

December 2010

artus[®] HI Virus-1 QS-RGQ Kit Handbook



24 (catalog no. 4513363)



72 (catalog no. 4513366)

Version 1



Quantitative in vitro diagnostics

For use with QIA Symphony[®] SP/AS and Rotor-Gene[®] Q Instruments



4513363, 4513366



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QIAGEN GmbH, QIAGEN Strasse 1, D-40724 Hilden

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Kit Contents

artus HI Virus-1 QS-RGQ Kit		(24)	(72)
Catalog no.		4513363	4513366
Number of reactions		24	72
Blue	HI Virus-1 RG Master A	4 x 144 µl	8 x 144 µl
Violet	HI Virus-1 RG Master B	4 x 216 µl	8 x 216 µl
Red	HI Virus-1 RG QS1* (1x 10 ⁴ IU/µl) QS	200 µl	200 µl
Red	HI Virus-1 RG QS 2* (1x 10 ³ IU/µl) QS	200 µl	200 µl
Red	HI Virus-1 RG QS 3* (1x 10 ² IU/µl) QS	200 µl	200 µl
Red	HI Virus-1 RG QS 4* (1x 10 ¹ IU/µl) QS	200 µl	200 µl
Green	HI Virus-1 RG IC [†] IC	1000 µl	2 x 1000 µl
White	Water (PCR grade)	1000 µl	1000 µl
	Handbook 	1	1

* Quantitation standard.

† Internal control.

Symbols

 <N> Contains reagents sufficient for <N> tests



Use by



In vitro diagnostic medical device



Catalog number



Lot number



Material number



Components

	Contains
	Number
	Temperature limitations
	Legal manufacturer
	Consult instructions for use
	Important note

Storage

The components of the *artus* HI Virus-1 QS-RGQ Kit should be stored at -20°C and are stable until the expiration date stated on the label. Repeated thawing and freezing (>2 x) should be avoided, as this may reduce assay performance.

Intended Use

The *artus* HI Virus-1 QS-RGQ Kit is an in vitro nucleic acid amplification test for the quantitation of human immunodeficiency virus type 1 (HIV-1) RNA in human EDTA plasma. This diagnostic test kit utilizes the reverse transcription polymerase chain reaction (RT-PCR) and is configured for use with the QIA Symphony SP/AS and Rotor-Gene Q instruments. Plasma samples containing Group M Subtypes A–H have been validated for use in the assay.

The *artus* HI Virus-1 QS-RGQ Kit is intended for use in conjunction with clinical presentation and other laboratory markers for disease prognosis and for use as an aid in assessing viral response to antiretroviral treatment as measured by changes in human EDTA plasma HIV-1 RNA levels. The *artus* HI Virus-1 QS-RGQ Kit is not intended to be used as a screening test for HIV or as a diagnostic test to confirm the presence of HIV infection.

Product Use Limitations

All reagents may exclusively be used in in vitro diagnostics.

The product is to be used by personnel specially instructed and trained in the in vitro diagnostics procedures (EN375) only.

Strict compliance with the user manual is required for optimal PCR results.

Attention should be paid to expiration dates printed on the box and labels of all components. Do not use expired components.

Although rare, mutations within the highly conserved regions of the viral genome covered by the kit's primers and/or probe may result in underquantitation or failure to detect the presence of the virus in these cases. Validity and performance of the assay design are revised at regular intervals.

Technical Assistance

At QIAGEN, we pride ourselves on the quality and availability of our technical support. Our Technical Service Departments are staffed by experienced scientists with extensive practical and theoretical expertise in sample and assay technologies and the use of QIAGEN products. If you have any questions or experience any difficulties regarding the *artus* HI Virus-1 QS-RGQ Kit or QIAGEN products in general, please do not hesitate to contact us.

QIAGEN customers are a major source of information regarding advanced or specialized uses of our products. This information is helpful to other scientists as well as to the researchers at QIAGEN. We therefore encourage you to contact us if you have any suggestions about product performance or new applications and techniques.

