

EZ1[®] Advanced Automated Solutions — Pure Convenience



Sample & Assay Technologies

Advances in automation reflect demanding research needs

The EZ1 Advanced and the EZ1 Advanced XL enable nucleic acid purification from a wide range of sample types relevant for molecular diagnostics, genetic identity testing, forensics, biomedical research, and gene expression analysis. The combination of easy-to-use instruments, with error-free protocol selection and worktable setup, and prefilled, sealed reagent cartridges makes nucleic acid purification easy.

EZ1 Advanced for high-quality, low-throughput nucleic acid purification

The EZ1 Advanced was developed to build on and extend the functionality of the well-established and highly successful BioRobot® EZ1. The improved workstation provides the convenience and reliability laboratories worldwide have come to rely on together with a fresh design and additional functions — ensuring effortless data management and improved safety. This instrument uses proven EZ1 Kits for low-throughput nucleic acid purification from up to 6 samples in parallel.

EZ1 Advanced XL developed for low-to-medium throughput

The EZ1 Advanced XL provides all the advantages of the EZ1 Advanced, and increases the throughput to 14 samples per run. This new workstation has been developed to combine the convenience and reliability of the EZ1 Advanced with the need for low-to-medium throughput.



"The worldwide success of the BioRobot EZ1 provided the driving force for development of the EZ1 Advanced and it remains at the top of the field by combining the highest safety standards with accuracy, reliability, and flexibility. The EZ1 Advanced XL meets laboratory demands for an easy-to-use solution for high-quality nucleic acid purification that enables throughput of 14 samples in 20 minutes."

EZ1 Advanced solutions — easy, safe, and reliable!

With EZ1 Advanced instruments, specialized user training is not required. In combination with EZ1 Kits, EZ1 Advanced solutions are highly suited for low-throughput (the EZ1 Advanced) or low- to medium-throughput (the EZ1 Advanced XL) laboratories handling urgent samples, requiring versatile nucleic acid purification for daily testing, or performing long-term research projects. For increased efficiency and convenience, up to 4 EZ1 Advanced instruments can be connected to one computer, giving you the flexibility you need to easily cope with varying sample preparation requirements.

EZ1 Advanced solutions deliver:

- Effortless data management with full traceability
- UV decontamination for a safe user environment
- Throughput options of up to 6 samples or up to 14 samples per run
- High-quality genomic DNA and RNA from a range of sample materials
- Viral nucleic acids from serum, plasma, CSF, urine, and respiratory samples

Self-contained EZ1 Advanced and EZ1 Advanced XL instruments ensure optimal ease of use and walkaway automation. All processing steps are performed by the workstation — from piercing reagent cartridges to elution of pure nucleic acids. A separate computer is not required for operation, and EZ1 Kits include all reagents and accessories required to process your samples.

EZ1 Kits provide prefilled, foil-sealed reagent cartridges that remain sealed until the instrument door is closed and the protocol run started, reducing the risk of contamination during setup.

Three simple steps

1. Insert the EZ1 Advanced Card or the EZ1 Advanced XL Card with the desired protocol into the card slot and start the workstation.
2. Place samples and prefilled, sealed reagent cartridges into the instrument. Samples are processed automatically and purified nucleic acids are transferred to elution tubes.
3. Remove pure nucleic acids in 1.5 ml microcentrifuge tubes at a concentration suited to your downstream application.





Flexibility and ease of use

A wide range of protocols is available for purification of DNA, RNA, or viral nucleic acids from 1–6 samples per run in less than 20 minutes using the EZ1 Advanced or from 1–14 samples per run in less than 20 minutes using the EZ1 Advanced XL. The workstation is operated via a keypad, and workstation information is displayed on the VFD (vacuum fluorescent display). To enable you to easily adapt to changing sample preparation requirements, up to 4 EZ1 Advanced or EZ1 Advanced XL instruments can be connected to an external computer (supplied by QIAGEN), expanding your throughput to up to 56 samples per run.



Standardization and traceability

The EZ1 Advanced and EZ1 Advanced XL set new standards in data management. Bar code reading enables complete tracking of samples and reagents throughout the entire purification process. Notes and assay identification information can also be easily entered. For increased process control and reliability, reagent identification and lot numbers are logged together with the expiration date, and a warning is issued if the expiration date has been exceeded. The run report, automatically generated at the end of each protocol, contains all workstation information, including maintenance procedures and decontamination data. The instruments generate a pdf and a csv file after each run. Data can be easily transferred to a printer or computer within your network and the report file can subsequently be processed by a LIMS (Laboratory Information Management System).



