illumina DNA Prep with Enrichment) |
| • Mate pair | — | — | — |
| • Single end | <1 day (with TruSeq Small RNA) | <1 day (with TruSeq Small RNA) | <1 day (with TruSeq Small RNA) |
| • RNA sequencing | <9 hours | <9 hours | <9 hours |
| • ChIP sequencing | <1.5 days (with TruSeq ChIP) | <1.5 days (with TruSeq ChIP) | <1.5 days (with TruSeq ChIP) |
| • Bisulfite sequencing | — | — | — |
| Hands-on time for the following: | | | |
| • Paired end | <1.5 hours | <1.5 hours | <1.5 hours |
| • Fragment | <1.5 hours (with AmpliSeq for Illumina); <2 hours (with Illumina DNA Prep with Enrichment) | <1.5 hours (with AmpliSeq for Illumina); <2 hours (with Illumina DNA Prep with Enrichment) | <1.5 hours (with AmpliSeq for Illumina); <2 hours (with Illumina DNA Prep with Enrichment) |
| • Mate pair | — | — | — |
| • Single end | <4 hours | <4 hours | <4 hours |
| • RNA sequencing | <3 hours | <3 hours | <3 hours |
| • ChIP sequencing | — | — | — |
| • Bisulfite sequencing | — | — | — |
| Library preparation equipment offered or supplied | none (standard lab equipment) | none (standard lab equipment) | none (standard lab equipment) |
| Cost of sequencing reagents per run | $548 (pricing based on iSeq 8-pack reagent kit) | $680–$1,909 | $359–$1,887 |
| Reagent tracking method | RFID | RFID | RFID |
| • Type of reagent information tracked | serial number, expiration date, lot and part numbers, number of cycles | serial number, expiration date, lot and part numbers, number of cycles | serial number, expiration date, lot and part numbers, number of cycles |
| Shipping conditions for amplification/sequencing reagents | —/dry ice | —/dry ice | —/dry ice |
| Storage conditions for amplification/sequencing reagents | —/cartridge: -15°– -25°C; flow cell: 2°–8°C | —/cartridge: -15°– -25°C; flow cell: 2°–8°C | —/cartridge: -15°– -25°C; flow cell: 2°–8°C |
| Shelf life of amplification/sequencing reagents | —/guaranteed 3 months | —/guaranteed 3 months | —/guaranteed 3 months |
| System requires a control sample on sequencing run | optional | optional | optional |
| • Company offers a sequencing control | yes (additional charge) | yes (additional charge) | yes (additional charge) |
| Sequencing system control software and devices to start run/for data analysis | iSeq Control Software/Local Run Manager, BaseSpace | MiniSeq Control Software/Local Run Manager, BaseSpace | MiSeq Control Software/Local Run Manager, MiSeq Reporter, BaseSpace |
| Complete walkaway automation for amplification, sequencing, and variant calling | yes | yes | yes |
| Remote system monitoring | yes | yes | yes |
| Total time required for setup of amplification, sequencing, and variant calling steps | 5 minutes | 10 minutes | 10 minutes |
| Maximum No. of libraries sequenced in a single run | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) |
| System includes secondary data-analysis software developed by company | yes (Local Run Manager, BaseSpace) | yes (Local Run Manager, BaseSpace) | yes (Local Run Manager, BaseSpace) |
| System includes post-sequencing data-analysis software | yes (included with purchase: Local Run Manager) | yes (included with purchase: BaseSpace) | yes (included with purchase: BaseSpace) |
| Mutations detectable via data-analysis software | substitutions, indels, copy number changes | substitutions, indels, copy number changes | substitutions, indels, copy number changes |
| System can generate a variant report | no | no | no |
| Types of maintenance plans available/mean time between failures | Advanced Exchange Service Plan/— | parts only, bronze, silver, gold, dedicated on site/— | parts only, bronze, silver, gold, dedicated on site/— |
| No. of field application scientists and engineers based in U.S. | >500 | >500 | >500 |
| Maintenance required: | | | |
| • Weekly | — | — | — |
| • Monthly | system check with provided cartridge | system check with provided cartridge | system check with provided cartridge |
| • Pre-run | — | — | — |
| Distinguishing features of NGS system (supplied by company) | • low capital cost to obtain highly accurate results with sequencing-by-synthesis technology<br>• small instrument footprint, clustering and sequencing all in one, analysis onboard or in the cloud; 19-hour run time for overnight results<br>• dry box–optics on the flow cell and fluidics in the cartridge | • affordable to acquire, cost-efficient to run, even with low numbers of samples<br>• push-button operation and simple data analysis | • quality scores with >70% of bases higher than Q30 at 2 × 300 bp and >85% bases higher than Q30 at 2 × 75 bp<br>• simple, streamlined workflow with as little as 30 minutes hands-on time from sample to answer |

*Note: a dash in lieu of an answer means company did not answer question or question is not applicable*

All information is supplied by the companies listed. The tabulation does not represent an endorsement by the CAP.