For technical assistance and more information, please see our Technical Support Center at www.qiagen.com/Support or call one of the QIAGEN Technical Service Departments or local distributors (see back cover or visit www.qiagen.com).

Quality Control

In accordance with QIAGEN's ISO-certified Quality Management System, each lot of *artus* HI Virus-1 QS-RGQ Kit is tested against predetermined specifications to ensure consistent product quality.

Safety Information

When working with chemicals, always wear a suitable lab coat, disposable gloves, and protective goggles. For more information, please consult the appropriate material safety data sheets (MSDSs). These are available online in convenient and compact PDF format at www.qiagen.com/support/MSDS.aspx where you can find, view, and print the MSDS for each QIAGEN kit and kit component.

For safety information for the QIASymphony DSP Virus/Pathogen Midi Kit, see the *QIASymphony DSP Virus/Pathogen Handbook*. For safety information regarding instruments, see the relevant instrument user manual.

Discard sample and assay waste according to your local safety regulations.

24-hour emergency information

Emergency medical information in English, French, and German can be obtained 24 hours a day from:

Poison Information Center Mainz, Germany

Tel: +49-6131-19240

Introduction

The *artus* HI Virus-1 QS-RGQ Kit constitutes a ready-to-use system for the detection of HIV-1 RNA using polymerase chain reaction (PCR) on Rotor-Gene Q Instruments with sample preparation and assay setup using the QIA Symphony SP/AS instruments. The HI Virus-1 RG Master A and B contain reagents and enzymes for the reverse transcription and specific amplification of a 93 bp region of the HIV-1 genome, and for the direct detection of the specific amplicon in fluorescence channel Cycling Green of the Rotor-Gene Q.

In addition, the *artus* HI Virus-1 QS-RGQ Kit contains a second heterologous amplification system to identify possible PCR inhibition. This is detected as an internal control (IC) in fluorescence channel Cycling Orange of the Rotor-Gene Q. The detection limit of the analytical HI Virus-1 RT-PCR is not reduced. External positive controls (HI Virus-1 RG QS 1–4) are supplied, which allow the determination of the amount of viral RNA. For further information, see “Quantitation”, page 30.

Principle

Pathogen detection by the polymerase chain reaction (PCR) is based on the amplification of specific regions of the pathogen genome. In real-time PCR the amplified product is detected via fluorescent dyes. These are usually linked to oligonucleotide probes that bind specifically to the amplified product. Monitoring the fluorescence intensities during the PCR run (i.e., in real-time) allows the detection and quantitation of the accumulating product without having to re-open the reaction tubes after the PCR run.*

Pathogen information

The human immunodeficiency virus (HIV) is a retrovirus that causes acquired immunodeficiency syndrome (AIDS). There are two types of HIV responsible for human infections, HIV-1 and HIV-2, which differ in their virulence and prevalence. Most reported cases of AIDS around the world have been attributed to HIV-1. Infection with HIV occurs by the transfer of infected blood, vaginal fluid, breast milk and other body fluids. Within these body fluids HIV is present as both free virus particles and virus within infected immune cells. The three major routes of transmission are unprotected sexual intercourse, contaminated needles and transmission from an infected mother to her baby at birth or through breast milk.

* Mackay, I.M. (2004) Real-time PCR in the microbiology laboratory. *Clin. Microbiol. Infect.* **10**, 190.

HIV primarily infects cells in the human immune system such as helper T cells (specifically CD4⁺). HIV infection leads to low levels of CD4⁺ T cells. When CD4⁺ T cell number decline below a critical level, cell-mediated immunity is lost, and the body becomes progressively more susceptible to opportunistic infections.