Proven technology with improved performance

Proven EZ1 Kits, in combination with EZ1 Advanced Cards or EZ1 Advanced XL Cards, ensure high-performance results in your purification procedures. The unrivaled ease of use of the EZ1 Advanced and EZ1 Advanced XL enables fast and reproducible purification without the need for specialized training or previous experience with robotic workstations. The extensive application range, including DNA purification from blood, tissues, and human identity and forensic samples, RNA purification from cells and tissues, and purification of viral nucleic acids from a range of sample types, delivers the flexibility that is essential for laboratories processing a wide variety of starting materials.



Safety and reliability

The EZ1 Advanced and EZ1 Advanced XL have been designed to ensure high process safety, high performance, and user convenience. The instruments can be placed in a safety cabinet, if required, providing increased user safety. A sensor ensures that the workstation door remains closed during sample preparation, reducing contact of laboratory personnel with potentially infectious samples and protecting sample integrity. At the end of each run, an intelligent-design UV lamp decontaminates the inner surface of the workstation, which helps to eliminate sample carryover from run to run. UV decontamination is highly effective in eliminating Gram positive and Gram negative bacteria (Table 1).

Table 1. UV lamp effectively eliminates bacterial contamination.

A <i>E. coli</i> colony numbers							
Irradiation (min.)	Run	Replicate					
		1	2	3	4	5	6
30	1	0	0	0	0	0	0
	2	0	0	0	1	0	0
	3	10	0	0	0	0	3
	Control	311	352	402	367	351	396
60	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	0	0	0	0	0
	Control	348	307	329	326	396	385

B <i>S. haemolyticus</i> colony numbers							
Irradiation (min.)	Run	Replicate					
		1	2	3	4	5	6
30	1	12	10	17	2	6	4
	2	0	0	0	0	0	0
	3	0	0	2	11	0	3
	Control	248	256	396	314	321	267
60	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	10	0	0	0	0	0
	Control	264	305	368	292	347	388

Six replicates (20 µl each) of **A** *Escherichia coli* cultures (17,750 CFU/ml) or **B** *Staphylococcus haemolyticus* cultures (15,700 CFU/ml) were irradiated using the integrated UV lamp of the EZ1 Advanced, followed by growth on plates in appropriate culture medium. Three independent irradiation runs were performed. Irradiation using the UV lamp was highly effective in eliminating bacteria.

Reproducible high performance using easy-to-run protocols

The EZ1 Advanced and the EZ1 Advanced XL use proven EZ1 Kits with preprogrammed protocols on EZ1 Advanced or EZ1 Advanced XL Cards. EZ1 Advanced Cards or EZ1 Advanced XL Cards specify a choice of purification protocols without any manual data entry. As your range of applications expands, new cards may be purchased — increasing your range of purification protocols without any retraining or costly modifications to the instrument. EZ1 Kits are available for a broad range of applications including work in human identity and forensics, biomedical research, and gene expression analysis (see Table 2).