| Part 2 of 4 | **Illumina**<br>info@illumina.com<br>**San Diego, CA**<br>**858-202-4500** www.illumina.com | **Illumina**<br>info@illumina.com<br>**San Diego, CA**<br>**858-202-4500** www.illumina.com | **Illumina**<br>info@illumina.com<br>**San Diego, CA**<br>**858-202-4500** www.illumina.com |
|---|---|---|---|
| Name of system | MiSeqDx System | NextSeq 550Dx System | NextSeq 1000 System |
| System application/FDA cleared or approved | in vitro diagnostic and research use/yes | in vitro diagnostic and research use/yes | research use/not required |
| Country where designed/Manufactured | U.S./U.S. | U.S./Singapore | U.S./Singapore |
| First year sold in U.S./First year installed in U.S. | 2013/2013 | 2017/2017 | 2020/2020 |
| System sold internationally | yes | yes | yes |
| Dimensions of sequencer (H × W × D)/Footprint of sequencer | 20.6 × 27 × 22.2 in./4.2 sq. ft. | 23 × 21 × 25 in./3.6 sq. ft. | 23.6 × 23.6 × 25.6 in./3.9 sq. ft. |
| Accessory equipment supplied with sequencer at no cost/Total footprint with accessory equipment | —— | —— | keyboard/—— |
| Type of computer supplied with sequencer | computer for analysis and operations combined | computer for analysis and operations combined | computer for analysis and operations combined |
| Analysis options provided with sequencer | onboard, cloud based | onboard, cloud based | onboard, cloud based, on-premise server |
| Where library preparation is performed | wet bench | wet bench | wet bench |
| Bioinformatics tools provided with sequencer | Local Run Manager, MiSeq Reporter, BaseSpace | Local Run Manager, BaseSpace | DRAGEN BIO-IT platform, BaseSpace |
| Sequencer supplied with UPS (uninterruptible power supply) | yes (extra charge) | no | yes (extra charge) |
| Electrical connection required for sequencer | 100–240 VAC at 50–60 Hz, 10 A, 400 W | 100–120 VAC at 50–60 Hz | 100–240 VAC at 50–60 Hz |
| List price of entire sequencer and necessary components | $125,000 | $347,000 | $210,000 |
| Purchase options | purchase, lease, reagent rental | purchase, lease, reagent rental | purchase, lease, reagent rental |
| Warranties offered | first year included with purchase; extended warranty available | first year included with purchase; extended warranty available | first year included with purchase; extended warranty available |
| Training included/Total time for basic training per operator | yes/<1 day | yes/2 days | yes/1–2 days |
| Training location/Follow-up training available | at customer site/yes (extra charge) | at customer site/yes (extra charge) | at customer site/yes (extra charge) |
| Maximum No. of samples amplified in a single amplification event | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) |
| Read length/Percent bases >Q30 | up to 2 × 300 bp/80% (for 2 × 150 bp) | up to 2 × 150 bp/75% | up to 2 × 300 bp/80–90% |
| Paired-end capability/Tag lengths/Spans | yes/up to 2 × 300 bp/up to 550 bp | yes/up to 2 × 150 bp/up to 350 bp | yes/2 × 300 bp/— |
| Fragment/Tag lengths/Spans | yes/up to 2 × 300 bp/up to 550 bp | yes/up to 2 × 150 bp/up to 350 bp | yes/2 × 300 bp/— |
| Mate pair/Tag lengths/Spans | yes/up to 2 × 150 bp/2–12 kb | yes/up to 2 × 150 bp/2–12 kb | yes/2 × 300 bp/— |
| Single end/Tag lengths/Spans | yes/up to 1 × 300 bp/up to 300 bp | yes/up to 1 × 300 bp/up to 300 bp | yes/2 × 300 bp/— |
| RNA sequencing/Tag lengths/Spans | yes/up to 2 × 300 bp/up to 550 bp | yes/up to 2 × 150 bp/up to 350 bp | yes/2 × 300 bp/— |
| ChIP sequencing/Tag lengths/Spans | yes/up to 2 × 300 bp/up to 550 bp | yes/up to 2 × 150 bp/up to 350 bp | yes/2 × 300 bp/— |
| Bisulfite sequencing/Tag lengths/Spans | yes/up to 2 × 300 bp/up to 550 bp | yes/up to 2 × 150 bp/up to 350 bp | yes/2 × 300 bp/— |
| Maximum No. of reads or fragments sequenced per single-end run | >15 million | >300 million | up to 400 million |
| Maximum No. of reads or fragments sequenced per paired-end run | >30 million | >600 million | up to 800 million |
| Total No. of nucleotides (bases) sequenced per run | up to 7.5 Gb | up to 120 Gb | up to 180 Gb |
| Wet lab bench time for sequencing preparation | 10 minutes | 10 minutes | 10 minutes |
| Sequencing run time | <28 hours | <36 hours | ~10–44 hours |
| Total time for generating standard gDNA library | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) |
