DNA-TECHNOLOGY

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For research use only

HIV Quantitative REAL-TIME PCR Kit

(*PREP-NA* DNA/RNA Extraction Kit included)

USER MANUAL

"DNA-Technology, Research & Production" LLC

Russia, 142281, Moscow Region,

Protvino, 20 Zheleznodorozhnaya Street,

Phone/fax: +7(495) 640.17.71

+7(4967)31.06.70,

E-mail: protvino@dna-technology.ru, mail@dna-technology.ru

Customer service department: +7 (495)640.16.93,

E-mail: hotline@dna-technology.ru,

http://www.dna-technology.ru

REF

Q4-P609-23/9EU

Q4-P609-S3/9EU

VER

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1. INTENDED USE

The **HIV Quantitative REAL-TIME PCR Kit** is intended for research and diagnostic applications as well as for evaluation of the therapy efficacy. The **HIV Quantitative REAL-TIME PCR Kit** is an *in vitro* Nucleic Acid Test (NAT) – based pathogen detection and quantification product. The **HIV Quantitative REAL-TIME PCR Kit** is designed to detect and quantitate Human immunodeficiency virus (HIV) type 1 nucleic acids in human blood plasma samples with an aid of Quantitative Real-Time Polymerase Chain Reaction (qPCR) method.

The **HIV Quantitative REAL-TIME PCR Kit** can be used in clinical practice for HIV diagnostics and viral load evaluation.

2. METHOD

Reverse transcription followed by quantitative PCR.

The detection is performed with an aid of real-time PCR technology.

All variants of the **HIV Quantitative REAL-TIME PCR Kits** are based on fluorescent modification of the PCR method. The PCR-mix contains target-specific probes bearing reporter and quencher molecules. Once hybridized to a target sequence, the probes become activated. As a result of activation fluorescence increases proportionally to target sequence amplification. The intensity of fluorescence is measured at every cycle of reaction with a Real-time PCR thermal cycler data collection unit and analyzed with the software provided.

Depending on the variant the **HIV Quantitative REAL-TIME PCR Kit** includes PCR-mixes specific for HIV and adapted for different appliances (see the catalogue at www.dna-technology.ru/en to see available supply options).

The **HIV Quantitative REAL-TIME PCR Kit** includes Internal Control (RNA-IC), which is stabilized RNA molecule. It is used for quality assessment of the entire assay.

The specific and control probes are labeled with FAM and HEX dyes correspondingly.

The **HIV Quantitative REAL-TIME PCR Kit** assay includes RNA extraction (sample preparation), reverse transcription (the generation of cDNA) and cDNA PCR amplification steps. The quantitation of the target RNA is performed with an aid of Standards (ST) with known concentration of artificially synthesized target RNA. The Kit supplied with STs of the two concentrations $1.0x10^6$ copies/mL (ST1) and $3.0x10^3$ copies/mL (ST2). The STs are used to build the standard curve, which is necessary to quantitate the DNA in the sample.

The automatic analysis for **HIV Quantitative REAL-TIME PCR Kits** is available on "DNA-Technology" made DTlite and DTprime REAL-TIME Thermal Cyclers (see the catalogue at www.dna-technology.ru/en to see the available supply options).

The **HIV Quantitative REAL-TIME PCR Kits** REF Q4-P609-23/9EU, Q4-P609-S3/9EU and Q4-P609-24/9EU are also approved for use with iQ (Bio-Rad Laboratories) real-time thermal cyclers and Rotor-Gene (Qiagen) thermal cyclers. The Kit can be supplied in either separate (1x96) or stripped (8x12) tubes.

(REF Q4-P609-23/9EU, Q4-P609-24/9EU and Q4-P609-S3/9EU respectively).