AIDS symptoms occur at an advanced stage of HIV infection when the compromised immune system cannot fight off opportunistic infections. At this stage, the infected person increasingly develops symptoms triggered by such infections. The most common infections include chronic cryptosporida diarrhea, cytomegalovirus-induced eye infection, pneumocystis pneumonia, toxoplasmosis, and tuberculosis as well as infections with members of the *Mycobacterium avium* complex. In addition, the development of different types of cancer, such as invasive cervical cancer, Kaposi sarcoma, or lymphoma, is frequently observed. At present, there is no cure for AIDS, and it is believed that most HIV infected people will eventually die of an AIDS-related illness. However, advancements in HIV/AIDS therapies, including those that fight the virus itself as well as those that prevent or treat opportunistic infections, have drastically improved life expectancy and quality of many HIV/AIDS patients.

Performance characteristics

Analytical sensitivity

The analytical detection limit in consideration of the purification (sensitivity limit) was assessed for the *artus* HI Virus-1 QS-RGQ Kit using HIV-positive clinical specimens in combination with the extraction on the QIA Symphony SP.

The analytical sensitivity in consideration of the purification of the *artus* HI Virus-1 QS-RGQ Kit was determined using a dilution series of the 2nd WHO International Standard for HIV-1 RNA (NIBSC code 97/650) from 316 to nominal 5 IU/ml spiked in clinical plasma specimens. These were subjected to RNA extraction using the QIA Symphony DSP Virus/Pathogen Kit in combination with the Cellfree1000 protocol (extraction volume: 1 ml, elution volume: 60 μ l). Each of the 8 dilutions was analyzed with the *artus* HI Virus-1 QS-RGQ Kit on 4 different days in 5 runs with 11 replicates each. The results were determined by a probit analysis. A graphical illustration of the probit analysis is shown in Figure 1. The analytical detection limit in consideration of the purification of the *artus* HI Virus-1 QS-RGQ Kit in combination with the Rotor-Gene Q is 76.4 IU/ml ($p = 0.05$). This means that there is a 95% probability that 76.4 IU/ml will be detected.

