iScan System

Dedicated array scanner delivers industry-leading application and throughput flexibility for genetic analysis.

Highlights

- **High Data Quality**
  Powerful assay technology combined with leading-edge scanner
- **High Sample Throughput**
  Fast optical scanner for dramatically reduced scan times
- **Flexible**
  Supports multiple formats, many applications and automation options for easy scale-up
- **Fully Integrated**
  Seamless integration with LIMS, AutoLoader 2.x, liquid handling robot, analysis software, and other downstream applications

A Flexible, Scalable System

The iScan System is a cutting-edge, dedicated array scanner that supports rapid, sensitive, and accurate imaging of Illumina's array-based genetic analysis products. As array products increase in complexity, with higher densities and a greater number of features, it is important to have a scanner that keeps pace. Illumina scientists and engineers have developed this high resolution scanner to deliver industry-leading application and throughput flexibility.

The iScan system is easily customizable to meet a variety of application and throughput needs. It supports Illumina's broad portfolio of innovative genetic analysis assays for genotyping, CNV analysis, DNA methylation, and gene expression profiling. Assay processing can be automated with the addition of liquid handling robot, and an AutoLoader 2.x can be used for hands-free scanning.

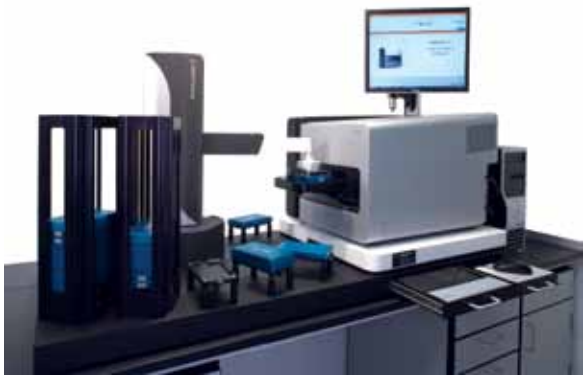
To support maximal instrument utilization, the iScan system can be combined with Illumina LIMS (laboratory information management system) and automation options. A single-scanner AutoLoader 2.x configuration can output over 1,000,000,000 genotypes per week.

This ease of customization allows the iScan system to grow as researchers' needs change. In combination with the broad spectrum of content options for diverse applications deployed on Illumina BeadArray™ products, the iScan system provides the fastest path to discoveries and publication.

Innovative Imaging System

The iScan Reader offers sub-micron resolution and unmatched throughput rates using high-performance lasers, optics and detection systems. The result is dramatically reduced scan times even on the highest density BeadChips without sacrificing data quality and reproducibility.

Figure 1: iScan System and AutoLoader 2.x



When combined with an AutoLoader 2.x, the iScan system is a high-throughput 24-hour per day scanning system for Illumina BeadArray™ products.

The scanner's high signal-to-noise ratio, high sensitivity, low limit of detection, and broad dynamic range contribute to exceptional data quality. The iScan system supports the high call rates provided by the Infinium® Assay for powerful genome-wide association studies (GWAS). High-resolution CNV analysis to accurately detect even single copy number changes is facilitated by the iScan system's sensitive and consistent fluorescence detection. Likewise, methylation and gene expression profiling benefit from the sensitive measurement and wide dynamic range.

High-Throughput Readout

Recent BeadArray product density advancements increase genomic coverage for whole-genome genotyping, resolution for cytogenetics and CNV detection, and sample throughput of gene expression, DNA methylation, and focused genotyping products. The iScan system handles even the highest density multi-sample arrays quickly to produce the high-quality data and rapid assay turnaround that Illumina customers expect (Table 1).

With the ability to scan BeadChips in minutes rather than hours, labs can process an entire study's worth of samples in record time. Such a dramatic drop in analysis time translates directly to faster project completion, faster publication, and reduced project costs.

Fully Automation Compatible

For labs with higher throughput requirements than can be satisfied by manual operation, Illumina offers optional equipment and software to automate the system. Assay sample processing can be automated to increase throughput, and scanner loading can be automated to support 24-hour per day scanning. A fully automated system under LIMS control represents the most robust and highest throughput configuration.

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Table 1: Weekly Throughput of Selected Illumina BeadChips with a Single iScan System

BeadChip	Approximate Scan Time Per Sample (minutes)	Manual Loading (Samples Per Week[1])	With Automation (Samples Per Week[2])
HumanOmni1-Quad	12.5	160	576
HumanOmniExpress	5	480	1,440
Human660W-Quad	9	160	800
HumanCytoSNP-12	2.9	480	1,728
iSelect® HD*	1.7	480	3,456
Universal-32 BeadChip for GoldenGate® Genotyping	0.3	1,440	1,440

* Scan times depend on content selection
[1] Assuming 8-hour day, 5-day week, single iScan
[2] Assuming 24-hour automated scanning, 5-day week, single iScan, Autoloader 2.x, and liquid handling automation

Assay Automation

A customized Tecan liquid-handling robot (ordered from and supported by Illumina) can be included in the system to automate assay protocols. The entire Infinium or GoldenGate Assay pre- and post-PCR workflows (after optional DNA quantitation) are performed by the robot to reduce labor requirements and ensure processing consistency.

This configuration yields outstanding reproducibility and high throughput. User-to-user variability is eliminated with consistent robotic pipetting. A single post-PCR robot increases the potential throughput of a single-scanner system running 12-sample BeadChips from 96 to 288 samples per day. A second post-PCR robot boosts the potential throughput to 576 samples per day.

AutoLoader 2.x

For the ultimate in sample throughput, Illumina provides options to automate BeadChip loading and scanning with the iScan system. By adding an AutoLoader 2.x to create either single or dual-scanner automated systems, users can maximize their scanner utilization to process thousands of samples per week (Table 1).

