Datasheet

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MiSeq FGx Sequencing System

The first and only fully validated next-generation sequencing instrument designed for forensic genomics

Highlights

- Easy to use instrument
  Simple operation with an intuitive touch-screen interface and load-and-go reagents.
- Superior analysis of challenging samples
  Advanced capacity to process complex DNA mixtures, degraded DNA, and other challenging samples.
- Integrated sequencing workflow
  End-to-end solution interrogates hundreds of markers in one run, consolidating library prep, sequencing, and analysis into a single workflow.
- Applications for human identification
  Adjustable read lengths, dual run modes, and two flow cells optimize flexibility across a growing range of capabilities.

Introduction

The Verogen MiSeq FGx® Sequencing System is the first and only next-generation sequencing (NGS) instrument designed and validated for forensic genomics applications. Key to the National DNA Index System (NDIS)-approved MiSeq FGx Forensic Genomics Solution, an end-to-end platform for analyzing forensic DNA samples, the MiSeq FGx System packages a simple workflow and tailored data output into a compact desktop instrument that fits into virtually any laboratory. Integrated software facilitates run setup, sample tracking, user management, audit trails, results interpretation, and reporting. Leveraging the most widely adopted NGS technology in the industry, Illumina sequencing-by-synthesis (SBS) chemistry, the MiSeq FGx System delivers superior resolution and unmatched accuracy for a variety of casework, from the everyday to the complex.[1,2]

Figure 1: The compact MiSeq FGx System pairs a simple workflow and user-friendly interface with power and accuracy to solve more cases and generate more leads.

NGS advantage for human identification

Compared to size-based analysis of short tandem repeats (STRs) using capillary electrophoresis (CE), NGS detects the full spectrum of genetic variation in a DNA sample with a faster time to results than other NGS technologies. Inherently sensitive, Verogen NGS technology goes beyond fragment size to identify underlying sequence variation. Comprehensive results are delivered quickly and clearly, displaying base-by-base sequences for easy interpretation with utmost confidence. Building on STR capabilities, NGS brings other advantages to modern forensic genomics, including analysis of nuclear single nucleotide polymorphisms (SNPs), mitochondrial DNA (mtDNA), messenger RNA (mRNA), and epigenetic markers, bolstering cases that require human identification while eliminating the need to weigh technical limitations against potentially informative data. Achieve superior results in a single sequencing run.[3]

Simple, streamlined workflow

Libraries sequenced on the MiSeq FGx System follow the same core NGS workflow: library prep, sequencing, and analysis (Figure 2). The first step uses a library prep kit to add primers to genomic DNA (gDNA), mtDNA, or mRNA extracted from forensic samples for simultaneous capture and amplification of hundreds of target regions, generating dual-indexed libraries ready for sequencing. After library prep, load-and-go reagents streamline run setup. Simply thaw the prefilled reagent cartridge, add libraries to the cartridge, and insert the cartridge into the instrument. The system software accepts run parameters and starts sequencing with the push of a button.[4]

Integrated software solution

The MiSeq FGx System features an intuitive touch-screen interface that provides step-by-step guidance through each stage of a sequencing run, from consumables loading through run configuration and monitoring. Onboard cluster generation and automated analysis initialization minimize hands-on time. Complementing the onboard software, the system integrates with Universal Analysis Software (UAS), a fully optimized analysis platform that delivers a powerful suite of forensic-tuned capabilities, including automatic detection of mixed samples, generation of population statistics, database-compatible reports, and more. UAS ships preinstalled on a dedicated server that is independent of the instrument, eliminating the need for auxiliary hardware and computing resources and maintaining the minimal instrument footprint of only 0.4 square meters.

Exceptional data quality

The MiSeq FGx System achieves exceptional data quality by employing a proprietary, reversible terminator-based method that detects single bases as they are incorporated into massively parallel DNA strands. Fluorescent terminator dyes are imaged as each deoxynucleotide triphosphate (dNTP) is added and then cleaved to allow incorporation of the next base. With all four reversible, terminator-bound dNTPs present at each sequencing cycle, natural competition among bases minimizes incorporation bias. The software makes base calls directly from signal intensity measurements during each incorporation cycle, reducing raw error rates compared to other technologies. The result is highly accurate, base-by-base sequencing that minimizes sequence context-specific errors, even within repetitive sequence regions or homopolymers.[5]

By applying this chemistry to forensic genomics, the MiSeq FGx System delivers an enhanced capacity to analyze degraded DNA, low-quantity DNA, complex DNA mixtures, and other challenging samples that can complicate or derail an investigation. Small amplicon sizes are well suited for interrogation of degraded DNA, while large numbers of markers—including many that are highly polymorphic—improve system ability to discern low-level minor components that CE might not detect. Additionally, one sequencing run interrogates hundreds of forensically relevant genetic markers, eliminating the need to choose between fragment length-based STR kits or otherwise make tradeoffs to accommodate challenging samples.