| • Paired end | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) |
| • Fragment | <7 hours (with AmpliSeq for Illumina); <6.5 hours (with Illumina DNA Prep with Enrichment) | <7 hours (with AmpliSeq for Illumina); <6.5 hours (with Illumina DNA Prep with Enrichment) | <7 hours (with AmpliSeq for Illumina); <6.5 hours (with Illumina DNA Prep with Enrichment) |
| • Mate pair | — | — | — |
| • Single end | <1 day (with TruSeq Small RNA) | <1 day (with TruSeq Small RNA) | <1 day (with TruSeq Small RNA) |
| • RNA sequencing | <9 hours | <9 hours | <9 hours |
| • ChIP sequencing | <1.5 days (with TruSeq ChIP) | <1.5 days (with TruSeq ChIP) | <1.5 days (with TruSeq ChIP) |
| • Bisulfite sequencing | — | — | — |
| Hands-on time for the following: | | | |
| • Paired end | <1.5 hours (with Illumina DNA Prep) | <1.5 hours (with Illumina DNA Prep) | <1.5 hours (with Illumina DNA Prep) |
| • Fragment | <1.5 hours (with AmpliSeq for Illumina); <2 hours (with Illumina DNA Prep with Enrichment) | <1.5 hours (with AmpliSeq for Illumina); <2 hours (with Illumina DNA Prep with Enrichment) | <1.5 hours (with AmpliSeq for Illumina); <2 hours (with Illumina DNA Prep with Enrichment) |
| • Mate pair | — | — | — |
| • Single end | <4 hours (with TruSeq Small RNA) | <4 hours (with TruSeq Small RNA) | <4 hours (with TruSeq Small RNA) |
| • RNA sequencing | <3 hours | <3 hours | <3 hours |
| • ChIP sequencing | — | — | — |
| • Bisulfite sequencing | — | — | — |
| Library preparation equipment offered or supplied | none | none (standard lab equipment) | none |
| Cost of sequencing reagents per run | $2,440 | $2,370–$6,841 | $900–$3,950 |
| Reagent tracking method | RFID | RFID | RFID |
| • Type of reagent information tracked | serial number, expiration date, lot and part numbers, number of cycles | serial number, expiration date, lot and part numbers, number of cycles | serial number, expiration date, lot and part numbers, number of cycles |
| Shipping conditions for amplification/sequencing reagents | —/box 1: dry ice; box 2: gel pack | —/dry ice, gel pack, ambient (variable based on product) | —/dry ice, gel pack, ambient (variable based on product) |
| Storage conditions for amplification/sequencing reagents | —/box 1: -15°– -25°C; box 2: 2°–8°C | —/reagent cartridge, HT1 buffer: -15°– -25°C; flow cell: 2°–8°C; buffer cartridge: 15°–30°C | —/reagent cartridge: -15°– -25°C; flow cell and resuspension buffer tube: 2°–8°C |
| Shelf life of amplification/sequencing reagents | —/guaranteed 6 months | —/guaranteed 6 months | —/guaranteed 6 months |
| System requires a control sample on sequencing run | optional | yes | no |
| • Company offers a sequencing control | yes (additional charge) | yes (additional charge) | yes (additional charge) |
| Sequencing system control software and devices to start run/for data analysis | MiSeq Control Software/Local Run Manager, MiSeq Reporter, BaseSpace | NextSeq 550Dx Control Software and Operating Software/Local Run Manager, BaseSpace | NextSeq Control Software/BaseSpace, DRAGEN |
| Complete walkaway automation for amplification, sequencing, and variant calling | yes | yes | yes |
| Remote system monitoring | yes | yes | yes |
| Total time required for setup of amplification, sequencing, and variant calling steps | 10 minutes | 10 minutes | ~15 hours |
| Maximum No. of libraries sequenced in a single run | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) |
| System includes secondary data-analysis software developed by company | yes (MiSeq Reporter, Local Run Manager, BaseSpace) | yes (BaseSpace) | yes (DRAGEN, BaseSpace Sequence Hub) |
| System includes post-sequencing data-analysis software | — | yes (included with purchase) | yes (included with purchase: DRAGEN, BaseSpace Sequence Hub) |
| Mutations detectable via data-analysis software | substitutions, indels, copy number changes | substitutions, indels, copy number changes | substitutions, indels, copy number changes |
| System can generate a variant report | yes | yes | yes |
| Types of maintenance plans available/mean time between failures | parts only, bronze, silver, gold, Dx, dedicated on site/— | parts only, bronze, silver, gold, Dx, dedicated on site/— | parts only, bronze, silver, gold, Dx, dedicated on site/— |