3. CONTENT

Table 1. *PREP-NA* DNA/RNA Extraction Kit

Reagent	Description	Total volume	Amount
Lysis buffer	Light blue slightly foaming liquid	30 mL	1 vial
Precipitation buffer	Colorless liquid	40 mL	1 vial
Washout solution 1	Colorless liquid	50 mL	1 vial
Washout solution 2	Colorless liquid	30 mL	1 vial
Dilution buffer	Colorless liquid	5.0 mL (1.25 mL in each tube)	4 tubes
Negative control	Colorless liquid	3.0 mL (1.5 mL in each tube)	2 tubes
Internal control (RNA-IC)	Colorless liquid	1.0 mL	1 tube

Table 2. Standards

Reagent	Description	Total volume	Amount
ST1 ($1.0x10^6$ copies/mL)	Colorless liquid	1.5 mL (0.3 mL in each tube)	5 tubes
ST2 ($3.0x10^3$ copies/mL)	Colorless liquid	1.5 mL (0.3 mL in each tube)	5 tubes

Table 3. HIV Quantitative Real-Time PCR Kit

Reagent	Description	Total volume	Amount
Paraffin sealed PCR-mix	Composition of colorless liquid and white waxy fractions	1.92 mL (20 µL per tube)	96 separate (1x96) or stripped (8x12) tubes
TECHNO Taq-polymerase	Colorless viscous liquid	50 µL	1 tube
PCR-buffer	Colorless liquid	1.0 mL (0.5 mL in each tube)	2 tubes
Positive control (“C+”)	Colorless liquid	150 µL	1 tube
Mineral oil (not supplied in Kit for Rotor-Gene)	Colorless viscous liquid	2.0 mL (1.0 mL in each tube)	2 tubes

Table 4. Reverse Transcription Kit

Reagent	Description	Total volume	Amount
RT-buffer	Colorless liquid	200 µL	1 tube
RT-HAV+HCV+HDV+HGV+HIV primers and dNTPs	Colorless liquid	100 µL	1 tube
Reverse transcriptase	Colorless viscous liquid	50 µL	1 tube

The approximate total time needed to perform the assay is 5 hours.

The *PREP-NA* DNA/RNA Extraction Kit is sufficient for extraction of 100 samples.

The **HIV Quantitative Real-Time PCR Kit** sufficient to test 44 (36 for Rotor-Gene) samples in duplicates.

4. REAGENTS AND EQUIPMENT REQUIRED BUT NOT PROVIDED

4.1 **Specimen collection**

The whole blood samples shoud be collected in 2.0 or 4.0 mL Vacuette type tubes with EDTA in 2.0 mg/mL final concentration. The sodium citrate anticoagulant is also applicable.

 The use of heparin anticoagulant is not allowed.

4.2 **RNA extraction and PCR**

Biological (microbiological) safety cabinet class II;

UV PCR cabinet;

Vortex mixer;

Aspirator with trap flask to remove supernatants;

1.5 mL tubes;

PCR tube rack for 0.2 and 1.5 mL tubes;

Vacuum blood collection tubes (Vacuette for example), containing ethylenediaminetetraacetic acid disodium salt (EDTA) or sodium citrate anticoagulant;

Single channel pipettes (volume range 2.0-20 µL, 20-200 µL, 200-1000 µL);

RNase and DNase free filtered pipette tips (volume range 20 µL, 200 µL, 1000 µL);

Powder-free surgical gloves;

Disinfectant solution;

Container for used pipette tips;

High speed centrifuge (RCF 16 000 x g);

Thermostat (temperature range from 40 °C to 95°C);

Refrigerator;

Real-time PCR thermal cycler.

5. WARNINGS AND PRECAUTIONS

The laboratory makeup should comply the requirements regulating work with microorganisms of I-IV classes of pathogenicity.

Handle and dispose all biological samples, reagents and materials used to carry out the assay as if they were able to transmit infective agents. Avoid direct contact with the biological samples reagents and materials used to carry out the assay. Any material coming in contact with the biological samples must be treated for at least 30 minutes with disinfecting solution or autoclaved for 1 hour at 121ºC before disposal.

Molecular biology procedures, such as nucleic acids extraction, reverse transcription, amplification and detection require qualified staff to avoid the risk of erroneous results, especially due to the degradation of nucleic acids contained in the samples or sample contamination by amplification products.

All oligonucleotide components are produced by artificial synthesis technology according to internal quality control protocol and do not contain blood or products of blood processing.

Positive control is produced by artificial DNA synthesis technology. Positive control does not include parts of infectious agents.

