Eco™ Real-Time PCR System

The Real-Time PCR performance you expect in an easy-to-use, affordable, personal instrument.

Eco Real-Time PCR System Highlights

- **Superior qPCR Performance**
  Sensitivity down to 1 copy; dynamic range > 9 logs; discriminate between 5,000 and 10,000 copies with 99%+ confidence
- **Easy-to-Use Instrument**
  Simple workflow and intuitive software
- **Most Affordable System Available**
  Priced for the individual researcher

Real-Time PCR for Everyone

The Eco Real-Time PCR system puts powerful qPCR applications within reach of individual researchers. Large, expensive thermal cyclers that take up an entire workspace are replaced with an affordable, compact system that fits easily on any lab bench (Figure 1). Delivering unsurpassed data quality in less than 40 minutes for 40-cycle runs, the Eco system revolutionizes qPCR accessibility for both new and experienced Real-Time PCR users.

The flexible Eco platform supports all chemistries and Real-Time PCR applications, including absolute quantification by standard curve, relative quantification using the ΔΔCq method with support for multiple reference gene normalization, allelic discrimination by end-point fluorescence, and genotyping by High Resolution Melt (HRM) curve analysis. Whatever your qPCR needs are, the Eco system meets them.

Breakthrough Instrument Design

Developed through a collaboration between the labs of Nobel Laureate David Baltimore, Ph.D., and Axel Scherer, Ph.D., at the California Institute of Technology, the Eco system supports a range of demanding Real-Time PCR applications. The innovative instrument design (Figure 2) includes an advanced thermal system for precise temperature control and a sensitive optical system that supports a wide variety of chemistries and fluorophores, providing researchers with a breakthrough user experience and unmatched cost-effectiveness.

Simple Installation

The benchtop Eco system is ready to use upon receipt. With a plug-and-play design, instrument installation by experienced or novice scientists is quick and easy. No calibration is required.

Optimized Sample Number

To provide a small, benchtop-friendly, 13.6" × 12.2" footprint, the Eco system employs an optimized 48-well plate format . For applications that require analysis of higher sample numbers, such as Standard Curve and Relative Quanitification studies, Illumina offers EcoStudy software. EcoStudy enables data from multiple plates to be combined and analyzed as a single study, effectively increasing sample throughput.

Unrivaled Temperature Control

qPCR specificity and efficiency depend upon precise temperature control during the annealing and extension steps. For the highest accuracy, the temperature must remain uniform across the entire heat block, ensuring that all samples proceed equally through the PCR reaction. Most thermocyclers demonstrate a ± 0.5°C variation in temperature across their heat blocks, potentially leading to inaccurate results. In addition, they can take up to 15 seconds to reach temperature equilibrium at any given step across all wells, increasing the time to complete a qPCR run. The Eco Real-Time PCR system (Figure 2) overcomes these shortcomings with a proprietary thermal system that provides accurate temperature control and quickly cycles from one temperature to the next.

To achieve this level of true temperature control, the Eco thermal system incorporates a precisely electroformed hollow silver block that is heated and cooled by a single Peltier device. The hermetically sealed hollow block contains a conductive fluid and two opposing agitators driven by electromagnetic motors. During PCR cycling, these agitators rapidly circulate the fluid throughout the hollow block, transferring heat from the Peltier device quickly and evenly across the block. This unique design virtually eliminates thermal non-uniformity and prevents "edge effects", providing a new level of thermal performance below ± 0.1°C well-to-well uniformity across the 48-well plate (Table 1). The result: higher qPCR performance (tighter Cq, greater PCR efficiency, higher R^2) and the ability to perform demanding applications such as HRM. In addition, this unique thermal block design facilitates an average thermal ramp rate to 5.5°C / sec., reducing overall PCR run times. Typical run time for a 40-cycle PCR protocol is < 40 minutes.