| No. of field application scientists and engineers based in U.S. | >500 | >500 | >500 |
| Maintenance required: | | | |
| • Weekly | none (manual wash if instrument idle for 7 days) | none (manual wash if instrument idle for 2 weeks) | none |
| • Monthly | maintenance wash | none | none |
| • Pre-run | none (post-run wash required after every run) | none (automatic wash completed after every run) | none |
| Distinguishing features of NGS system (supplied by company) | • FDA-regulated NGS platform allows clinical diagnostics in Dx mode and clinical research applications in research mode<br>• FDA-regulated content includes MiSeqDx cystic fibrosis 139-variant assay, MiSeqDx cystic fibrosis clinical sequencing assay<br>• leverages proven MiSeq technology | • FDA-regulated NGS platform allows clinical diagnostics in Dx mode and clinical research applications in research mode<br>• FDA-regulated content includes NextSeq 550Dx high-output reagent kit v2.5, Illumina DNA Prep with Enrichment Dx kit<br>• flexible output for sample multiplexing and different research applications, from targeted panels to whole genome | • offers the flexibility of seven flow-cell configurations across multiple outputs and read lengths up to 2×300 for choice of cost-efficient configurations<br>• integrated reagent cartridge design eliminates need for maintenance wash between runs<br>• DRAGEN onboard allows the user to seamlessly integrate sequencing and analysis in run setup |

*Note: a dash in lieu of an answer means company did not answer question or question is not applicable*

All information is supplied by the companies listed. The tabulation does not represent an endorsement by the CAP.

# NEXT–GENERATION SEQUENCING SYSTEMS

| Part 3 of 4 | **Illumina**<br>info@illumina.com<br>**San Diego, CA**<br>**858-202-4500** www.illumina.com | **Illumina**<br>info@illumina.com<br>**San Diego, CA**<br>**858-202-4500** www.illumina.com | **Illumina**<br>info@illumina.com<br>**San Diego, CA**<br>**858-202-4500** www.illumina.com |
|---|---|---|---|
| Name of system | NextSeq 2000 System | NovaSeq 6000 | NovaSeq 6000Dx |
| System application/FDA cleared or approved | research use/not required | research use/not required | in vitro diagnostic and research use/yes |
| Country where designed/Manufactured | U.S./Singapore | U.S./U.S. | U.S./U.S. |
| First year sold in U.S./First year installed in U.S. | 2020/2020 | 2017/2017 | 2022/2022 |
| System sold internationally | yes | yes | yes (in EU) |
| Dimensions of sequencer (H × W × D)/Footprint of sequencer | 23.6 × 23.6 × 25.6 in./3.9 sq. ft. | 65.2 × 31.5 × 37.2 in./8.2 sq. ft. | 31.5 × 37.2 ×65.2 in. (includes monitor)/8.2 sq. ft. |
| Accessory equipment supplied with sequencer at no cost/Total footprint with accessory equipment | keyboard/— | — | Illumina DRAGEN server for NovaSeq 6000Dx/11.8 sq. ft. |
| Type of computer supplied with sequencer | computer for analysis and operations combined | computer for analysis and operations combined | computer for analysis and operations combined |
| Analysis options provided with sequencer | onboard, cloud based, on-premise server | onboard, cloud based | onboard, cluster based, cloud based |
| Where library preparation is performed | wet bench | — | accessory equipment, wet bench |
| Bioinformatics tools provided with sequencer | DRAGEN BIO-IT platform, BaseSpace | BaseSpace | DRAGEN BIO-IT platform, Illumina Run Manager, BaseSpace Sequence Hub |
| Sequencer supplied with UPS (uninterruptible power supply) | yes (no extra charge) | yes (no extra charge) | yes (no extra charge) |
| Electrical connection required for sequencer | 100–240 VAC at 50–60 Hz | 200–240 VAC at 50–60 Hz | 200–240 VAC at 50–60 Hz, 16A, single phase, 2500 W |
| List price of entire sequencer and necessary components | $335,000 | $985,000 | $1,080,000 |
| Purchase options | purchase, lease, reagent rental | purchase, lease, reagent rental | purchase, lease, reagent rental |
| Warranties offered | first year included with purchase; extended warranty available | first year included with purchase; extended warranty available | first year included with purchase; extended warranty available |