Table 2. Combinations of EZ1 Advanced Cards and EZ1 Kits

Card	Kit	Sample
EZ1 Advanced DNA Blood Card (cat. no. 9018293) or EZ1 Advanced XL DNA Blood Card (cat. no. 9018695)	EZ1 DNA Blood 200 µl Kit	Blood and blood-derived samples
EZ1 Advanced DNA Blood Card (cat. no. 9018293) or EZ1 Advanced XL DNA Blood Card (cat. no. 9018695)	EZ1 DNA Blood 350 µl Kit	Blood and blood-derived samples
EZ1 Advanced DNA Dried Blood Card (cat. no. 9018299) or EZ1 Advanced XL DNA Dried Blood Card (cat. no. 9018698)	EZ1 DNA Tissue Kit	Dried blood
EZ1 Advanced DNA Buffy Coat Card (cat. no. 9018294) or EZ1 Advanced XL DNA Buffy Coat Card (cat. no. 9018697)	EZ1 DNA Blood 350 µl Kit	Buffy coat
EZ1 Advanced DNA Tissue Card (cat. no. 9018295) or EZ1 Advanced XL DNA Tissue Card (cat. no. 9018701)	EZ1 DNA Tissue Kit	Tissues
EZ1 Advanced DNA Paraffin Section Card (cat. no. 9018298) or EZ1 Advanced XL DNA Paraffin Section Card (cat. no. 9018700)	EZ1 DNA Tissue Kit	Paraffin-embedded tissues
EZ1 Advanced DNA Buccal Swab Card (cat. no. 9018296) or EZ1 Advanced XL DNA Buccal Swab Card (cat. no. 9018696)	EZ1 DNA Tissue Kit	Buccal swabs
EZ1 Advanced DNA Investigator Card (cat. no. 9018302) or EZ1 Advanced XL DNA Investigator Card (cat. no. 9018699)	EZ1 DNA Investigator Kit	Forensic and human identity samples
EZ1 Advanced DNA Bacteria Card (cat. no. 9018301) or EZ1 Advanced XL DNA Bacteria Card (cat. no. 9018694)	EZ1 DNA Tissue Kit	Human samples, swabs, biopsies, bacterial cultures
EZ1 Advanced Virus Card v2.0 (cat. no. 9018303) or EZ1 Advanced XL Virus Card v2.0 (cat. no. 9018708)	EZ1 Virus Mini Kit v2.0	Viral DNA and RNA from serum, plasma, CSF, urine, and respiratory samples
EZ1 Advanced RNA Card (cat. no. 9018297) or EZ1 Advanced XL RNA Card (cat. no. 9018705)	EZ1 RNA Cell Mini Kit EZ1 RNA Tissue Mini Kit EZ1 RNA Universal Tissue Kit	Cultured cells or white blood cells Standard tissue samples Any type of human or animal tissue
EZ1 Advanced DSP DNA Blood Card (cat. no. 9018305) or EZ1 Advanced XL DSP DNA Blood Card (cat. no. 9018702)*	EZ1 DSP DNA Blood Kit*	Human whole blood
EZ1 Advanced DSP Virus Card (cat. no. 9018306) or EZ1 Advanced XL DSP Virus Card (cat. no. 9018703)*	EZ1 DSP Virus Kit*	Human plasma, serum, or CSF

* EZ1 Advanced DSP Cards and EZ1 DSP Kits are intended for in vitro diagnostic use in Europe and the United States.

EZ1 DNA Blood and Tissue Kits

By eliminating most sources of variation during processing, the EZ1 Advanced and EZ1 Advanced XL, in combination with EZ1 Kits, provide highly reproducible data from run to run (Figures 1 and 2). The high quality of the purified nucleic acids allows sensitive downstream applications, such as quantitative RT-PCR or amplification of single-copy genes (Figure 3).

The EZ1 DNA Blood Kit enables purification of genomic DNA from whole blood and buffy coat samples. The EZ1 DNA Tissue Kit enables purification of genomic DNA from up to 40 mg tissue samples and bacterial DNA from primary samples. The high-quality DNA obtained using EZ1 DNA Blood or Tissue Kits and Cards with the EZ1 Advanced or EZ1 Advanced XL is suited for use in many applications, such as genotyping analysis, including SNP, STR, VNTR, RAPD, and AFLP technologies.

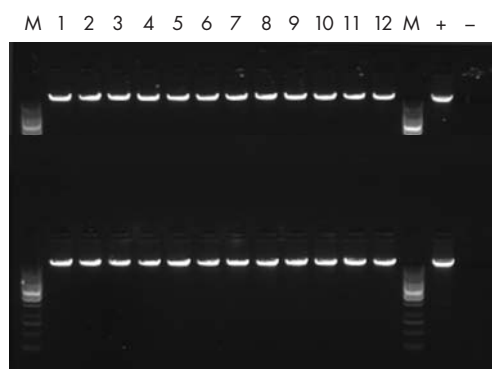


Figure 1. Reproducible high-quality DNA. Genomic DNA purified from whole blood. Upper lanes are from 200 µl blood, lower lanes are from 350 µl blood. Lanes 1–6 and 7–12 are from the first and last of 8 processing runs on the EZ1 Advanced workstation, respectively. **M**: 1000 bp DNA ladder (100 ng); **+**: positive control; **-**: negative control. A 2 µl aliquot (1%) of each eluate was visualized on the agarose gel.

