

# MiSeq<sup>TM</sup> Dx Instrument

First FDA-regulated, CE-IVD–  
marked, NGS instrument for  
*in vitro* diagnostic use

- Simple instrument operation with intuitive touch screen interface and an automated workflow
- Exceptional data quality and reliability demonstrated through extensive system verification
- Wide menu of molecular diagnostic assays designed for clinical laboratory environments
- Open platform for custom IVD assay development and option to run other assays in Research Mode

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## Overview

The MiSeqDx Instrument is the first Food and Drug Administration (FDA)–regulated and Conformité Européenne *in vitro* diagnostic (CE-IVD)–marked platform for next-generation sequencing (NGS) (Figure 1). Designed specifically for the clinical laboratory environment, the MiSeqDx Instrument offers a small footprint (0.3 square meters), an easy-to-use workflow, and data output tailored to the diverse needs of clinical labs. In addition, the on-instrument integrated software enables run setup, sample tracking, user management, audit trails, and results interpretation.\* Taking advantage of proven Illumina sequencing by synthesis (SBS) chemistry, the MiSeqDx Instrument provides accurate, reliable screening and diagnostic testing.



Figure 1: MiSeqDx Instrument—The FDA-regulated, CE-IVD–marked MiSeqDx Instrument offers a simple workflow, user-friendly software interface, and enhanced user security.

\* Detailed results reports are available for target-specific assays, such as the TruSight Cystic Fibrosis 139-Variant Assay and TruSight Cystic Fibrosis Clinical Sequencing Assay.

## The NGS advantage

Compared to capillary electrophoresis–based Sanger sequencing, NGS can detect a broader range of DNA variants, including low-frequency variants and adjacent phased variants, with a faster time to result and fewer hands-on steps.<sup>1,2</sup> Illumina SBS chemistry employs natural competition among all four labeled nucleotides, which reduces incorporation bias and allows more robust sequencing of repetitive regions and homopolymers compared to other sequencing systems.<sup>3</sup> Comprehensive results are delivered quickly, eliminating the need for time-consuming reflex testing.

## Simple, three-step workflow

Assays run on the MiSeqDx Instrument follow a simple, three-step process (Figure 2) that starts with genomic DNA (gDNA) extracted from human peripheral whole blood specimens or formalin-fixed, paraffin embedded (FFPE) tissues. DNA samples are then prepared for sequencing through the addition of primers, generating indexed libraries for simultaneous capture and amplification of hundreds of targeted regions in multiple samples.

Prepared libraries are sequenced with a ready-to-use, prefilled MiSeqDx reagent cartridge. Simply thaw the cartridge, load the library, insert into the MiSeqDx Instrument, and start sequencing with the push of a button.

NGS on the MiSeqDx Instrument uses Illumina SBS chemistry, in which massively parallel sequencing of millions of DNA fragments occurs by a proprietary reversible terminator–based method. Single bases are detected as they are incorporated into growing DNA strands. Base calls are made directly from signal intensity measurements during each cycle. Learn more about SBS chemistry at [illumina.com](http://illumina.com).

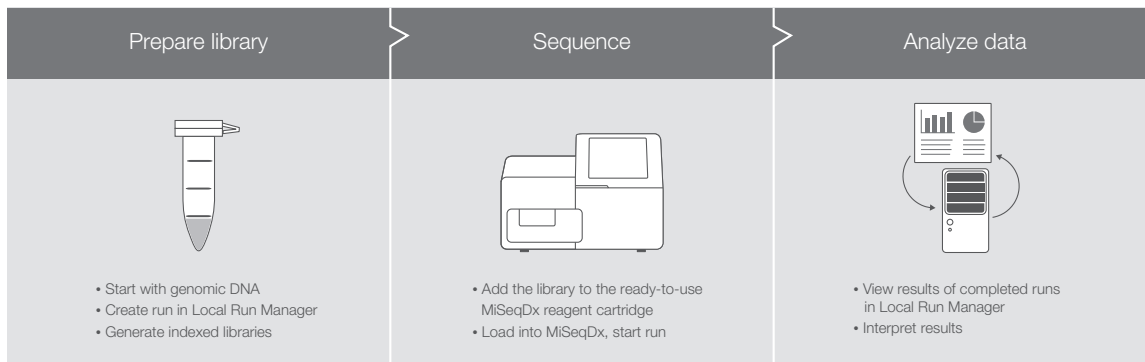


Figure 2: Three-step MiSeqDx assay process—The MiSeqDx Instrument is part of an integrated process including library preparation and data analysis for molecular diagnostic assays. Detailed results reports are only available with target-specific assays, such as the Extended RAS Panel, TruSight Cystic Fibrosis 139-Variant Assay, and TruSight Cystic Fibrosis Clinical Sequencing Assay.

