

OpenArray® technology on the QuantStudio™ 12K Flex Real-Time PCR System

High-throughput profiling, confirmation, and screening in a mid-density format

- Fast—generate over 43,000 expression profiles, or more than 110,000 genotypes, per workday without robotics
- High-throughput—screen over 5,184 genotyping samples, or more than 2,304 expression samples per workday
- Economical—save precious samples and reduce reagent costs through cost-effective use of nanoliter volumes

Introduction

OpenArray® technology on the QuantStudio™ 12K Flex Real-Time PCR System accelerates genomic confirmation and screening, enabling unprecedented gene coverage and sample throughput. With OpenArray® technology on the QuantStudio™ 12K Flex system, a single user can now easily complete most projects in days instead of weeks, and generate from 1 to over 12,000 data points in a single

run. A broad selection of predesigned and custom plate formats are available to meet the specific needs of a wide spectrum of research applications.

The QuantStudio™ 12K Flex OpenArray® plates have an easy-to-use format. For most applications, assays are preloaded onto plates at our state-of-the-art manufacturing facility. To run the plates, simply mix your sample with master mix, load

with the automated QuantStudio™ 12K Flex OpenArray® AccuFill™ System (Table 1), cycle, and image (Figure 1).

The self-metering nanofluidic design of the QuantStudio™ 12K Flex OpenArray® plates uses only 33 nL of reaction per data point. This significantly minimizes reagents and costs while still delivering high performance (Tables 2–4) and the reproducibility required to trust your results.

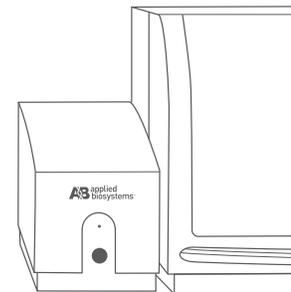
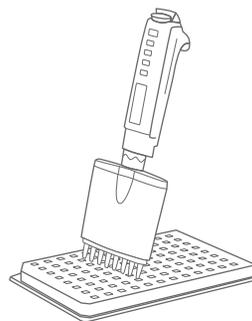
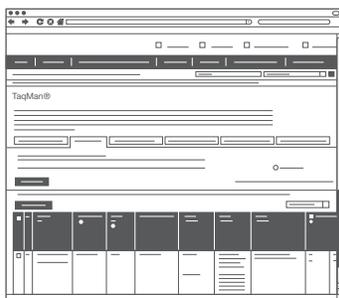


The QuantStudio™ 12K Flex Real-Time PCR System

1. Select assays or panels and order products

2. Add samples and master mix

3. Load sa



Go to lifetechnologies.com to select assays and QuantStudio™ 12K Flex OpenArray® plate formats for custom plates, or to select from predesigned OpenArray® Fixed-Content Panels or OpenArray® Digital PCR Plates.

For gene expression and genotyping applications, mix cDNA or DNA samples with master mix in 384-well sample plates. For digital PCR applications, mix assays, samples, and master mix in 384-well sample plates.

Load sample mixes onto a QuantStudio™ 12K Flex OpenArray® plate with the QuantStudio™ 12K Flex AccuFill™ System.

Figure 1. The OpenArray® workflow on the QuantStudio™ 12K Flex Real-Time PCR System.

Custom offerings of QuantStudio™ 12K Flex OpenArray® plates include a suite of 11 formats (Tables 5 and 6) to provide flexible solutions to configure your plates for gene expression analysis and genotyping. Off-the-shelf, predesigned QuantStudio™ 12K Flex OpenArray® Real-Time PCR Fixed-Content Panels are also available. You can choose from a variety of pathways such as signal transduction, kinome, and inflammation, as well as stem cell, cancer, genetic barcoding, and pharmacogenomics panels. Digital

PCR applications use TaqMan® Assay chemistry in open-format QuantStudio™ 12K Flex TaqMan® OpenArray® Digital PCR Plates.