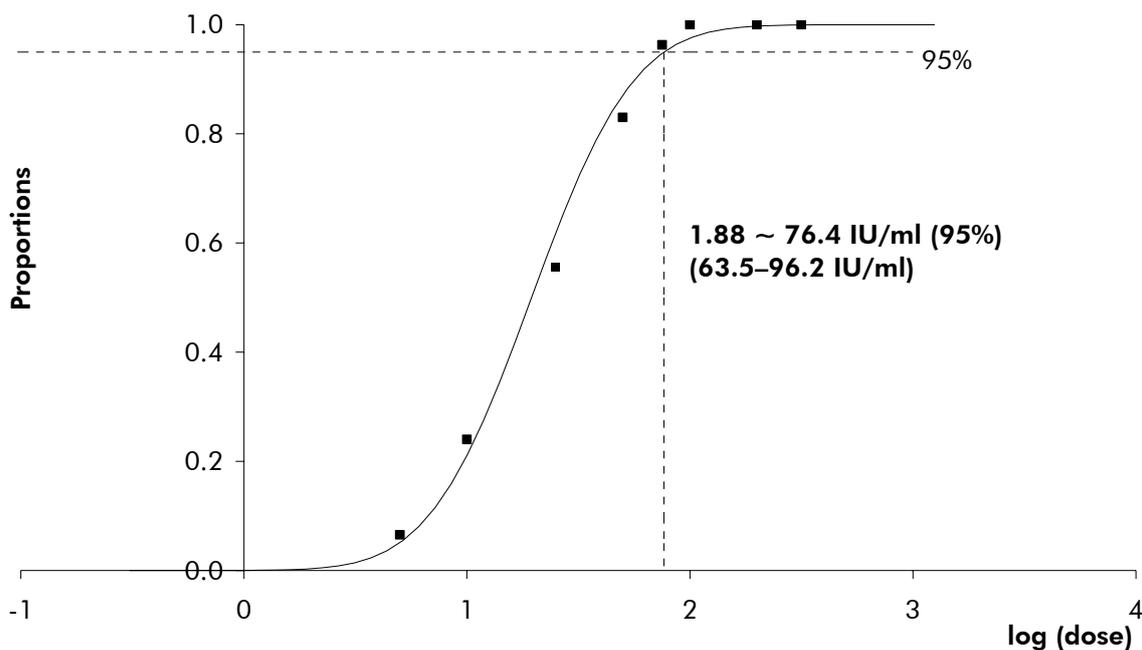


Figure 1. Probit analysis: HI Virus-1 (Rotor-Gene Q). Analytical sensitivity in consideration of the purification (QIAAsymphony DSP Virus/Pathogen Kit) of the *artus* HI Virus-1 QS-RGQ Kit on the Rotor-Gene Q.

Specificity

The specificity of the *artus* HI Virus-1 QS-RGQ Kit is first and foremost ensured by the selection of the primers and probes, as well as the selection of stringent reaction conditions. The primers and probes were checked for possible homologies to all sequences published in gene banks by sequence comparison analysis. The detectability of all relevant genotypes has thus been ensured by a database alignment and by an RT-PCR run on Rotor-Gene instruments with the following genotypes (see Table 1).

For further specificity testing, HI virus-1 strains with known sequence differences in the pre-core region of the HI virus-1 genome (HI Virus-1 Pre-Core Mutant Panel, Teragenix, Florida, USA) were used. All 9 pre-core mutant strains of this panel could be detected using the *artus* HI Virus-1 QS-RGQ Kit.

Moreover, the specificity was validated with 100 different HIV negative plasma samples. These did not generate any signals with the HIV-1 specific primers and probes, which are included in the HI Virus-1 RG Masters.

A potential cross-reactivity of the *artus* HI Virus-1 QS-RGQ Kit was tested using the control group listed in Table 2 (page 12). None of the tested pathogens has been reactive. No cross-reactivities appeared with mixed infections.

Table 1. Testing of the specificity of relevant genotypes

Virus	Genotype	Source	HIV (Cycling Green)	Internal control (Cycling Orange)
HI virus-1	A	NIBSC*	+	+
HI virus-1	B	NIBSC	+	+
HI virus-1	C	NIBSC	+	+
HI virus-1	D	NIBSC	+	+
HI virus-1	E	NIBSC	+	+
HI virus-1	F	NIBSC	+	+
HI virus-1	G	NIBSC	+	+
HI virus-1	H	NIBSC	+	+

* National Institute for Biological Standards and Control, Hertfordshire.

Table 2. Testing the specificity of the kit with potentially cross-reactive pathogens

Control group	HIV (Cycling Green)	Internal control (Cycling Orange)
Hepatitis A virus	-	+
Hepatitis B virus	-	+
Hepatitis C virus	-	+
Human herpesvirus 1 (herpes simplex virus 1)	-	+
Human herpesvirus 2 (herpes simplex virus 2)	-	+
Human herpesvirus 3 (varicella- zoster virus)	-	+
Human herpesvirus 5 (cytomegalovirus)	-	+

Table continued on next page

Table 2. Continued

Control group	HIV (Cycling Green)	Internal control (Cycling Orange)
Human T cell leukemia virus type 1 and type 2	–	+
Enterovirus	–	+
Parvovirus B19	–	+
Yellow fever	–	+
<i>Aspergillus flavus</i>	–	+
<i>Aspergillus fumigatus</i>	–	+
<i>Candida albicans</i>	–	+
<i>Chlamydia trachomatis</i>	–	+
<i>Cryptosporidium parvum</i>	–	+
<i>Filobasidiella neoformans</i>	–	+
<i>Mycoplasma pneumoniae</i>	–	+
<i>Pneumocystis carinii</i>	–	+
<i>Staphylococcus</i> sp.	–	+
<i>Streptococcus agalactiae</i>	–	+
<i>Staphylococcus aureus</i>	–	+
<i>Streptococcus pyogenes</i>	–	+