## Integrated system software

The MiSeqDx Instrument offers fully integrated onboard instrument software that can be accessed through a user-friendly touch screen interface. Sequencing runs can be planned and tracked with audit trails using the Local Run Manager software, which supports library tracking and specification of sequencing run parameters. The Local Run Manager software runs on the instrument computer, allowing users to monitor run progress and view analysis results from other computers connected to the same network. After sequencing is completed, Local Run Manager automatically starts data analysis using one of several available analysis modules. Assay-specific analysis modules are available to perform alignment and variant calling of specific variants or across user-defined targeted regions.

## User management software

To ensure proper system use, the MiSeqDx Instrument is equipped with an integrated user management system. This enables laboratories to control and trace system access, ensuring that only authorized personnel are running tests.

## Available assays and reagents

Multiple *in vitro* diagnostic (IVD) assays and reagents are currently available for use on the MiSeqDx instrument:<sup>†</sup>

- **TruSight™ Cystic Fibrosis 139-Variant Assay** detects 139 clinically relevant and functionally verified variants in the cystic fibrosis transmembrane conductance regulator (*CFTR*) gene, as defined by the CFTR2 database<sup>4</sup>
- **TruSight Cystic Fibrosis Clinical Sequencing Assay** detects mutations within the protein coding regions and intron/exon boundaries of the *CFTR* gene
- **TruSeq™ Custom Amplicon Kit Dx** is an amplicon-based sequencing solution that enables users to develop assays targeting the genetic variants most important to them; Users design their own oligonucleotide probes specific to their regions of interest and use validated MiSeqDx reagents to prepare libraries and sequence
- **Extended RAS Panel** is the first FDA-approved NGS-based IVD to aid in the identification of patients with colorectal cancer for treatment with Vectibix by simultaneously evaluating 56 mutations in *RAS* genes contraindicated for Vectibix therapy; On-instrument software delivers an easy-to-interpret report<sup>‡</sup>

<sup>†</sup> Detailed results reports are available for target-specific assays, such as the TruSight Cystic Fibrosis 139-Variant Assay and TruSight Cystic Fibrosis Clinical Sequencing Assay.

<sup>‡</sup> Currently available only in the US.

For added functionality, use Illumina library preparation assays designed for use on the MiSeq System on the MiSeqDx Instrument when run in Research Mode.

## MiSeqDx instrument specifications

### Instrument configuration

RFID tracking for consumables  
MiSeq operating software  
Local Run Manager software

### Instrument control computer (internal)

Base Unit: Intel Core i7-7700 2.9 GHz CPU  
Memory: 2 × 8 GB DDR3 SO-DIMM  
Hard drive: None  
Solid state drives: 2 × 1 TB SATA  
Operating system: Windows 10

### Light emitting diode (LED)

520 nm, 660 nm

### Dimensions

W × D × H: 68.6 cm × 56.5 cm × 52.3 cm  
(27.0 in × 22.2 in × 20.6 in)  
Weight: 54.5 kg (120 lb)  
Crated weight: 90.9 kg (200 lb)

### Power requirements

100-240 V AC @ 50/60 Hz, 10 A, 400 W

### Radio frequency identifier (RFID)

Frequency: 13.56 MHz  
Power: 100 mW

### Throughput

1-96 samples/run, depending upon assay

### Performance parameters

Maximum read length: Up to 2 × 300 bp (Refer to package insert for assay-dependent specifications)  
Output (2 × 150 bp run): ≥ 5 Gb  
Reads passing filters: ≥ 15 million  
Q30 score (at read length of 2 × 150 bp): ≥ 80%  
Accuracy, germline:<sup>a</sup> >99.9% OPA<sup>b</sup> to reference data  
Accuracy, somatic:<sup>a</sup> 100% OPA to reference data  
Reproducibility, germline:<sup>c</sup> 99.88% OPA to reference data  
Reproducibility, somatic:<sup>d</sup> 99.6% expected call for mutant samples