OpenArray® technology accelerates and enables many high-throughput research applications

OpenArray® technology helps streamline real-time PCR studies that use large numbers of samples, assays, or both, as a single QuantStudio™ 12K Flex OpenArray® plate is equivalent to running eight traditional 384-well plates. The system can run up to four

QuantStudio™ 12K Flex OpenArray® plates simultaneously, allowing you to process up to 1,728 genotyping samples and 2,304 samples for gene expression in an 8-hour day. Enhance your genotyping throughput by thermal cycling offline using the Dual Flat Block GeneAmp® PCR System 9700, and process a total of over 5,184 genotyping samples in one day.

Drug discovery

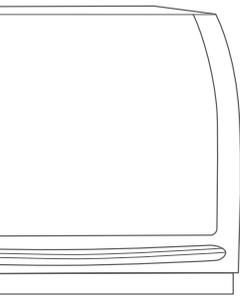
TaqMan® Assay chemistry is routinely used to confirm microarray results and screen large numbers of samples in biomarker, genotyping, and

Table 1. Specifications for the QuantStudio™ 12K Flex OpenArray® AccuFill™ System.

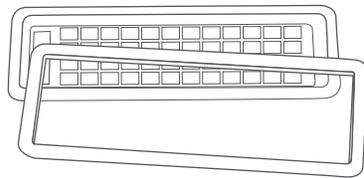
Fill rate	99.25%
Maximum allowable sample carryover	<1%
Maximum allowable assay carryover	<1%
Maximum number of through-hole data points lost due to evaporation	<5%

Table 2. Performance specifications for QuantStudio™ 12K Flex TaqMan® OpenArray® Real-Time PCR Plates.

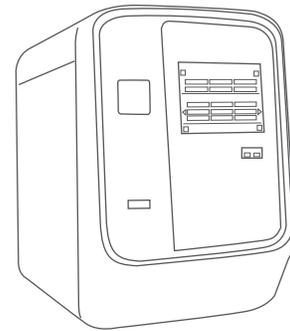
Specificity based on no-template control	No demonstrable amplification
Precision of replicates at 100 copies	Standard dev. for C _t : <0.25
No amplification in empty holes	>99% holes
Loading time for 4 OpenArray® plates (12,288 reactions)	<20 minutes
Time from cDNA or DNA to real-time data	~2.5 hours
Throughput of one technician in one day	>43,000 reactions (up to 2,304 samples)



QuantStudio™ 12K Flex
QuantStudio™ 12K Flex



The QuantStudio™ 12K Flex OpenArray® plate is encased in an alloy bottom for easy handling; simply apply the adhesive lid and fill the case with immersion fluid.



Easily run up to four QuantStudio™ 12K Flex OpenArray® plates for any application on the QuantStudio™ 12K Flex instrument in stand-alone mode.

toxicology projects. The OpenArray® technology is used in the drug discovery environment to streamline confirmation and screening efforts (Figure 2).

Pharmaceutical target confirmation

When you need to test tens to hundreds of genes against tens to thousands of samples, OpenArray® technology is the way to go. The ability to easily switch from microtiter plates to QuantStudio™ 12K Flex OpenArray® plates on a single system allows continuity of data analysis as well as significant cost reduction.

MicroRNA profiling

OpenArray® technology is ideal for human and rodent microRNA (miRNA) profiling studies. Combined with up-front sample preparation using Megaplex™ Primer Pools to streamline conversion of miRNA to cDNA, and preamplification prior to quantification, QuantStudio™ 12K Flex TaqMan® OpenArray® MicroRNA Panels deliver TaqMan® MicroRNA Assay performance with superior throughput. These panels can be used to profile up to 36 samples per day and offer researchers a fast, easy, and affordable path to validated data.