Linear range

The linear range in consideration of the purification of the *artus* HI Virus-1 QS-RGQ Kit was determined by analyzing a dilution series of Acrometrix HIV standard material ranging from 1.00×10^8 IU/ml to 1.00×10^2 IU/ml. The purification was carried out in replicates ($n = 4$ for concentrations $\geq 1.00 \times 10^7$ IU/ml; $n = 8$ for concentrations $< 1.00 \times 10^7$ IU/ml) using the QIASymphony DSP Virus/Pathogen Kit in combination with the Cellfree1000 protocol (extraction volume: 1 ml, elution volume: 60 μ l). Each of the samples was analyzed using the *artus* HI Virus-1 QS-RGQ Kit. The linear range in consideration of the purification of the *artus* HI Virus-1 QS-RGQ Kit has been

determined to cover concentrations from 2.50×10^2 IU/ml to 1.00×10^8 IU/ml (Figure 2).

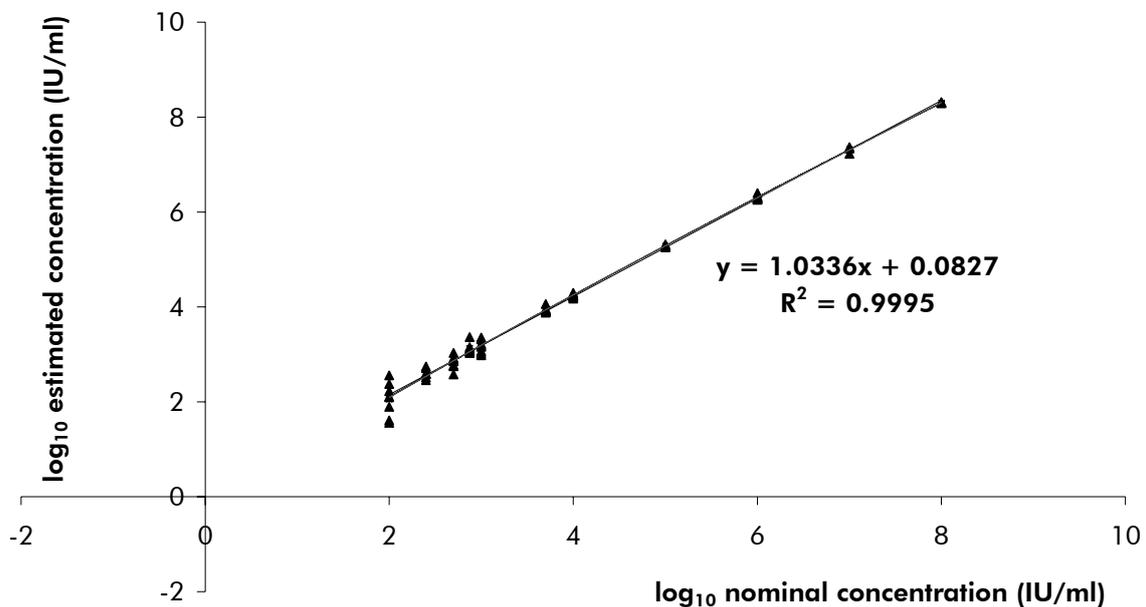


Figure 2. Linear range of the artus HI Virus-1 QS-RGQ Kit. Calculation of the linear range. The straight line was determined by a linear regression of the log₁₀ calculated concentrations with the log₁₀ nominal concentrations. The equation of the regression line is included in the figure.

Precision

The precision data of the artus HI Virus-1 QS-RGQ Kit allow determination of the total variance of the assay. The total variance consists of the intra-assay variability (variability of multiple results of samples of the same concentration within one experiment), the inter-assay variability (variability of multiple results of the assay generated on different instruments of the same type by different operators within one laboratory) and the inter-batch variability (variability of multiple results of the assay using various batches). The data obtained were used to determine the standard deviation, the variance and the coefficient of variation for the pathogen specific and the internal control PCR.