| Training included/Total time for basic training per operator | yes/1–2 days | yes/2 days | yes/2 hours |
| Training location/Follow-up training available | at customer site/yes (extra charge) | at customer site/yes (extra charge) | at customer site/yes (extra charge) |
| Maximum No. of samples amplified in a single amplification event | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) |
| Read length/Percent bases >Q30 | up to 2 × 300 bp/80–90% | up to 2 × 250 bp/75% | up to 2 × 250 bp/85% |
| Paired-end capability/Tag lengths/Spans | yes/2 × 300 bp/— | yes/up to 2 × 250 bp/up to 550 bp | yes/up to 2 × 250 bp/up to 550 bp |
| Fragment/Tag lengths/Spans | yes/2 × 300 bp/— | yes/up to 2 × 250 bp/up to 550 bp | yes/up to 2 × 250 bp/up to 550 bp |
| Mate pair/Tag lengths/Spans | yes/2 × 300 bp/— | yes/up to 2 × 150 bp/2–12 kb | yes/up to 2 × 150 bp/2–12 kb |
| Single end/Tag lengths/Spans | yes/2 × 300 bp/— | yes/up to 1 × 300 bp/up to 350 bp | yes/up to 1 × 300 bp/up to 350 bp |
| RNA sequencing/Tag lengths/Spans | yes/2 × 300 bp/— | yes/up to 2 × 250 bp/up to 500 bp | yes/up to 2 × 250 bp/up to 500 bp |
| ChIP sequencing/Tag lengths/Spans | yes/2 × 300 bp/— | yes/up to 2 × 250 bp/up to 550 bp | yes/up to 2 × 250 bp/up to 550 bp |
| Bisulfite sequencing/Tag lengths/Spans | yes/2 × 300 bp/— | yes/up to 2 × 250 bp/up to 550 bp | yes/up to 2 × 250 bp/up to 550 bp |
| Maximum No. of reads or fragments sequenced per single-end run | up to 1.2 billion | up to 20 billion | up to 20 billion |
| Maximum No. of reads or fragments sequenced per paired-end run | up to 2.4 billion | up to 40 billion | up to 40 billion |
| Total No. of nucleotides (bases) sequenced per run | up to 360 Gb | up to 3,000 Gb | up to 6,000 Gb per run, 3,000 Gb per flow cell |
| Wet lab bench time for sequencing preparation | 10 minutes | 10 minutes | 10 minutes |
| Sequencing run time | ~10–48 hours | ~13–44 hours | >45 hours |
| Total time for generating standard gDNA library | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) |
| • Paired end | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) | <3.5 hours (with Illumina DNA Prep) |
| • Fragment | <7 hours (with AmpliSeq for Illumina); <6.5 hours (with Illumina DNA Prep with Enrichment) | <7 hours (with AmpliSeq for Illumina); <6.5 hours (with Illumina DNA Prep with Enrichment) | <7 hours (with AmpliSeq for Illumina); <6.5 hours (with Illumina DNA Prep with Enrichment) |
| • Mate pair | — | — | — |
| • Single end | <1 day (with TruSeq Small RNA) | <1 day (with TruSeq Small RNA) | <1 day (with TruSeq Small RNA) |
| • RNA sequencing | <9 hours | <9 hours | <9 hours |
| • ChIP sequencing | <1.5 days (with TruSeq ChIP) | <1.5 days (with TruSeq ChIP) | <1.5 days (with TruSeq ChIP) |
| • Bisulfite sequencing | — | — | — |
| Hands-on time for the following: | | | |
| • Paired end | <1.5 hours (with Illumina DNA Prep) | <1.5 hours (with Illumina DNA Prep) | <1.5 hours (with Illumina DNA Prep) |
| • Fragment | <1.5 hours (with AmpliSeq for Illumina); <2 hours (with Illumina DNA Prep with Enrichment) | <1.5 hours (with AmpliSeq for Illumina); <2 hours (with Illumina DNA Prep with Enrichment) | <1.5 hours (with AmpliSeq for Illumina); <2 hours (with Illumina DNA Prep with Enrichment) |
| • Mate pair | — | — | — |
| • Single end | <4 hours (with TruSeq Small RNA) | <4 hours (with TruSeq Small RNA) | <4 hours (with TruSeq Small RNA) |
| • RNA sequencing | <3 hours | <3 hours | <3 hours |
| • ChIP sequencing | — | — | — |
| • Bisulfite sequencing | — | — | — |
| Library preparation equipment offered or supplied | none | none (standard lab equipment) | none |
| Cost of sequencing reagents per run | $900–$6,150 | $2,300–$16,000 | $10,080 –$15,120 |
| Reagent tracking method | RFID | RFID | RFID |
| • Type of reagent information tracked | serial number, expiration date, lot and part numbers, number of cycles | serial number, expiration date, lot and part numbers, number of cycles | serial number, expiration date, lot and part numbers, number of cycles |
| Shipping conditions for amplification/sequencing reagents | —/dry ice, gel pack, ambient (variable based on product) | —/dry ice, gel pack, ambient (variable based on product) | —/dry ice, gel pack, ambient (variable based on product) |