All the liquid solutions are designed for single use and can not be used more than once in amplification reactions. Plastic tubes do not contain phthalates. Do not breathe gas/fumes/vapour/spray produced by the components of the kit. Do not eat/drink components of the kit. Avoid contact with eyes. Do not use the kit after the expiry date provided. Only use the reagents provided in the kit and those recommended by manufacturer. Do not mix reagents from different batches. Do not use reagents from third party manufacturers' kits.

Significant health effects are **NOT** anticipated from routine use of this kit when adhering to the instructions listed in the current manual.

6. RNA EXTRACTION PROTOCOL

The **HIV Quantitative Real-Time PCR Kit** is designed to detect RNA extracted from blood plasma. Shake the tube containing blood sample thoroughly to mix the blood and anticoagulant.

 Using of heparin as anticoagulant is not allowed.

 The overall storage of the sample should not exceed 6 hours.

The transportation and storage temperature from collecting the sample till analysis should be in between 2 °C and 8 °C range.

 Whole blood cannot be frozen.

6.1 To obtain the plasma spin the tubes with blood at 800-1600 x g (corresponds to 3000 rpm on Eppendorf Centrifuge 5424) for 20 min at room temperature (between 18 °C and 25 °C).

 Relative centrifugal force (RCF or g) depends on rotation frequency and centrifugation radius (Annex A). To establish if your centrifuge meets the requirements apply to the exploitation manual for centrifuge.

6.2 Take the upper fraction (plasma) with an automatic sampler and put it into the new 1.5 mL tube. The blood plasma can be stored at temperature from minus 18 °C to minus 22 °C for no longer than 3 months.


The lysis buffer can contain the precipitate. Dissolve it at 65 °C for 10 min prior to use.


At this step of assay use only disposable pipette tips witch have filter and are RNase and DNase free.


To rise the reliability of the results it is advised to perform the extraction in duplicates.

6.3 Mark the required number of 1.5 mL tubes by the following scheme:

- 2 tubes for each sample to be tested
- 1 tube for the negative control (C-)
- 3 tubes for “ST1”
- 3 tubes for “ST2”

For example if you need to test 10 samples, mark 27 tubes (20 for the samples, 1 for “C-“, 3 for “ST1” and 3 for “ST2”).

6.4 Add 10 µL of the premixed RNA-IC in each tube (except “ST1”, “ST2”).

6.5 Add 300 µL of the lysis buffer avoiding contact of the pipette tip with an edge of the tube. Close the tubes.


Open the tube, add sample, then close the tube before proceeding to the next sample to prevent contamination.

6.6 Add 100 µL of the blood plasma sample into the marked tubes. Do not add samples to the “C-“, “ST1” and “ST2” tubes.

6.7 Add 100 µL of the “C-“, “ST1” and “ST2” into corresponding tubes.

6.8 Vortex the tubes maximally intensively for 3–5 sec twice, spin down drops for 3–5 sec.

6.9 Incubate the tubes for 15 min at 65 °C, spin down the drops at at 16000 x g (corresponds to 13000 rpm on Eppendorf Centrifuge 5424) for 30 sec at room temperature.

6.10 Add 400 µL of the precipitation buffer into each tube. Vortex the tubes maximally intensively for 3–5 sec twice.

6.11 Spin the tubes at at 16000 x g (corresponds to 13000 rpm on Eppendorf Centrifuge 5424) for 15 min at room temperature.

6.12 Remove the supernatant avoiding contact of the pipette tip with the precipitate. Use new tip for each sample.

6.13 Add 500 µL of the washout solution №1 to the precipitate. Vortex the tubes for 3–5 sec. Invert the tube up and down washing of the cap of the tube. It is necessary to carry out this procedure with each tube individually.

6.14 Spin the tubes at 16000 x g (corresponds to 13000 rpm on Eppendorf Centrifuge 5424) for 5 min at room temperature.

6.15 Remove the supernatant avoiding contact of the pipette tip with the precipitate. Use new tip for each sample.

6.16 Add 300 µL of the washout solution №2 to the precipitate. Vortex the tubes for 3–5 sec. Gently invert the tube up and down washing of the walls and the cap of the tube. It is necessary to carry out this procedure with each tube individually.