Agricultural molecular testing

OpenArray® technology can be used to detect viral, fungal, and bacterial pathogens. The flexibility of OpenArray® technology allows agricultural diagnostics researchers to very quickly add new pathogens to their hit lists, and to test more than 760 samples in triplicate in just one day. OpenArray® technology is also used to select crop seed lines, in fine-mapping studies, and in quantitative trait locus (QTL) mapping—for broad animal tracking and trait selection.

Table 3. Performance specifications for QuantStudio™ 12K Flex TaqMan® OpenArray® Genotyping Plates.

Assay conversion rate from a 7900HT Real-Time PCR System	>95%*
Concordance with assays run on a 7900HT Real-Time PCR System	99.7%*
Call rate	>95%*
Number of haploid copies of gDNA/through-hole	250
TaqMan® OpenArray® Genotyping Plate capacity per 8-hour day by a single person	36**
Time from purified DNA to genotyping data	~5 hours
Throughput of one technician in one day	110,000**

* Individual performance is dependent on end user's sample integrity and purity.
** Combination of one instrument run with a Dual Flat Block GeneAmp® PCR System 9700 (optional).

Table 4. Performance specifications for QuantStudio™ 12K Flex TaqMan® OpenArray® Digital PCR Plates.

Available real estate	3,072 through-holes (up to 144 digital PCR answers per run)
Time from sample to answer	~3 hours
Throughput of one technician in one day	>49,000 data points (up to 576 dilutions or samples)
False-negative/false-positive rate	<5%

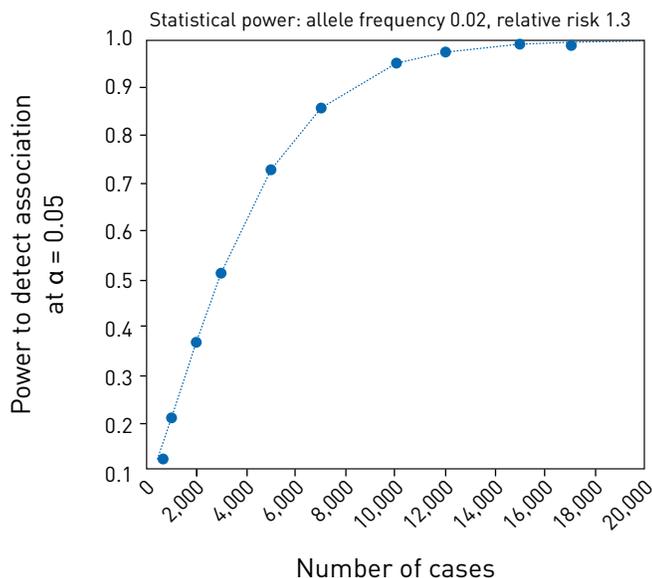


Figure 2. More samples mean greater statistical power: the larger the sample size, the more confidence you have in detecting a real effect. OpenArray® technology helps provide the high throughput and low cost needed for high-powered confirmation or screening studies.

Digital PCR

OpenArray® technology can be used for digital PCR applications such as accurate, traceable quantification of viral load, sensitive detection of mutant sequences against backgrounds of somatic wild type DNA, and GMO quality control. When you need to rescue ambiguous qPCR data, QuantStudio™ 12K Flex TaqMan® OpenArray® Digital PCR Plates help deliver precise, absolute answers. The open format of the plate facilitates experimental design, allowing multiple sample dilutions for increased input dynamic range (Figure 3).

Rapid and cost-effective analysis with fixed-content panels

Quickly understand which genetic changes may have biological significance, with cost-effective OpenArray® fixed-content panels. These panels are preconfigured with TaqMan® Gene Expression or SNP Genotyping Assays for specific biological processes, pathways, or disease states. With 1- to 2-day shipping and no minimum orders, these assays allow for accurate, efficient, and cost-effective assessment of a specific pathway (Table 7) across hundreds to thousands of samples in a single day.