| Storage conditions for amplification/sequencing reagents | —/reagent cartridge: -15°– -25°C; flow cell and resuspension buffer tube: 2°–8°C | —/cluster, SBS cartridges: -15°– -25°C; flow cell: 2°–8°C; buffer cartridge: 15°–30°C | —/cluster, SBS cartridges: -15°– -25°C; flow cell: 2°–8°C; buffer cartridge: 15°–30°C |
| Shelf life of amplification/sequencing reagents | —/guaranteed 6 months | —/guaranteed 6 months | —/guaranteed 6 months |
| System requires a control sample on sequencing run | no | optional | no |
| • Company offers a sequencing control | yes (additional charge) | yes (additional charge) | no |
| Sequencing system control software and devices to start run/for data analysis | NextSeq Control Software/BaseSpace, DRAGEN | NovaSeq Control Software/BaseSpace | — |
| Complete walkaway automation for amplification, sequencing, and variant calling | yes | yes | yes |
| Remote system monitoring | yes | yes | yes |
| Total time required for setup of amplification, sequencing, and variant calling steps | ~15 hours | 5–30 minutes | 5–30 minutes |
| Maximum No. of libraries sequenced in a single run | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) | 384 samples (>384 samples with custom barcodes) |
| System includes secondary data-analysis software developed by company | yes (DRAGEN, BaseSpace Sequence Hub) | yes (BaseSpace Sequence Hub) | yes (Illumina Run Manager) |
| System includes post-sequencing data-analysis software | yes (included with purchase) | — | yes (included with purchase: Illumina Run Manager) |
| Mutations detectable via data-analysis software | substitutions, indels, copy number changes | substitutions, indels, copy number changes | substitutions, indels, copy number changes |
| System can generate a variant report | yes | no | yes |
| Types of maintenance plans available/mean time between failures | parts only, bronze, silver, gold, dedicated on site/— | parts only, bronze, silver, gold, dedicated on site/— | bronze, silver, gold/— |
| No. of field application scientists and engineers based in U.S. | >500 | >500 | >500 |
| Maintenance required: | | | |
| • Weekly | none | none (manual wash if instrument idle for 2 weeks) | none (maintenance wash required every 2 weeks) |
| • Monthly | none | none | — |
| • Pre-run | none | none (automatic wash completed after every run) | — |
| Distinguishing features of NGS system (supplied by company) | • offers the flexibility of 11 flow-cell configurations across multiple outputs and read lengths up to 2×300 for choice of cost-efficient configurations<br>• integrated reagent cartridge design eliminates need for maintenance wash between runs<br>• cost-efficient from instrument selection to tunable outputs | • match data output, time to results, and price per sample to study needs<br>• configure sequencing method, flow cell type, and read length to support a broad range of applications<br>• increase lab efficiency with a simplified workflow and reduced hands-on time | • more samples and deeper sequencing from diagnostic testing to clinical research; flexible RUO and IVD modes with scalable sequencing power<br>• accurate, efficient data analysis; high-quality data with a paired, dedicated DRAGEN server<br>• reduce time to answer; re-imagined user interface with a simple workflow |

*Note: a dash in lieu of an answer means company did not answer question or question is not applicable*

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| Part 4 of 4 | **Illumina**<br>info@illumina.com<br>**San Diego, CA**<br>**858-202-4500** www.illumina.com | **Thermo Fisher Scientific**<br>customercare@thermofisher.com<br>**Carlsbad, CA**<br>**800-955-6288** www.thermofisher.com/genestudio | **Thermo Fisher Scientific**<br>customercare@thermofisher.com<br>**Carlsbad, CA**<br>**800-955-6288** www.thermofisher.com/genexus |
|---|---|---|---|
| Name of system | NovaSeq X Plus | Ion GeneStudio S5 System | Ion Torrent Genexus Integrated Sequencer; Genexus Dx Integrated Sequencer |
| System application/FDA cleared or approved | research use/not required | research use/not required | Genexus: research use/not required; Dx: in vitro diagnostic and research use/underway |
| Country where designed/Manufactured | U.S./U.S. | U.S./Singapore | U.S./Singapore |