6.17 Spin the tubes at 16000 x g (corresponds to 13000 rpm on Eppendorf Centrifuge 5424) for 5 min at room temperature.

6.18 Remove the supernatant avoiding contact of the pipette tip with the precipitate. Use new tip for each sample.

6.19 Open the tubes and dry the precipitate at 65 °C for 5 min strictly.

6.20 Add 16.5 µL of the dilution buffer to the precipitate. Spin down the drops for 3–5 sec.

6.21 Incubate the tubes for 10 min at 65 °C.

6.22 Spin down the drops at 16000 x g (corresponds to 13000 rpm on Eppendorf Centrifuge 5424) for 30 sec.

The RNA preparation is ready. RNA should be used for reverse transcription reaction within 30 min RNA sample shouldn't be stored.

7. REVERSE TRANCRIPTION PROTOCOL

7.1 Thaw "RT–buffer" and "RT-HAV+HCV+HDV+HGV+HIV primers and dNTPs" contents from reverse transcription reagent set at temperatures between 18 °C and 25 °C, then vortex thoroughly and spin down drops for 3–5 sec.

The RT buffer can contain the precipitate. Keep it at room temperature with intermittent vortexing until precipitate fully dissolved.

7.2 Prepare RT-mix by mixing together "RT–buffer", "RT-HAV+HCV+HDV+HGV+HIV primers and dNTPs" and reverse transcriptase in separate plastic tube:

- 2.0 x (N+1) µL of the "RT–buffer";
- 1.0 x (N+1) µL of the "RT-HAV+HCV+HDV+HGV+HIV primers and dNTPs";
- 0.5 x (N+1) µL of the reverse transcriptase,

N – is the number of the marked tubes considering "C-", "ST1" and "ST2".

Reverse transcriptase should be kept out of freezer chamber for as short time as possible.

7.3 Vortex RT-mix and spin down drops for 3-5 sec at room temperature.

7.4 Add 3.5 µL RT-mix to tubes with isolated NA samples and "C–", "ST1" and "ST2" tubes, close tube lids. Vortex the tube and spin down the drops.

7.5 Place tubes in thermostat and incubate them at 40 °C for 30 min, then at 95 °C for 5 min.

7.6 Spin down condensate by centrifuging at 16000 x g (corresponds to 13000 rpm on Eppendorf Centrifuge 5424) for 30 sec.

The cDNA preparation is ready for PCR.

The storage of the cDNA preparation is allowed at temperature from minus 18 °C to minus 22 °C for no longer than 1 month.

8. PCR PROTOCOL

 When using package S, strips, strictly observe the completeness of the strips and caps. Do not use the caps for the strips of the other kits!

8.1 Mark tubes with PCR-mix for each test sample, negative control (C-), positive control (C+) and three tubes for each of the Standards (ST1 and ST2).

For example if you need to test 10 samples, mark 28 tubes (20 for each sample in duplicate, 1 for “C-“, 1 for “C+”, 3 for “ST1” and 3 for “ST2”).

 Mark only the caps of the tubes when using Rotor-Gene Thermal Cycler.

8.2 Thaw PCR-buffer at the room temperature.

8.3 Mix the PCR-buffer and TECHNO Taq-polymerase thoroughly (3-5 sec), then spin briefly (1-3 sec) at room temperature.

 Hold Taq-polymerase at room temperature as short time as possible. The overheating is detrimental to its performance.

8.4 Prepare the mixture of PCR-buffer and Taq-polymerase (TECHNO Taq-polymerase solution). Add into the one tube:

- 10 x (N+1) µL of PCR-buffer;
- 0.5 × (N+1) µL of TECHNO Taq-polymerase,

N — number of the marked tubes including “C-“, “C+”, “ST1” and “ST2”

8.5 Vortex the tube with TECHNO Taq-polymerase solution for 3-5 sec and spin down the drops for 1-3 seconds at room temperature.

 The maximum storage time for prepared mixture at the temperature between 2 °C and 8 °C for no longer than 1 hour.