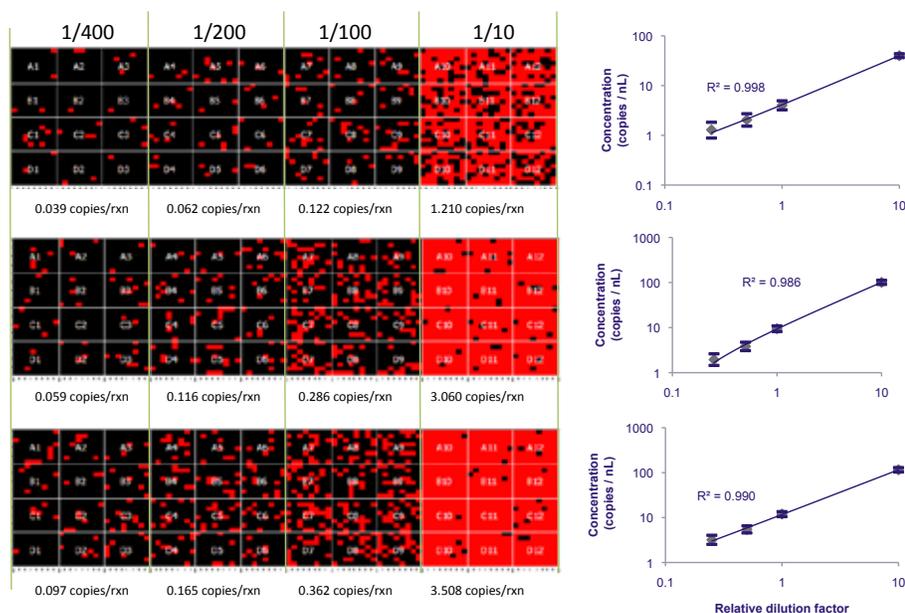


Figure 3. Serial dilutions of DNA across QuantStudio™ 12K Flex TaqMan® OpenArray® Digital PCR Plates. Dilution series of Acrometrix® standards for the dsDNA viruses Epstein-Barr virus, cytomegalovirus, and BK virus were evaluated using digital PCR. The viral standards were diluted as indicated and quantified using TaqMan® OpenArray® Digital PCR Plates. For each dilution set, digital PCR reactions were run in 12 subarrays, each containing 64 through-holes, for 768 replicates per sample (heat maps on left). The graphs on the right show the linearity and precision of target detection.

Table 5. QuantStudio™ 12K Flex OpenArray® Gene Expression Plate format options.

Plate format	Samples/ plate	Minimum order (10 pack)	
		Inventoried assays only	Inventoried, predesigned, and custom assays
18 (3X) assays	48	1	1
56 assays	48	1	1
112 assays	24	1	2
168 assays	16	1	3
224 assays	12	1	4

Table 6. QuantStudio™ 12K Flex OpenArray® Genotyping Plate format options.

Plate format	Samples/plate	Minimum order (10 pack)
16 assays	144	1
32 assays	96	1
64 assays	48	2
128 assays	24	4
192 assays	16	6
256 assays	12	8

Table 7. Types of fixed-content panels available for OpenArray® analysis on the QuantStudio™ 12K Flex Real-Time PCR System.

Panels	Description
Genetic barcode	<ul style="list-style-type: none"> • High-throughput tracking and sample identity confirmation • Contains 64 assays specific to genetic barcodes
Human stem cell	<ul style="list-style-type: none"> • Gene expression markers to characterize human embryonic stem cell (hESC) identity • Contains 631 assays specific to stem cell-related genes
MicroRNA (human or rodent)	<ul style="list-style-type: none"> • Identify well-characterized and well-studied miRNAs • Contains 754 assays per panel and 3 samples per panel
Inflammation (human or mouse)	<ul style="list-style-type: none"> • Gene expression markers to characterize key pathways of inflammation response • Contains 607 assays specific to human inflammation genes, 648 assays specific to mouse inflammation genes
Human kinome	<ul style="list-style-type: none"> • Identifies profile of genes involved in the regulation of cellular pathways • Contains 828 assays specific to kinase and kinase-related genes
Human signal transduction	<ul style="list-style-type: none"> • Identifies major genes involved in key signaling pathways • Contains 597 assays specific to signal transduction-related genes
Human cancer	<ul style="list-style-type: none"> • Identifies differentially expressed genes involved in key pathways of cancer • Contains 648 assays specific to cancer
Pharmacogenomics (PGx)	<ul style="list-style-type: none"> • Validation of drug-metabolizing enzyme markers • Contains 164 assays specific to drug enzymes