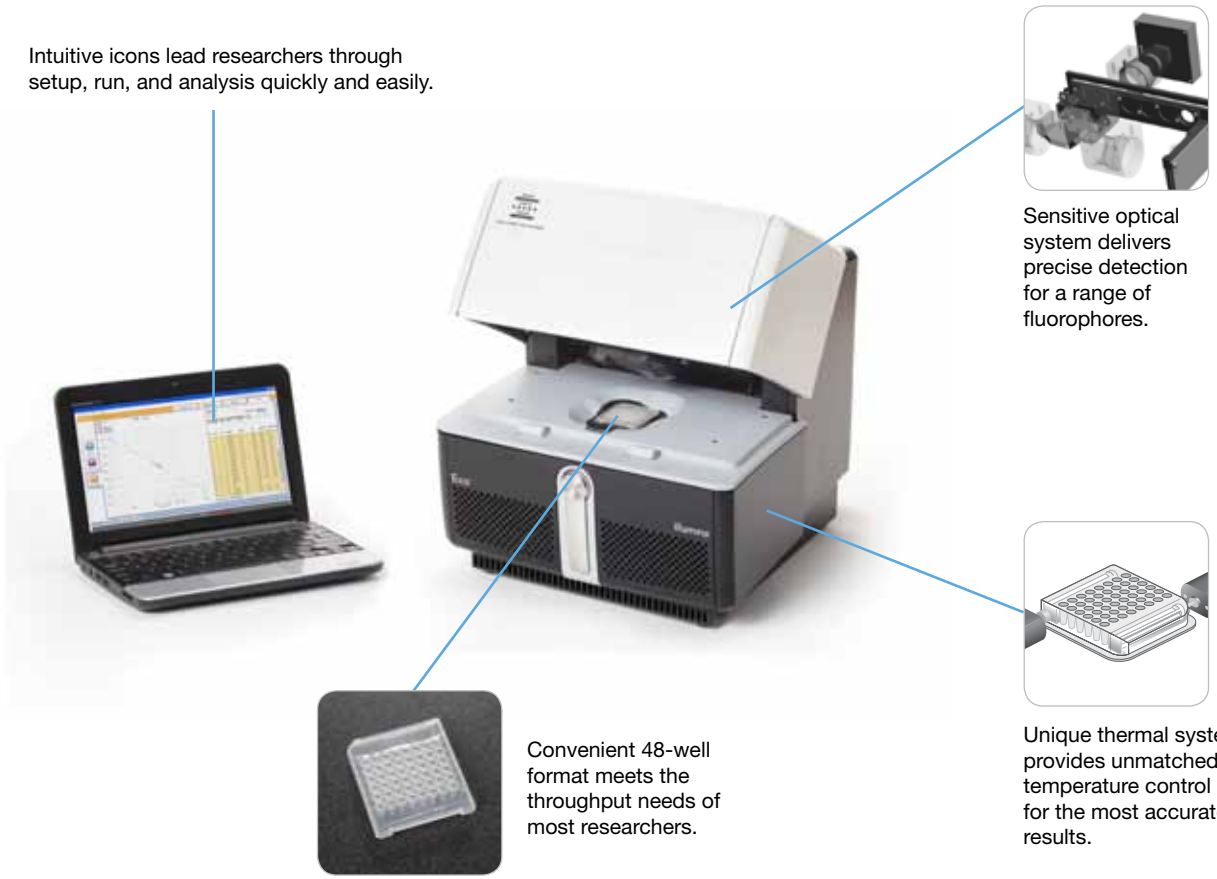
Precise, Sensitive Optical System

The Eco Real-Time PCR system contains an advanced high-performance optical system that delivers precise and sensitive fluorescence detection, facilitating all four-color multiplex applications. The system

Figure 1: Eco Real-Time PCR System

Key components of the high-performance Eco Real-Time PCR system include the Eco instrument, a netbook with Eco software pre-installed, and the Eco sample loading dock.

Figure 2: Eco Real-Time PCR System Innovative Design Features



The Eco Real-Time PCR system offers the qPCR capabilities of larger instruments in a compact footprint. Innovative features include a precise thermal system for unrivaled temperature control, an advanced optical system for highly sensitive fluoresence detection, a 48-well plate for flexible sample throughput, and intuitive, icon-driven software for error-free instrument operation.

is provided factory-calibrated for use with SYBR, FAM, HEX, VIC, ROX, and Cy5, but can be used with any Real-Time PCR fluorophores overlapping spectra with the calibrated dyes (Table 2).