| First year sold in U.S./First year installed in U.S. | 2022/2023 | 2018/2018 | Genexus: 2019/2019; Dx: — |
| System sold internationally | yes (worldwide) | yes (worldwide) | Genexus: yes (worldwide); Dx: yes (in multiple countries) |
| Dimensions of sequencer (H × W × D)/Footprint of sequencer | 62.5 × 34.0 × 36.7 in./8.7 sq. ft. | 21.3 × 31.7 × 20 in./— | open: 81.1 × 58.5 × 43.5 in.; closed: 66.1 × 41.9 × 32.1 in./ open: 17.67 sq. ft.; closed: 9.36 sq. ft. |
| Accessory equipment supplied with sequencer at no cost/Total footprint with accessory equipment | — | — | — |
| Type of computer supplied with sequencer | computer for analysis and operations combined | computer for analysis and operations combined | computer for analysis and operations combined |
| Analysis options provided with sequencer | onboard, cluster based, cloud based | onboard, cloud based, local server | onboard, cloud based, local server |
| Where library preparation is performed | wet bench | accessory equipment | sequencer |
| Bioinformatics tools provided with sequencer | Illumina Run Manager, DRAGEN BIO-IT platform, BaseSpace Sequence Hub | Torrent Suite (optional: Ion Reporter, Oncomine Reporter) | Ion Torrent Genexus Software (optional: Ion Reporter, Oncomine Reporter) |
| Sequencer supplied with UPS (uninterruptible power supply) | yes (no extra charge) | no | no |
| Electrical connection required for sequencer | 200–240 VAC at 50–60 Hz | 100–240 VAC at 50–60 Hz, 6.5–14.5 A | 100–240 VAC |
| List price of entire sequencer and necessary components | $1,250,000 | — | — |
| Purchase options | purchase, lease, reagent rental | purchase, trade-in, lease, finance | purchase, trade-in, lease, finance |
| Warranties offered | first year included with purchase; extended warranty available | first year included with purchase; extended warranty available | first year included with purchase; extended warranty available |
| Training included/Total time for basic training per operator | yes/2 days | yes/1 day | yes/2 days |
| Training location/Follow-up training available | at customer site/yes (extra charge) | at vendor office or customer site/yes (extra charge) | at vendor office or customer site/yes (extra charge) |
| Maximum No. of samples amplified in a single amplification event | 384 samples (>384 samples with custom barcodes) | 384 samples (with custom barcodes) | 32 samples on system, 96 samples off instr. (for library prep) |
| Read length/Percent bases >Q30 | up to 2 × 150 bp/85–90% | up to 600 bp/— | up to 400 bp/— |
| Paired-end capability/Tag lengths/Spans | yes/2 × 150 bp/— | — | — |
| Fragment/Tag lengths/Spans | yes/2 × 150 bp/— | yes/—/up to 600 bp | yes/—/— |
| Mate pair/Tag lengths/Spans | yes/2 × 150 bp/— | — | — |
| Single end/Tag lengths/Spans | yes/2 × 150 bp/— | yes/—/up to 400 bp | — |
| RNA sequencing/Tag lengths/Spans | yes/2 × 150 bp/— | yes/—/up to 400 bp | — |
| ChIP sequencing/Tag lengths/Spans | yes/2 × 150 bp/— | — | — |
| Bisulfite sequencing/Tag lengths/Spans | yes/2 × 150 bp/— | yes/—/up to 400 bp | — |
| Maximum No. of reads or fragments sequenced per single-end run | up to 52 billion | 2–130 million | 48–60 million at 200–400 bp |
| Maximum No. of reads or fragments sequenced per paired-end run | up to 104 billion | — | — |
| Total No. of nucleotides (bases) sequenced per run | up to 16,000 Gb | 20–25 Gb (Ion 550); 10–15 Gb (Ion 540); 3–4 Gb (Ion 530); 0.6–1 Gb (Ion 520); 0.3–0.5 Gb (Ion 510 chip) | 9.6–12 Gb at 200 bp |
| Wet lab bench time for sequencing preparation | 10 minutes | <45 minutes | 10 minutes |
| Sequencing run time | ~13–48 hours | 2.5–4 hours | 19–24 hours (includes automated library prep) |
| Total time for generating standard gDNA library | <3.5 hours (with Illumina DNA Prep) | — | — |
| • Paired end | <3.5 hours (with Illumina DNA Prep) | — | — |
| • Fragment | <7 hours (with AmpliSeq for Illumina); <6.5 hours (with Illumina DNA Prep with Enrichment) | 4–6 hours | — |
| • Mate pair | — | — | — |
| • Single end | <1 day (with TruSeq Small RNA) | 5–7 hours | — |
| • RNA sequencing | <9 hours | <6 hours | — |
| • ChIP sequencing | <1.5 days (with TruSeq ChIP) | — | — |
| • Bisulfite sequencing | — | — | — |
| Hands-on time for the following: | | | |
| • Paired end | <1.5 hours (with Illumina DNA Prep) | — | — |