A complete, scalable, and economical solution

OpenArray® technology on the QuantStudio™ 12K Flex system is an affordable solution for high-throughput gene expression, genotyping, miRNA, and digital PCR applications. This unique technology minimizes reagent use and helps greatly decrease the price per data point, so more samples can be run on the same budget. Additionally, there are no setup charges or other hidden fees.

The QuantStudio™ 12K Flex system empowers you to perform a wide range of experiments. You can scale from low-throughput feasibility studies to high-throughput screens with a single platform by bundling your system with up to 5 interchangeable thermal cycling blocks.

Accelerate your genotyping—with an optional flat block thermal cycler

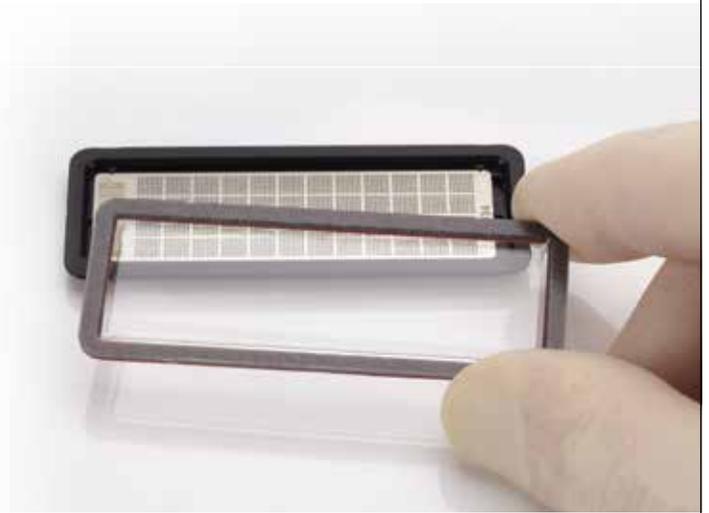
Developed for use in genotyping applications where sample throughput is of the utmost importance, the Dual Flat Block GeneAmp® PCR System 9700 can thermal-cycle up to eight QuantStudio™ 12K Flex TaqMan® OpenArray® Genotyping Plates simultaneously. This system offers interchangeable blocks to switch to standard multi-well plate formats. The GeneAmp® instrument is optional and sold separately from the QuantStudio™ 12K Flex system.

Comprehensive coverage with TaqMan® Assays

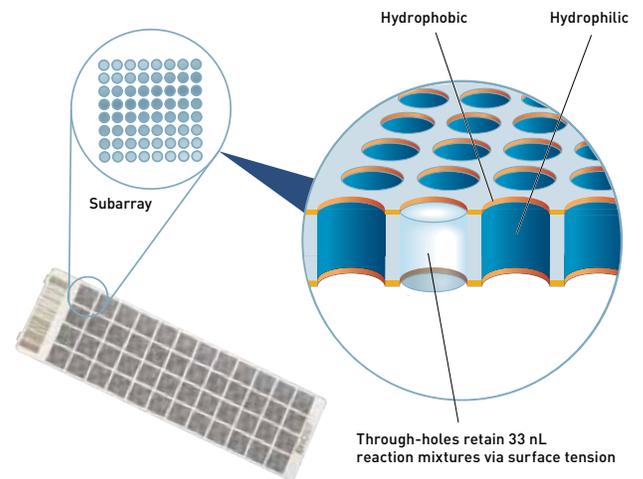
We offer over 61,000 inventoried TaqMan® Gene Expression Assays and over 4.5 million predesigned genotyping assays, including assays for 3.5 million HapMap SNPs and 2,700 inventoried drug-metabolizing enzymes (DME), for use with QuantStudio™ 12K Flex OpenArray® plates. Over 750 TaqMan® MicroRNA Assays are available as predefined sets in QuantStudio™ 12K Flex OpenArray® MicroRNA Panels. Additionally, you can create Custom TaqMan® Gene Expression or SNP Genotyping Assays by submitting your target sequences at lifetechnologies.com/cadt