8.6 Add 10 µL of TECHNO Taq-polymerase solution into each tube. Avoid paraffin layer break.

8.7 Add 20 µL of mineral oil into each tube. Avoid paraffin layer break (skip this step when using Q4-P609-24/9EU). Close the tubes.

8.8 Vortex the tubes with samples, “ST1”, “ST2”, “C-“, “C+” for 3-5 sec and spin down the drops for 1-3 sec.

8.9 Add 5.0 µL of cDNA sample into corresponding tube (two for each sample). Avoid paraffin layer break.

 Open the tube, add cDNA/DNA sample, then close the tube before proceeding to the next cDNA/DNA sample to prevent contamination. Use filter tips.

8.10 Add 5.0 µL of “C-“, “C+”, “ST1” and “ST2” into corresponding tubes. Avoid paraffin layer break.

8.11 Spin tubes briefly (1-3 sec) at room temperature (not applicable to kits approved for use with Rotor-Gene thermal cycler).

8.12 Set the tubes to Real-Time PCR Termal Cycler.

8.13 Launch the Thermal Cycler software and run PCR according to instructions supplied with device. See table 5 - 8 to refer the cycling program and table 9 to refer the detection channels.

Table 5. The PCR program for DTlite and DTprime Thermal Cyclers

Step	Temperature, °C	Min.	Sec.	Number of cycles	Optical measurement	Type of the step
1	94.0	5	00	1		Cycle
2	94.0	0	10	50		Cycle
	58.0	0	25		v	
	64.0	0	15			
3	10.0[1]	…	…	Holding		Holding
[1] – holding at 25°C is allowed						

Table 6. The PCR program for iCycler iQ (Bio-Rad Laboratories)

Cycle	Repeats	Step	Dwell time	Setpoint, °C	PCR/Melt Data Acquisition
1	1				
		1	00:30	80.0	
		2	05:00	94.0	
2	10				
		1	00:20	94.0	
		2	00:20	58.0	
		3	00:10	64.0	
3	1				
		1	00:20	85.0	Real Time
4	40				
		1	00:10	94.0	
		2	00:10	58.0	
		3	00:30	58.0	Real Time
		4	00:20	64.0	
5		…	…	10.0	storage

Table 7. The PCR program for iCycler iQ5 thermal cyclers (with persistent well factor)

Cycle	Repeats	Step	Dwell time	Setpoint, °C	PCR/Melt Data Acquisition
1	1				
		1	05:00	94.0	
2	50				
		1	00:10	94.0	
		2	00:25	58.0	Real Time
		3	00:15	64.0	
3	1				
		1	01:00	10.0	

Table 8. The PCR program for Rotor-Gene Thermal Cyclers

Cycling	Temperature	Hold Time	Cycle Repeats
Cycling	80 °C	300 sec	1 time
Cycling 2	94 °C	10 sec	
	54 °C	5 sec	50 times
	58 °C[1]	25 sec	
	64 °C	20 sec	

Table 9. Detection channels

	Specific product	IC
DTprime, DTlite and IQ5	FAM	HEX
Rotor-Gene	Green	Yellow

9. CONTROLS

Table 10.

Control	The controlled step	Result		Interpretation
		Specific signal is present	Specific signal is absent	
C+	PCR	+	+	Valid
		-	-	Invalid
C-	PCR, RT and RNA extraction	+	+	Invalid
		-	-	Valid
RNA-IC	PCR, RT and RNA extraction	+	+	Valid
		-		Valid
			-	Invalid

The sample is considered positive if the signal for specific DNA is present. The signal for IC could be absent in samples with high concentration of specific DNA due to competitive priming.

The sample is considered negative if the signal for specific DNA is absent and for IC is present.

If the signal for C- is present, whole tests of current batch considered false. Decontamination required.

[1] - take the measurement

10. DATA ANALYSIS

The analysis performed automatically. After completion of the run the device will build standard curve, define the concentration of viral RNA and form the report. The efficiency should be in 90-100% range (0.91 – 1.01 for Rotor-Gene).

The interpretation should be performed in accordance with table 11.

Table 11.