For excitation, two panels—48 fixed LEDs each—provide excitation energy of a distinct spectra, enabling excitation over a broad range of fluorophores. Each of the 48 LEDs illuminates a specific well location within the plate, eliminating the optical distortion created by most stationary optical systems.

The optical system enables real-time detection of up to four targets in a single reaction. Four emission filters in a linear filter slide and a high-performance CCD camera detect the fluorescence from each well at each cycle (Figure 2). This approach prevents data loss and allows changes to plate setup and data analysis even after the run is completed. Standard melt curve and HRM analysis protocols are supported by continuous data acquisition in a single dye channel during the melt for increased data collection and reduced run times.

User-Friendly Software

A netbook computer pre-installed with flexible, easy-to-use software that integrates user control, real-time data collection, and advanced data analysis is provided with the Eco system. The software conforms to MIQE (Minimum Information for Publication of Quantitative Real-Time PCR Experiments) guidelines*, making data analysis and submission for publication review more efficient.

Easy-to-Use Interface

Eco software uses a unique icon-driven user interface to simplify experimental design and setup (Figure 3). Pre-set thermal profile defaults are provided for the most commonly used experimental protocols. Temperature and time for each protocol step can easily be changed by click-and-drag action with the mouse. Experiment templates can be customized and saved for future use.

* Bustin SA, Benes V, Garsong JA, Hellemans J, Hugget J, et al. (2009) The MIQE Guidelines: Minimum Information for Publication of Quantitative Real-Time PCR Experiments. Clinical Chemistry 55:4.

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Table 1: The Eco System Maintains Thermal Uniformity Over the Entire Plate for Better Cq Reproducibility

Average Cq	Standard Deviation of Cq	Maximum Cq	Minimum Cq
24.131	0.063	24.339	24.017

When running 48 replicates of a given assay, the Eco thermal system virtually eliminates the "edge effect" observed on other block-based qPCR instruments, leading to strong reproducibility of the replicates as shown by the extremely small standard deviation of the Cq.

Table 2: Eco System Excitation and Emission

Channel	Excitation (nm)	Emission (nm)	Example Fluorophores Detected
1	452–486	505–545	SYBR, FAM
2	542 – 582	604–644	ROX
3	452 – 486	562–596	HEX, VIC

Two excitation LED arrays combined with four emission filters produce raw fluorescence data that are automatically analyzed using spectral deconvolution software to effectively minimize cross-talk between dyes. Additional dyes in the wavelength range of the optical system emission filters are supported with no additional calibration required.

Data Analysis

With the Eco system and software, data collection is monitored in real time, allowing researchers to access run viability immediately. The user-friendly data analysis interface allows researchers to easily view the component data, amplification plot, melt curve analysis, and the analyzed results, including Cq values, standard curve equations, RQ values, and genotyping calls. Data can be exported into Excel or CSV and custom reports generated directly into PowerPoint or PDF formats. High-resolution images can be directly exported in multiple image formats, ready to use in any presentation.

Increased Throughput

EcoStudy software allows mulitple PCR runs to be combined and analyzed as a single study, effectively increasing the Eco system's sample throughput. One standard curve is applied across all the plates so that only one, the "mother plate", needs to dedicate multiple wells to reference standards. All additional plates or "daughter plates", are compared against the standard curve generated on the mother plate. This eliminates the need for each plate to carry its own standards, making wells available for samples and increasing throughput.

Simplified Workflow

The Eco workflow is based on three simple steps: load samples into the 48-well plate, place the plate into the Eco instrument, and run (Figure 4). The Eco software provides instrument control, data collection, and data analysis. The most common qPCR parameters are automatically in place. These can be easily changed on the computer to meet specific experimental requirements.

Figure 3: Icon-Based Interface Easily Directs Users From Setup to Analysis

Intuitive icons on each screen enable researchers to easily walk through setup, run, and analysis for their Real-Time PCR experiment.