LIMS Integration

Accurate sample information, workflow enforcement, and data tracking are ensured with an optional integrated Infinium or GoldenGate LIMS designed specifically for Illumina products. Illumina LIMS features an easy-to-use custom interface, positive sample tracking (posID), and tools to manage entire projects.

Samples are validated and enforced throughout the workflow to ensure correct assay processing. Integrated tools support project management tasks such as managing concurrent projects, tracking progress and viewing queues, and assigning samples to a project, principle investigator, or institution. Downstream processes, such as generation and emailing notifications and reports, are performed automatically.

A fully automated LIMS-controlled iScan system reduces the burden on support staff and minimizes costly errors when processing hundreds or thousands of samples per day.

Workstation and Software

The iScan system includes a computer workstation that controls all aspects of the scanner. This automated system provides laser control, precision mechanics control (including focus motor), detection of excitation signals, image registration, image extraction, and data output.

Data analysis is supported by Illumina's state-of-the-art GenomeStudio® software, featuring visualization tools, advanced data manipulation features, and extensive reporting capabilities. GenomeStudio consists of application-specific modules with a common framework. This modular architecture makes the iScan system a truly multi-purpose instrument for wide-ranging genetic analysis, while providing a consistent user environment and tools for integrated analysis.

Installation and Support

Comprehensive installation and training is included with every iScan system purchase. Following installation by a Field Service Engineer, extensive on-site training is performed by an Illumina Field Applications Scientist for the purchased array application. Ongoing technical support is provided by Illumina Technical Support Scientists. The iScan system and Autoloader 2.x are benchtop instruments designed to fit easily in typical laboratories (Figure 2).

Warranty and Service

Illumina has one of the industry's best service organizations, with a strong drive to ensure customer satisfaction. A comprehensive 12-month warranty is included with the iScan system that covers the scanner and all hardware and accessories provided with each installed Option Package.

The Standard Warranty includes:

- Emergency on-site service calls during normal business hours
- One on-site preventative maintenance service
- Software upgrades for the applications purchased
- Parts, labor, and consumables for system maintenance or repairs
- Phone support and assistance

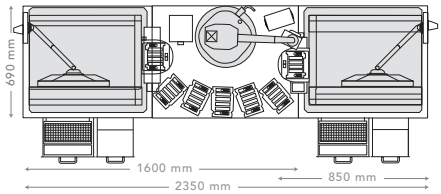
Flexible extended warranty options ensure that every system continues to optimum performance.

Summary

The iScan system is a cutting-edge dedicated array instrument supporting a wide breadth of applications. The system can also be easily expanded to meet changing throughput needs. An industry-leading support organization helps ensure that researchers get the most out of their iScan system.

As the pace of genetic studies increases, researchers can't afford lengthy studies. The iScan system harnesses the high data quality that Illumina genetic analysis products deliver and provides a faster path to discovery and publication. For more information about Illumina's genetic analysis products, visit www.illumina.com.

Figure 2: iScan System Dimensions



Even a dual-scanner AutoLoader 2.x configuration easily fits on typical lab benches. System height excluding monitor is 510 mm.

Table 2: Scanner Specifications

Parameter	Specification
Field of View	1 mm wide
Pixel Resolution	0.54 µm
Laser Excitation	532 nm and 658 nm dual-laser excitation
Emission Spectra	550–600 nm and 677–697 nm
Image Registration	Automatic
Data Extraction	Automatic
Image File Output	TIFF or JPG data file output with automatic image quality analysis (uncompressed or compressed)
Data File Output	IDAT (Illumina proprietary format)
Detector A-to-D	16 bit
Limit of Detection	5 fluor/µm^2 (Cy3 or Cy5)
Input Voltage	100-240 VAC 50/60 Hz, single phase
Input Power	3 A (110V): 1.5A (220V)
Dimensions	52 cm (width) x 45 cm (height) x 66 cm (depth)
Dimensions of Air Table	61 cm (width) x 6 cm (height) x 69 cm (depth)
Weight	65 kg

Table 3: Site Requirements

Parameter	Specification
Power	Dedicated circuit, 100–120/200–240 VAC, 50/60 Hz, 360 VA, 15A for 110V Reader/12A for 220V Reader
Pressured Pneumatic Line	30–35 psi pressurized air for isolation table with 5 µm element filter
Environmental Conditions	• Up to 2,000 m elevation • 10–30°C • 10–90% relative humidity • Overvoltage II installation category

Ordering Information

Product	Catalog No.
iScan System, 110V/220V	SY-101-1001
AutoLoader 2.x, Single-Scanner Configuration, 110V/220V	SY-202-1001
AutoLoader 2.x, Dual-Scanner Configuration, 110V/220V	SY-202-1002
GoldenGate Product Option Kit, 110V (220V)	SE-101-1001 (1002)
Gene Expression (IVT) Product Option Kit, 110V (220V)	SE-101-1003 (1004)
Universal Starter Kit, 110V (220V)	SE-101-1005 (1006)
Infinium Genotyping LIMS Server System, 110V (220V)	WG-15-103 (104)
GoldenGate Genotyping LIMS Standalone Server, 110V (220V)	SC-35-101 (102)
GoldenGate Genotyping LIMS Upgrade, 110V (220V)	SC-35-103 (104)
GoldenGate Genotyping and Infinium Automation, Post-Amplification LIMS-ready, 110V (220V)	SC-30-403 (404)
GoldenGate Genotyping and Infinium Automation, Post-Amplification, 110V (220V)	SC-30-401 (402)

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