Detection channel		**Interpretation**
Fam/Green copies/mL	**Hex/Yellow** Cp (Ct)[2]	
Test samples		
$5.0x10^2$ – $1.0x10^8$	Not considered	Positive with specified viral load (copies/mL)
Less than **$5.0x10^2$**	Not considered	Positive with notification «**Less than 500 copies/mL**» (no specified value)
More than **$1.0x10^8$**	Not considered	Positive with notification «**More than $1.0x10^8$ copies/mL**» (no specified value)
Not specified (for iQ N/A)	Cp 29-34 (for iQ5 Ct 29-34, for Rotor-Gene Ct≤36)	Negative
Not specified (for iQ N/A)	Not specified (for iQ N/A, for Rotor-Gene N/A or Ct>36)	Uncertain
C+		
$2.0\times10^5 – 9.0\times10^5$*	Not considered	Positive with specified viral load (copies/mL)
C-		
Not specified (for iQ N/A)	Cp 29-34 (for iQ5 Ct 29-34, for Rotor-Gene Ct<36)	Negative

[2] - if the Cp (Ct) value for HEX channel exceeds the indicated range the result should be considered uncertain.

* - If the concentration of the C+ falls out the $2.0\times10^5–9.0\times10^5$ range the test should be repeated.

11. STORAGE, TRANSPORTATION AND HANDLING REQUIREMENTS

Shelf life - 9 months if all the conditions of transportation, storage and operation are met.

All components of the **HIV Quantitative Real-Time PCR Kit** except Paraffin sealed PCR-mix, “ST1”, “ST2” and “C+” must be stored at temperature from minus 18 °C to minus 22 °C over the storage period. The PCR-buffer and mineral oil can be stored at temperatures between 2 °C and 8 °C.

The Paraffin sealed PCR-mix, “ST1”, “ST2”, “C+” and *PREP-NA* DNA/RNA Extraction Kit must be stored at temperatures between 2 °C and 8 °C over the storage period.

Transportation can be held by all types of roofed transport with adherence to above mentioned temperature requirements.

An expired **HIV Quantitative Real-Time PCR Kit** must not be used.

We strongly recommend following the instructions to get robust and reliable results.

The conformity of the **HIV Quantitative Real-Time PCR Kit** to the prescribed technical requirements is subject to compliance of storage, carriage and handling conditions recommended by manufacturer.

Contact our customer service by quality issues of the **HIV Quantitative Real-Time PCR Kit**:
“DNA-Technology” LLC, 117587, Russia, Moscow, int. ter. Municipal District Chertanovo Severnoye, Varshavskoye shosse, 125 Zh, building 5, floor 1, office 12

Phone: +7 (495)640.16.93,

Phone/Fax: +7 (495)640.17.71

E-mail: hotline@dna-technology.ru, www.dna-technology.ru

12. SPECIFICATIONS

a. **Analytical specificity:** the **HIV Quantitative Real-Time PCR Kit** allows detection M HIV-1: A, B, C, D, E, F, G, H subtypes. The samples containing HIV will be defined as positive and characterized quantitatively. The samples not containing HIV will be defined as negative.

b. **Linear range:** $5.0x10^2 – 1.0x10^8$ copies/mL

c. **Variation coefficient:** less than 7%

d. **Sensitivity:** not less than 200 copies of HIV RNA per 1.0 mL of blood plasma.

 The claimed specifications are guaranteed when DNA extraction is performed with *PREP-NA* DNA/RNA Extraction Kit.

13. QUALITY CONTROL

“DNA-Technology, Research&Production” LLC declares that the above mentioned products meet the provision of the Council Directive 98/79/EC for *In Vitro* Diagnostic Medical Devices. The quality control procedures performed in accordance with ISO ISO 9001:2008 and ISO 13485:2003

14. KEY TO SYMBOLS

Authorized representative in EU

Manufacturer

Caution

Negative control

Consult instructions for use

Positive control

Date of manufacture

Cataloque number

Expiration date

Sufficient for

For research use only

Temperature limitation

Batch code

Upper limit of temperature

Version

Annex A
Nomogram and formula for calculation of relative centrifugal force (RCF) in the speed of rotation (RPM) depending of the rotor diameter