OpenArray® technology

OpenArray® technology is a broadly applicable nanoliter fluidics platform for low-volume, solution-phase reactions. Researchers using this technology benefit from the parallelism of microarrays and the data quality of PCR-based solution-phase reactions.



OpenArray® technology utilizes a microscope slide–sized plate with 3,072 through-holes. Each plate contains 48 subarrays with 64 through-holes. Each through-hole is 300 µm in diameter and 300 µm in depth.



OpenArray® plate anatomy. Each through-hole is coated with hydrophilic and hydrophobic coatings. Reagents are retained in the through-holes via surface tension. QuantStudio™ 12K Flex OpenArray® plates come encased with an alloy bottom, so there is no need to touch the array. Simply apply the adhesive lid and fill the case with immersion fluid.

Ordering information

Product	Quantity	Cat. No.
OpenArray® instrumentation and accessories		
QuantStudio™ 12K Flex Real-Time PCR System, Desktop Configuration. Includes QuantStudio™ 12K Flex Real-Time PCR Instrument, QuantStudio™ 12K Flex OpenArray® AccuFill™ System, OpenArray® thermal cycling block, computer/monitor, analysis software, installation, basic training at the time of installation, and 1-year warranty	1 system	4471090
QuantStudio™ 12K Flex OpenArray® AccuFill™ System	1 system	4471021
QuantStudio™ 12K Flex AccuFill™ Upgrade Kit	1 module	4471022
QuantStudio™ 12K Flex Real-Time PCR System, OpenArray® Block without AccuFill™ System	1 instrument	4472380
Optional instrument accessories		
QuantStudio™ 12K Flex Automation Robot	1	4471066
Dual Flat Block GeneAmp® PCR System 9700	1 system	4428234
Dual Flat Block GeneAmp® PCR System 9700, Sample Module Only	1 module	4425757
QuantStudio™ 12K Flex OpenArray® Block Upgrade with AccuFill™ System	1	4471067
Starter kits		
QuantStudio™ 12K Flex TaqMan® OpenArray® Genotyping Starter Kit	1 kit	4469605
QuantStudio™ 12K Flex TaqMan® OpenArray® Gene Expression Starter Kit	1 kit	4469604
QuantStudio™ 12K Flex TaqMan® OpenArray® Human miRNA Starter Kit	1 kit	4469606
QuantStudio™ 12K Flex TaqMan® OpenArray® Digital PCR Starter Kit	1 kit	4469607
Practice kits		
QuantStudio™ 12K Flex OpenArray® Practice Kit. Includes 6 loading plates, QuantStudio™ 12K Flex TaqMan® OpenArray® Starter Accessories Kit, OpenArray® AccuFill™ System tips, 384-well sample plates and loading plate, and TaqMan® OpenArray® Genotyping Master Mix	1 kit	4469620
Calibration kits		
QuantStudio™ 12K Flex OpenArray® Installation & Calibration Kit	1 kit	4478601
QuantStudio™ 12K Flex OpenArray® RNase P Kit with Accessories Kit	1 kit	4469602
Accessories		
OpenArray® AccuFill™ System Tips	Box of 384	4457246
OpenArray® 384-Well Sample Plates	10 plates	4406947
OpenArray® 384-Well Sample Plates, Barcoded	10 plates	4453929
TaqMan® OpenArray® Real-Time PCR Master Mix	5 mL	4462164
TaqMan® OpenArray® Real-Time PCR Master Mix	1.5 mL	4462159
TaqMan® OpenArray® Genotyping Master Mix	1 x 5 mL for 10 arrays	4404846
QuantStudio™ 12K Flex TaqMan® OpenArray® Accessories Kit	1 kit for 10 arrays	4469576
QuantStudio™ 12K Flex TaqMan® OpenArray® Genotyping Training Plate (requires QuantStudio™ 12K Flex TaqMan® OpenArray® Accessories Kit, Cat. No. 4469576, available separately)	Sold as single plates	4471225
QuantStudio™ 12K Flex TaqMan® OpenArray® HS Endogenous Control Panel (requires QuantStudio™ 12K Flex TaqMan® OpenArray® Accessories Kit, Cat. No. 4469576, available separately)	Sold as single plates	4471226
Service		
AB Assurance, QuantStudio™ 12K Flex system with OpenArray® block		ZG11SCQ STUDIO12K-OA
AB Assurance, AccuFill™ system		ZG11SC ACCUFILL
Block upgrades		
96-Well (Standard or Fast) Block Upgrade	1 standard block	4453543
	1 Fast block	4453544
384-Well Block Upgrade	1 block	4453545
QuantStudio™ 12K Flex TaqMan® Array Card Block	1 block	4453546