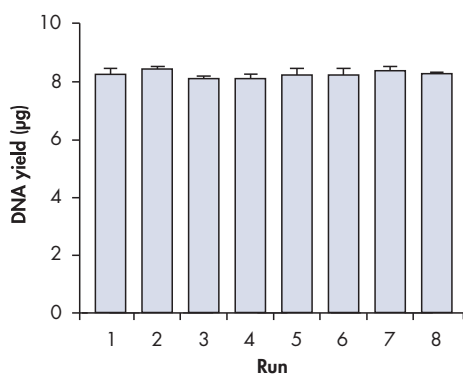


Figure 2. Reproducible yields of high-quality DNA (350 µl blood samples). Genomic DNA was purified from 48 x 350 µl samples (white-cell count $4.9 \times 10^6/\text{ml}$) of human whole blood using the EZ1 DNA Blood 350 µl Kit. Average yields from each run of six samples are shown. DNA yield was quantified by absorbance (A_{260}) using background correction. Purified DNA was eluted in 200 µl RNase-free water. Average DNA yield was 8.20 µg (S.D. = 0.23). Average DNA purity (A_{260}/A_{280}) was 1.85 (S.D. = 0.01).

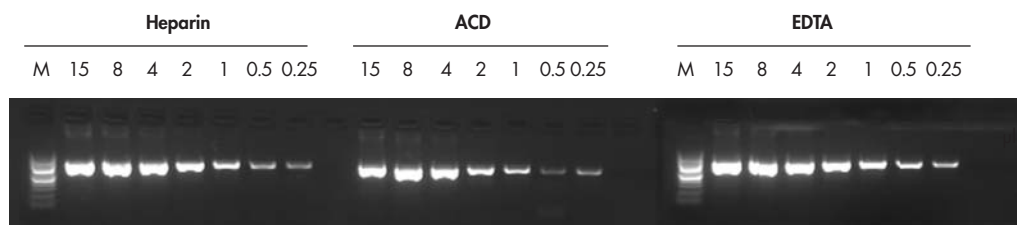


Figure 3. High-quality DNA for sensitive and specific analyses. PCR of the single copy MECL-1 gene using DNA purified from whole blood. Genomic DNA was purified from samples of ACD-, EDTA-, and heparin-preserved human whole blood using the EZ1 DNA Blood 200 µl Kit. Template DNA was serially diluted. An aliquot of purified DNA (volume as indicated) was used in each 50 µl PCR.

EZ1 DNA Investigator Kit

The EZ1 DNA Investigator Kit reproducibly purifies genomic DNA from a wide variety of samples encountered in forensic, human identity, and biosecurity applications (Figure 4). Automated processing of swabs, blood disks, cigarette butts, and other solid samples includes optimized protocols and normalization for uniform yields (Figures 5–7). Large-volume protocols are available for processing textiles, bone samples, or dilute samples.

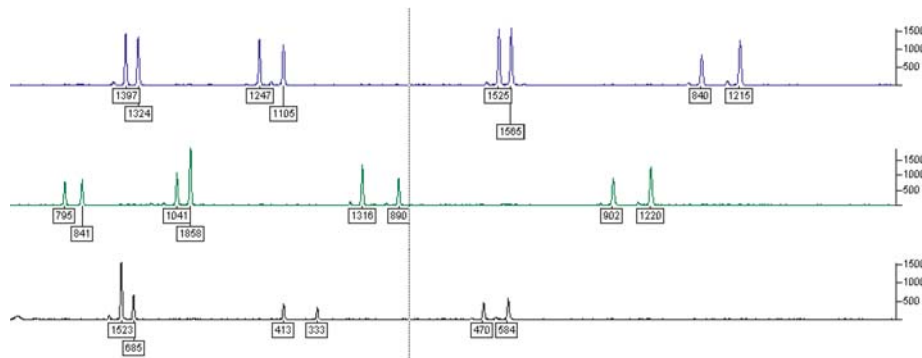


Figure 4. Improved performance in STR analysis. AmpF/STR® control DNA (1 ng) was diluted in 200 µl Buffer G2 and purified using the EZ1 DNA Investigator Kit and the trace protocol on the EZ1 Advanced. DNA was eluted in 50 µl water, and 10 µl (corresponding to 200 pg DNA) was used for STR analysis. PCR products were analyzed on an ABI PRISM® 310 Genetic Analyzer with Genotyper® software (data kindly provided by B. Bayer and K. Anslinger, Institute of Legal Medicine, Ludwig Maximilian University, Munich, Germany).