| • Fragment | <1.5 hours (with AmpliSeq for Illumina); <2 hours (with Illumina DNA Prep with Enrichment) | 1 hour | — |
| • Mate pair | — | <1 hour | — |
| • Single end | <4 hours (with TruSeq Small RNA) | 15 minutes | — |
| • RNA sequencing | <3 hours | 1 hour (with Ion AmpliSeq Transcriptome) | — |
| • ChIP sequencing | — | — | — |
| • Bisulfite sequencing | — | 15 minutes | — |
| Library preparation equipment offered or supplied | none | Ion Chef System for Ion AmpliSeq libraries | — |
| Cost of sequencing reagents per run | $1,900–$16,000 | — | — |
| Reagent tracking method | RFID | RFID | RFID, barcode reader |
| • Type of reagent information tracked | serial no., expiration date, lot and part nos., no. of cycles | expiration date, lot and part numbers | expiration date, lot and part numbers, placement |
| Shipping conditions for amplification/sequencing reagents | —/ambient | -20°C, 4°C, ambient (both variable based on product) | -20°C, 4°C, ambient (both variable based on product) |
| Storage conditions for amplification/sequencing reagents | —/reagent cartridge, pre-load buffer, lyo insert: -15°– -25°C; flow cell: 2°– 8°C; library tube strip, buffer cartridge: 15°– 30°C | -20°C, 4°C, ambient (both variable based on product) | -20°C, 4°C, ambient (both variable based on product) |
| Shelf life of amplification/sequencing reagents | —/guaranteed 3 months | 12–36 months from manufacture date (both variable based on product) | 12–36 months from manufacture date (both variable based on product) |
| System requires a control sample on sequencing run | optional | yes | yes |
| • Company offers a sequencing control | yes (additional charge) | yes (included at no charge) | yes (included at no charge) |
| Sequencing system control software and devices to start run/ for data analysis | NovaSeq X Plus Control Software/BaseSpace Sequence Hub, DRAGEN | Torrent Suite/Ion Reporter, Oncomine Reporter | Ion Torrent Genexus Software/Ion Reporter, Oncomine Reporter |
| Complete walkaway automation for amplification, sequencing, and variant calling | yes | — | yes |
| Remote system monitoring | yes | — | yes |
| Total time required for setup of amplification, sequencing, and variant calling steps | 5–30 minutes | <30 minutes | 10 minutes |
| Maximum No. of libraries sequenced in a single run | 384 samples (>384 samples with custom barcodes) | 384 samples | 48 samples or 96 libraries |
| System includes secondary data-analysis software developed by company | yes (DRAGEN, BaseSpace Sequence Hub) | yes (Ion Reporter, Oncomine Reporter) | yes (Ion Reporter, Oncomine Reporter) |
| System includes post-sequencing data-analysis software | yes (included with purchase: DRAGEN) | yes | yes |
| Mutations detectable via data-analysis software | substitutions, indels, copy number changes | substitutions, indels, copy number changes | substitutions, indels, copy number changes, fusions |
| System can generate a variant report | yes | yes | yes |
| Types of maintenance plans available/mean time between failures | parts only, bronze, silver, gold, dedicated on site/— | AB Assurance/— | AB Assurance, AB Platinum NGS/— |
| No. of field application scientists and engineers based in U.S. | >500 | 450 | 450 |
| Maintenance required: | | | |
| • Weekly | none (manual wash required every 2 weeks) | — | — |
| • Monthly | none | — | — |
| • Pre-run | none | — | — |
| Distinguishing features of NGS system (supplied by company) | • automated onboard cluster generation and secondary analysis<br>• ambient shipping of sequencing consumables<br>• configure sequencing method, flow cell type, and read length to support a broad range of applications | • end-to-end NGS solution from library to report with fast turnaround time (<24 hours) and minimal hands-on time (<45 minutes)<br>• start with as little as 1 ng of input DNA<br>• flexible sequencing depth and sample number throughput | • Dx sequencer is CE-IVD marked; walkaway automation of NGS workflow, incl. library prep, sequencing, analysis, reporting<br>• start with as little as 1 ng of input DNA<br>• scalable plug-and-play reagent architecture allows for cost-efficient sequencing of small and large batches |

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