QuantStudio™ 12K Flex TaqMan® OpenArray® plates

Product	Description
QuantStudio™ 12K Flex TaqMan® OpenArray® Genotyping Kits	Available in 6 different plate formats with your choice of TaqMan® SNP Genotyping, Custom TaqMan® SNP Genotyping, or TaqMan® Drug Metabolism Genotyping (DME) Assays. Each kit includes 10 QuantStudio™ 12K Flex TaqMan® OpenArray® Plates and one QuantStudio™ 12K Flex TaqMan® OpenArray® Accessories Kit.
QuantStudio™ 12K Flex TaqMan® OpenArray® Real-Time PCR Kits	Available in 5 different plate formats of TaqMan® Assays. Each TaqMan® OpenArray® Real-Time PCR Kit includes 10 QuantStudio™ 12K Flex TaqMan® OpenArray® Real-Time PCR Plates and one QuantStudio™ 12K Flex TaqMan® OpenArray® Accessories Kit.
QuantStudio™ 12K Flex TaqMan® OpenArray® Digital PCR Plates	Available in two sizes for use with your TaqMan® Assays. The 10-pack kit includes 10 QuantStudio™ 12K Flex TaqMan® OpenArray® Digital PCR Plates, TaqMan® OpenArray® Digital PCR Master Mix, and one QuantStudio™ 12K Flex TaqMan® OpenArray® Accessories Kit. The 4-pack kit includes 4 QuantStudio™ 12K Flex TaqMan® OpenArray® Digital PCR Plates and TaqMan® OpenArray® Digital PCR Master Mix. The QuantStudio™ 12K Flex TaqMan® OpenArray® Accessories Kit (Cat. No. 4469576) is required, but is not included with the 4-pack kit, and must be purchased separately.
QuantStudio™ 12K Flex TaqMan® OpenArray® MicroRNA Panels (human and rodent)	Single QuantStudio™ 12K Flex OpenArray® plates for human or rodent (mouse and rat) miRNA profiling.
QuantStudio™ 12K Flex TaqMan® OpenArray® Fixed-Content Panels	Single QuantStudio™ 12K Flex OpenArray® plates for a specific biological process, pathway, or disease state. Panels include: cancer, genetic barcoding, stem cell, kinome, signal transduction, inflammation, and pharmacogenomics.

Find out more at lifetechnologies.com