Growing suite of applications

In partnership with the forensic community, Verogen is continuing to expand the menu of forensic applications optimized for the MiSeq FGx System. With faster turnaround times and simplified workflows, the MiSeq FGx System offers an extensible alternative to CE. The instrument enables capabilities across all biological molecules and a growing number of applications, including both short- and long-range kinship analysis. For added functionality, the system features dual modes: Forensic Genomics mode sequences ForenSeq® libraries and Research Use Only (RUO) mode sequences libraries designed for the Illumina MiSeq System. Adjustable read lengths, flow cell options, and choice of run modes allow unprecedented flexibility for matching data output to an ever-increasing range of human identification needs.

Summary

The MiSeq FGx System is integral to a validated workflow designed specifically for forensic laboratories.

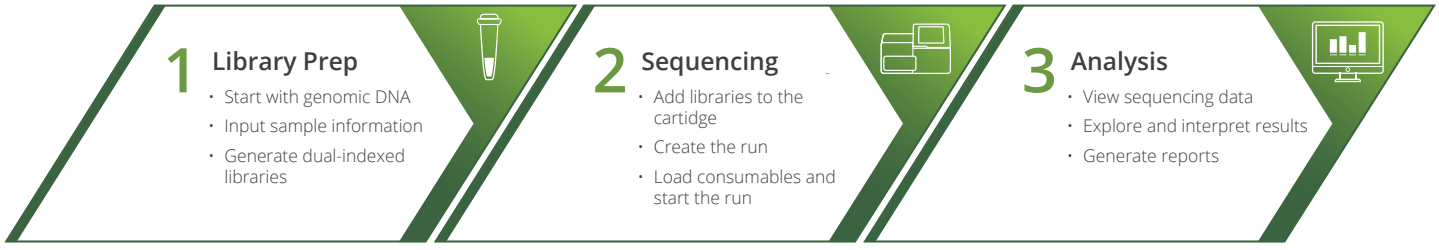

Figure 2: The Verogen NGS workflow takes you from sample to answer in three simple steps.

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Table 1: MiSeq FGx System specifications

System Configuration
RFID tracking for consumables MiSeq FGx Control Software
Instrument Computer (Internal)
Base unit: Intel Core i7-2710QE 2.10 GHz CPU Memory: 2 × 8 GB DDR3 Hard drive: 1 TB Operating system: Windows 10 Enterprise LTSC 2019 (embedded)
Operating Environment
Temperature: 19–25°C (66–77°F) Humidity: Noncondensing 30–75% Altitude: < 2000 m (6500 ft.) Air quality: Pollution degree rating of II Ventilation: Maximum 1364 BTU/h For indoor use only
Light Emitting Diode
530 nm, 660 nm
Dimensions
W×D×H: 68.6 cm × 56.5 cm × 52.3 cm (27 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 @ 50/60Hz, 10A, 400 W
Radio Frequency Identifier (RFID)
Frequency: 13.56 MHz Power: 100 mW
Throughput
1–384 samples per run, depending on assay
Performance Parameters
Maximum read length: 2 x 300 bp, depending on assay Output (2 x 150 bp run): ≥ 5 Gb Reads passing filters: 12.5 million Q30 score (at read length of 2 x 150 bp): ≥ 80% Total overall accuracy: ≥ 99.66% Total overall reproducibility: ≥ 99.7%
Safety and Compliance
NRTL certified IEC 61010-1 CE marked FCC/IC approved

Fully supported by Verogen, the system has available performance qualifications and regular maintenance aligned to forensic laboratory requirements. Building on the speed and accuracy of Illumina SBS chemistry, Verogen brings the unprecedented focus of forensic genomics to NGS, granting criminal justice a powerful ally.

Ordering information

Product	Part #
MiSeq FGx Sequencing System	15048975
MiSeq FGx Reagent Kit	15066817
MiSeq FGx Reagent Micro Kit	20021681
Extended Support Plan	V16000097
Extended Support Plan PLUS	V16000098

Discover more at **www.verogen.com/products/miseq-fgx-sequencing-system**

References

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