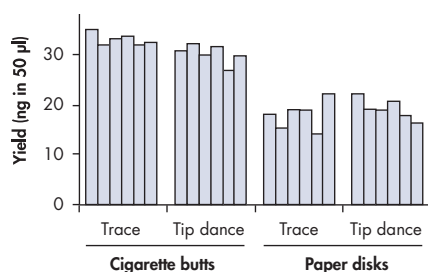


Figure 5. Easy and efficient processing of solid materials with the "tip dance" protocol. Papers from cigarette butts or 3 paper disks per sample were spotted with 50 ng DNA per sample. After proteinase K digestion, the samples were incubated at 95°C for 5 minutes. Solid materials were removed from half of the samples, which were then processed using the EZ1 DNA Investigator Kit with the standard trace protocol (**Trace**). The remaining half of the samples was processed using the EZ1 DNA Investigator Kit with the "tip dance" protocol, without removing solid materials from the sample tubes (**Tip dance**). DNA yields were quantified by real-time, quantitative PCR.

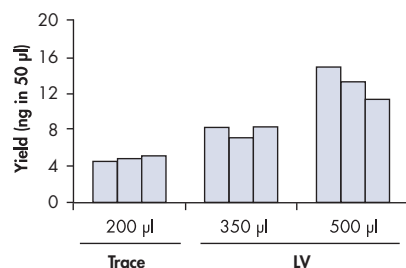


Figure 6. Higher yields of concentrated DNA with the large-volume protocol. DNA was diluted in Buffer G2 to a final concentration of 50 pg/µl, and the indicated volumes were processed using the EZ1 DNA Investigator Kit with the standard trace protocol (**Trace**) or the large-volume protocol (**LV**). All samples were eluted in 50 µl water, and 5 µl was quantified using real-time, quantitative PCR.

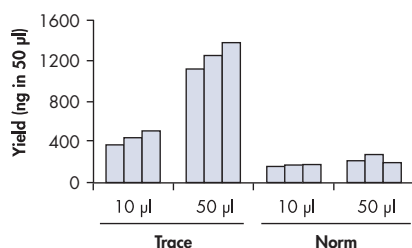


Figure 7. Uniform yields with the normalization protocol. DNA was purified from the indicated volumes of whole blood using the EZ1 DNA Investigator Kit with the standard trace protocol (**Trace**) or the normalization protocol (**Norm**). All samples were eluted in 50 µl water. DNA yields were quantified by real-time, quantitative PCR. DNA yields were uniformly limited to 150–250 ng using the normalization protocol.

EZ1 Virus Mini Kit v2.0

The EZ1 Virus Mini Kit allows simultaneous purification of viral DNA and RNA from serum, plasma, CSF, urine, respiratory samples, and other cell-free body fluids from up to 400 µl sample volume. Purified nucleic acids can be eluted in as little as 60 µl elution buffer. Efficient purification of viral RNA and DNA results in sensitive analytical detection on a variety of real-time thermal cyclers (data not shown; visit www.qiagen.com/goto/EZ1Virus for more information). The kit provides optimized binding conditions for robust and reproducible capture of nucleic acids and improved wash conditions for high analytical sensitivity in downstream assays (Figures 8 and 9). Efficient yields, even with low viral titers, ensure sensitive analytical detection.