- Results based on a representative TruSeq Amplicon-based assay designed to query a variety of genes covering 12,588 bases across 23 different chromosomes using 150 amplicons
- OPA: overall percent agreement
- Results based on Cystic Fibrosis (CF-139) Assay
- Results based on a representative 2-gene TruSeq Amplicon-based assay

## Ordering information

Product	Catalog no.
MiSeqDx Instrument	DX-410-1001
MiSeqDx Reagent Kit v3	20037124
TruSeq Custom Amplicon Kit Dx	20005718
TruSight Cystic Fibrosis Library Prep (supports TruSight Cystic Fibrosis 139-Variant Assay and TruSight Cystic Fibrosis Clinical Sequencing Assay, 96 tests)	20036925
Extended RAS Panel (Configured for 2 runs with up to 10 samples plus 2 controls per run, or 20 samples per kit)	20012431

## Learn more

MiSeqDx Instrument, [illumina.com/miseqdx](https://illumina.com/miseqdx)

Molecular diagnostics, [illumina.com/clinical/diagnostics](https://illumina.com/clinical/diagnostics)

## References

- Shokralla S, Porter TM, Gibson JF, et al. [Massively parallel multiplex DNA sequencing for specimen identification using an Illumina MiSeq platform.](#) *Sci Rep.* 2015;5:9687.
- Precone V, Monaco VD, Esposito MV, et al. [Cracking the Code of Human Diseases Using Next-Generation Sequencing: Applications, Challenges, and Perspectives.](#) *Biomed Res Int.* 2015;161648.
- Bentley DR, Balasubramanian S, Swerdlow HP, et al. [Accurate Whole Human Genome Sequencing using Reversible Terminator Chemistry.](#) *Nature.* 2008;456(7218):53–59.
- Clinical and Functional TRanslation of CFTR (CTFR2). [cftr2.org](https://cftr2.org). Accessed February 23, 2021.

## Intended use statements

### MiSeqDx Instrument intended use

The MiSeqDx 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 for *in vitro* diagnostic (IVD) assays performed on the instrument. The MiSeqDx Instrument is not intended for whole genome or *de novo* sequencing. The MiSeqDx Instrument is to be used with registered and listed, cleared, or approved IVD reagents and analytical software.

### MiSeqDx Reagent Kit v3 intended use

The Illumina MiSeqDx Reagent Kit v3 is a set of reagents and consumables intended for sequencing of sample libraries when used with validated assays. The MiSeqDx Reagent Kit v3 is intended for use with the MiSeqDx Instrument and analytical software.

### TruSight Cystic Fibrosis 139-Variant Assay intended use

The Illumina TruSight Cystic Fibrosis 139-Variant Assay is a qualitative *in vitro* diagnostic system used to simultaneously detect 139 clinically relevant cystic fibrosis disease-causing mutations and variants of the cystic fibrosis transmembrane conductance regulator (*CFTR*) gene in genomic DNA isolated from human peripheral whole blood samples. The variants include those recommended in 2004 by the American College of Medical Genetics (ACMG) 1 and in 2011 by the American College of Obstetricians and Gynecologists (ACOG).<sup>2</sup> The test is intended for carrier screening in adults of reproductive age, in confirmatory diagnostic testing of newborns and children, and as an initial test to aid in the diagnosis of individuals with suspected cystic fibrosis. The results of this test are intended to be interpreted by a board-certified clinical molecular geneticist or equivalent and should be used in conjunction with other available laboratory and clinical information. This test is not indicated for use for newborn screening, fetal diagnostic testing, preimplantation testing, or for stand-alone diagnostic purposes. The test is intended to be used on the Illumina MiSeqDx Instrument.