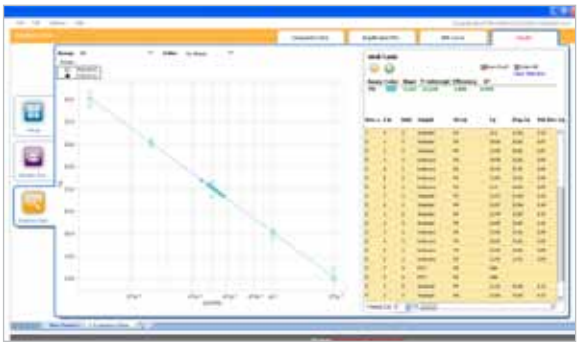
Figure 4: Simplified Eco System Workflow

1. Load samples in plate using the convenient Eco sample loading dock.

2. Place sample plate in instrument.

3. Run—intuitive software takes care of the rest, including data analysis.

Figure 5: Highly Accurate qPCR Results



Results obtained from a standard qPCR run using the Eco evaluation plate. The experiment was performed in a 20-µl final reaction volume with SYBR Green Master Mix. PCR efficiency is 100% with $R^2 = 0.996$. The 24 unknown samples were quantified with a Standard Deviation of Cq = 0.09. These measurements indicate great data quality.

High-Performance Results

Due to unmatched temperature control and an optical system designed for individual well monitoring, the Eco system produces highly accurate, reliable results with PCR efficiencies between 90% and 110% and $R^2 > 0.99$ when using standard optimized assays (Figure 5).

Accessible qPCR

With the Eco Real-Time PCR system, highly accurate qPCR results can be easily obtained on any budget. Combining precise temperature control, four-color multiplex capabilities, an optimized optical system, and intuitive software in a small-footprint device, the affordable Eco system is available to all researchers. Now everyone can own their own qPCR instrument; ready for use when they are, leading to more productive and successful research.

Learn more

For more information about the Eco Real-Time PCR system, visit www.illumina.com/ecoqpcr.

Eco System and Accessories

Product	Quantity	Catalog No.
Eco Real-Time PCR System (110 V)	1 unit	EC-100-1000
Eco Real-Time PCR System (220 V)	1 unit	EC-100-1001
Eco loading dock	1 unit	EC-200-1001
Eco plates	40 plates	EC-200-1002
Eco adhesive seals	40 seals	EC-200-1003
Eco evaluation plate	1 plate	EC-200-1004

Eco System Specifications

Catalog No. EC-100-1000

Instrument

Thermal system: Proprietary hollow silver block with Peltier-based system

Block format: 48-well block

Consumables: 48-well custom plates and optical adhesive seals

Sample volumes: Validated for 5–20 µl

Average ramp rate: 5.5°C/sec

Temperature range: 40–100°C

Temperature uniformity: ± 0.1°C

Optical system: Dual LED excitation (452–486 nm and 542–582 nm), four emission filters (505–545 nm, 562–596 nm, 604–644 nm, and 665–705 nm) and CCD camera

Calibrated dyes at shipment: SYBR Green, FAM, HEX, ROX, Cy5. Additional dyes within the wavelength range compatible with Eco filters are supported with no additional calibration required for implementation

Passive reference dyes: Use of ROX is supported, but optional

Data collection: Data collected in all four filters for all wells regardless of plate setup; plate setup for data analysis can be altered after run completion

Melt curve analysis supports continuous data acquisition in a single filter to provide increased data point collection and reduced run times

Real-Time PCR run time (40 cycles): Less than 40 minutes

12-month service contract, including parts and labor

Electrical

Voltage: 120–240 VAC = 10%

Frequency: 50/60 Hz = 1%

Nominal current draw: 8A

Peak power: 500W; typical power is 180W

Software

Multiple-license Eco system software is included at no additional cost; virtually all chemistries supported; applications include Absolute Quantification, Relative Quantification, Allelic Discrimination, High Resolution Melt curve analysis (HRM)

Dimensions

Closed W×D×H: 13.6 in × 12.2 in × 12.6 in

Open W×D×H: 13.6 in × 12.2 in × 14.5 in

Weight: 13.6 Kg (30 lbs)

Performance

Sensitivity: 1 copy

Dynamic range: > 9 logs linear range

Precision: Discriminates 5,000 and 10,000 template copies with 99% confidence

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