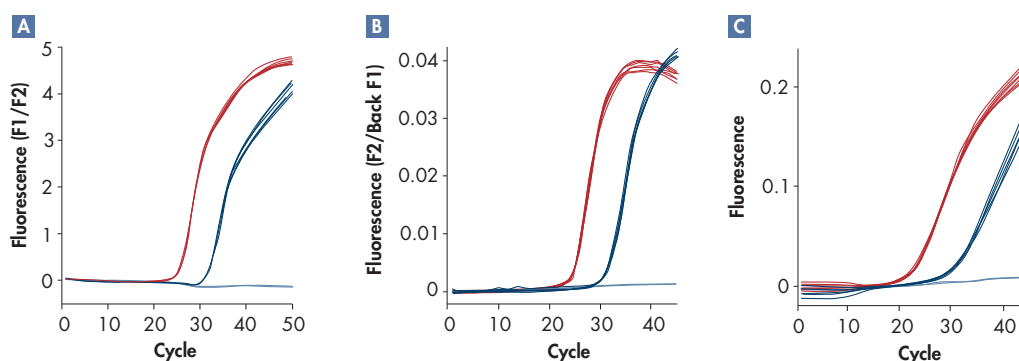


Figure 8. Highly reproducible purification of viral nucleic acids. Viral DNA and RNA was purified from human plasma spiked with 2 dilutions of each virus, in replicates of 12, and from 2 additional negative controls using the EZ1 Virus Mini Kit v2.0, with elution in 90 µl. **A** HAV RNA was detected using an HAV RT-PCR Research Kit. CVs of crossing-point values were 0.54% and 0.24% for calculated titers of 3.9×10^5 IU/ml and 4.2×10^3 IU/ml, respectively. **B** HBV DNA was detected using an HBV PCR Research Kit. CVs of crossing-point values were 0.38% and 0.95% for calculated titers of 1.0×10^5 IU/ml and 9.7×10^2 IU/ml, respectively. **C** HIV-1 RNA was detected using an HIV-1 RT-PCR Research Kit. CVs of C_T values were 1.26% and 0.97% for calculated titers of 2.4×10^6 IU/ml and 3.5×10^4 IU/ml, respectively. The baseline is shown in each amplification plot.

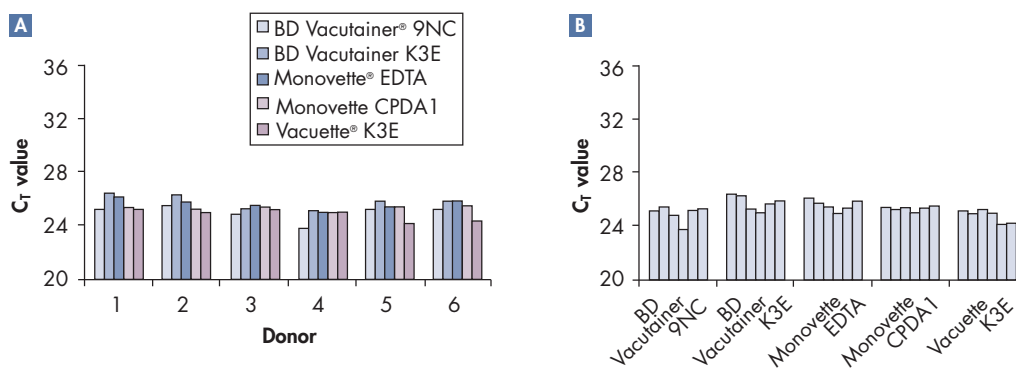


Figure 9. System robustness using different tubes. Blood was collected from 6 different donors into the indicated collection tubes. Plasma was prepared and spiked with an HBV standard (Teragenix) at 1×10^4 IU/ml. Viral DNA was purified using the EZ1 Virus Mini Kit v2.0, and eluates were analyzed using custom-designed primers and probe with the QuantiTect® Probe PCR Kit. **A** Tube-to-tube variability for each donor. **B** Donor-to-donor variability for each tube type.

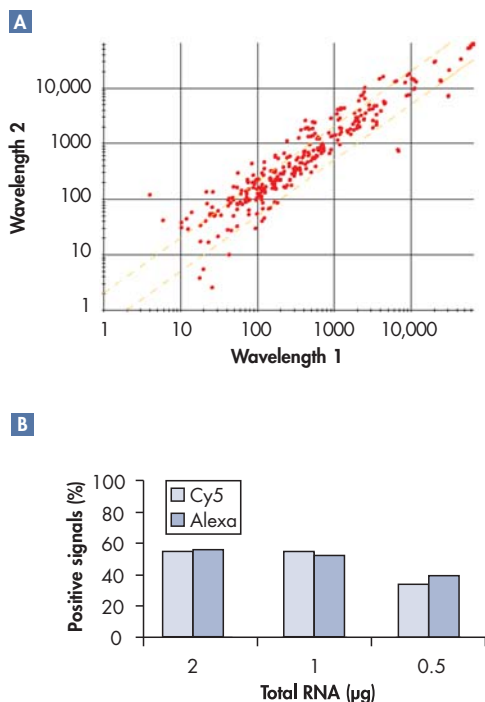


Figure 10. Efficient labeling of target for microarray analysis. Total RNA was purified from HeLa cells using the EZ1 Advanced. cDNA was synthesized from total RNA and simultaneously labeled with both Alexa Fluor® 532 and Cy®5 fluorophores using the QIAGEN LabelStar® Array Kit. Labeled cDNA was hybridized to a SensiChip™ DNA Array Bar containing stress- and aging-specific capture probes. **A** Plot showing that intensities of signal correlate well following hybridization with 1 µg cDNA, independent of the fluorophore type. **B** Comparison of numbers of positive (signal:noise ratio >3) signals detected (5-second exposure) following hybridization with the indicated amounts of total RNA.