### References for TruSight Cystic Fibrosis 139-Variant Assay

1. Watson MS, Cutting GR, Desnick RJ, et al. [Cystic fibrosis population carrier screening: 2004 revision of American College of Medical Genetics mutation panel](#). *Genet Med* 2004;6(5):387–391.
2. American College of Obstetricians and Gynecologists Committee on Genetics. [ACOG Committee Opinion No. 486: Update on carrier screening for cystic fibrosis](#). *Obstet Gynecol.* 2011;117(4):1028–1031.

### TruSight Cystic Fibrosis Clinical Sequencing Assay intended use

The Illumina TruSight Cystic Fibrosis Clinical Sequencing Assay is a targeted sequencing *in vitro* diagnostic system that resequences the protein coding regions and intron/exon boundaries of the cystic fibrosis transmembrane conductance regulator (*CFTR*) gene in genomic DNA isolated from human peripheral whole blood specimens collected in K2EDTA. The test detects single nucleotide variants and small indels within the region sequenced, and additionally reports on two deep intronic mutations and two large deletions. The test is intended to be used on the Illumina MiSeqDx Instrument.

The test is intended to be used as an aid in the diagnosis of individuals with suspected cystic fibrosis (CF). This assay is most appropriate when the patient has an atypical or nonclassic presentation of CF or when other mutation panels have failed to identify both causative mutations. The results of the test are intended to be interpreted by a board-certified clinical molecular geneticist or equivalent and should be used in conjunction with other available information including clinical symptoms, other diagnostic tests, and family history. This test is not indicated for use for stand-alone diagnostic purposes, fetal diagnostic testing, preimplantation testing, carrier screening, newborn screening, or population screening.

### TruSeq Custom Amplicon Kit Dx intended use

The Illumina TruSeq Custom Amplicon Kit Dx is a set of reagents and consumables used to prepare sample libraries from DNA extracted from peripheral whole blood and formalin-fixed, paraffin-embedded (FFPE) tissue. User-supplied analyte specific reagents are required for

the preparation of libraries targeting specific genomic regions of interest. The generated sample libraries are intended for use on Illumina high-throughput DNA sequence analyzers.

#### Extended RAS Panel intended use

The Praxis™ Extended RAS Panel is a qualitative *in vitro* diagnostic test using targeted high-throughput parallel sequencing for the detection of 56 specific mutations in *RAS* genes [*KRAS* (exons 2, 3, and 4) and *NRAS* (exons 2, 3, and 4)] in DNA extracted from formalin-fixed, paraffin-embedded (FFPE) colorectal cancer (CRC) tissue samples. The Praxis Extended RAS Panel is indicated to aid in the identification of patients with CRC for treatment with Vectibix (panitumumab) based on a no mutation detected test result. The test is intended to be used on the Illumina MiSeqDx Instrument.

#### Extended RAS Panel relevant warnings and limitations

- For prescription use only
- Optimal performance of the test requires appropriate sample handling as described in the instructions for use
- The Extended RAS Panel Report only determines the presence or absence of the *KRAS* and *NRAS* mutations listed in the package insert<sup>2,3</sup>
- For samples that pass the DNA qualification step based on requirements described in the instructions for use, the assay has an estimated invalid rate of 6.9%-14.5% as assessed in the retrospective clinical and accuracy studies, respectively
- The risks of the Extended RAS Panel are associated with the potential mismanagement of patients resulting from false results of the test. A false positive test result may lead to Vectibix treatment being withheld from

a patient who might have benefited. A false negative test result may lead to Vectibix treatment being administered to a patient who is not expected to benefit, therefore potentially exposing them to any adverse side effects associated with this therapy and also causing the patient to possibly fail to receive a different drug that might be more appropriate for them than Vectibix

- Laboratories should follow safety procedures, as some components contain potentially hazardous chemicals and personal injury can occur through inhalation, ingestion, skin contact, and eye contact

#### References for Extended RAS Panel

1. Vectibix. [Prescribing information](#). Amgen; 2017. Accessed March 2, 2021.
2. Extended RAS Panel. [Package insert](#). Illumina; 2017. Accessed March 2, 2021.
3. Extended RAS Panel. [FDA Summary of Safety and Effectiveness Data](#). Illumina; 2017. Accessed March 2, 2021.

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1.800.809.4566 toll-free (US) | +1.858.202.4566 tel  
techsupport@illumina.com | www.illumina.com

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