EZ1 RNA Cell and Tissue Kits

The high purity and integrity of RNA purified using EZ1 Advanced solutions ensures high performance in gene expression analysis. The high-quality RNA allows sensitive and precise downstream analysis using methods such as microarray analysis (Figure 10) and real-time RT-PCR (Figure 11). Up to 1×10^6 cultured cells, 2×10^6 blood cells, or 10 mg easy-to-lyse tissue can be processed per sample.

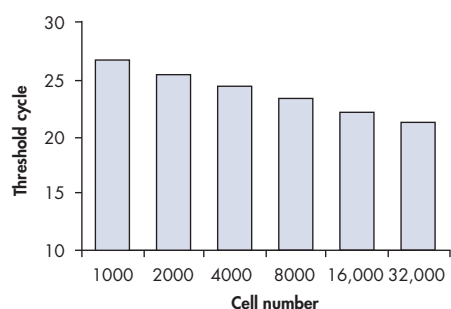


Figure 11. Consistent accuracy provides high resolution. Dilution series were performed on lysates of 3.2×10^4 HeLa cells to produce aliquots equivalent to 1000–32,000 cells. RNA was purified from lysates using the EZ1 Advanced. Purified RNA was eluted in 200 µl and 5 µl aliquots were used in 25 µl real-time RT-PCR of human p53 mRNA using the QuantiTect Probe RT-PCR Kit. Three reactions were performed using each dilution. Plot of C_T values and cell number equivalents shows high linearity over a wide range of starting template amounts.

Ordering Information

Product	Contents	Cat. no.
EZ1 Advanced	Robotic workstation for automated purification of nucleic acids from up to 6 samples using EZ1 Kits, 1-year warranty on parts and labor*	9001410
EZ1 Advanced XL	Robotic workstation for automated purification of nucleic acids from up to 14 samples using EZ1 Kits, 1-year warranty on parts and labor*	9001492
IQ/OQ Services		
IQ/OQ Services	Validation support service for the EZ1 Advanced and EZ1 Advanced XL. Validation support provides IQ/OQ documentation and performance of the qualification protocols with costs for labor and travel covered.	9240826
EZ1 Kits		
EZ1 DNA Investigator Kit (48)	For 48 preps: Reagent Cartridges, Plasticware, Buffers and Reagents, Carrier RNA	952034
EZ1 Virus Mini Kit v2.0 (48)	For 48 preps: Reagent Cartridges, Plasticware, Carrier RNA, Buffer AVE	955134
EZ1 DNA Blood 200 µl Kit (48)	For 48 preps: Reagent Cartridges, Plasticware	951034
EZ1 DNA Blood 350 µl Kit (48)	For 48 preps: Reagent Cartridges, Plasticware	951054
EZ1 DNA Tissue Kit (48)	For 48 preps: Reagent Cartridges, Plasticware, Buffer G2, Proteinase K	953034
EZ1 RNA Cell Mini Kit (48)	For 48 preps: Reagent Cartridges, Plasticware, Buffer RLT, RNase-Free DNase I	958034
EZ1 RNA Tissue Mini Kit (48)	For 48 preps: Reagent Cartridges, Plasticware, Buffer RLT, RNase-Free DNase I	959034
EZ1 RNA Universal Tissue Kit (48)	For 48 preps: Reagent Cartridges, Plasticware, QIAzol Lysis Reagent, Buffer RLT	956034
EZ1 DSP DNA Blood Kit (48) [†]	For 48 preps: Reagent Cartridges, Plasticware	62124
EZ1 DSP Virus Kit (48) [†]	For 48 preps: Reagent Cartridges, Plasticware, Buffers, Carrier RNA	62724

* Warranty PLUS 2 (cat. no. 9237720) recommended: 3-year warranty, 1 preventive maintenance visit per year, 48-hour priority response, all labor, travel, and repair parts. [†] Not available in all countries; please inquire.

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Visit www.qiagen.com/goto/EZ1Advancedsolutions to discover just how easy, safe, and reliable walkaway automation can be!

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