Analytical precision data of the artus HI Virus-1 QS-RGQ Kit (without consideration of the purification) were collected using the quantitation standard of the lowest concentration (QS4; 10 IU/μl). Testing was performed with 8 replicates. The precision data were calculated on basis of the C_T values of the amplification curves (C_T: threshold cycle, see Table 3). Based on these results, the overall statistical spread of any given sample with the mentioned concentration is 1.66% (C_T), and 2.15% (C_T) for the detection of the internal

control. These values are based on the totality of all single values of the determined variabilities.

Table 3. Precision data on basis of the C_T values

	C_T value	Standard deviation	Coefficient of variation (%)
Intra-assay variability: HI Virus-1 RG QS 4	35.62	0.45	1.26
Intra-assay variability: Internal control	31.24	0.18	0.58
Inter-assay variability: HI Virus-1 RG QS 4	35.75	0.56	1.55
Inter-assay variability: Internal control	31.65	0.36	1.13
Inter-batch variability: HI Virus-1 RG QS 4	35.40	0.61	1.73
Inter-batch variability: Internal control	31.20	0.55	1.76
Total variance: HI Virus-1 RG QS 4	35.58	0.59	1.66
Total variance: Internal control	31.40	0.67	2.15

Precision data in consideration of the purification of the *artus* HI Virus-1 QS-RGQ Kit was collected using Acrometrix HIV standard material with a concentration of 1.00×10^3 IU/ml spiked in clinical plasma specimens. Testing was performed using the QIA Symphony DSP Virus/Pathogen Kit in combination with the Cellfree1000 protocol (extraction volume: 1 ml, elution volume: 60 μ l). Testing was performed on 36 replicates using a matrix of various batches of the QIA Symphony DSP Virus/Pathogen Kit and the *artus* HI Virus-1 QS-RGQ Kit. Based on these results, the overall statistical spread of any given sample with the mentioned concentration is 1.45% (C_T) or 31.34% (concentration), and 1.47% (C_T) for the detection of the internal control (Tables 4 and 5). These values are based on the totality of all single values of the determined variabilities in consideration of the purification.

Table 4. Precision data (total variance) on basis of the C_T values

	Standard deviation	Variance	Coefficient of variation (%)
Acrometrix HIV standard (1.00 x 10 ³ IU/ml)	0.48	0.24	1.45
Internal control (HIV, 1.00 x 10 ³ IU/ml)	0.51	0.26	1.47

Table 5. Precision data (total variance) on basis of the quantitative results (in IU/ml)

	Mean	Standard deviation	Coefficient of variation (%)
Acrometrix HIV standard (1.00 x 10 ³ IU/ml)	1.54 x 10 ³	4.84 x 10 ²	31.34

Robustness

The verification of the robustness allows the determination of the total failure rate of the *artus* HI Virus-1 QS-RGQ Kit. To verify the robustness, 100 HIV negative samples of plasma were spiked with 230 IU/ml of HIV (approximately threefold concentration of the analytical sensitivity limit). After extraction using the QIA Symphony DSP Virus/Pathogen Kit in combination with the Cellfree1000_DSP protocol (extraction volume: 1 ml, elution volume: 60 µl), these samples were analyzed with the *artus* HI Virus-1 QS-RGQ Kit. In addition, the robustness of the internal control was assessed by purification and analysis of the 100 spiked plasma samples. Inhibitions were not observed. Thus, the robustness of the *artus* HI Virus-1 QS-RGQ Kit is ≥99%.

Reproducibility

Reproducibility data permit a regular performance assessment of the *artus* HI Virus-1 QS-RGQ Kit as well as an efficiency comparison with other products. These data are obtained by the participation in established proficiency programs.

Cross-contamination

Absence of cross-contamination between samples for the entire workflow was proven by the correct detection of all known positive and negative samples in

alternating positions (checkerboard pattern) for a representative *artus* QS-RGQ system.

Workflow

The QIA Symphony RGQ workflow starts with purification of nucleic acids from human plasma samples on the QIA Symphony SP instrument. The eluates, containing purified nucleic acids, from the sample preparation procedure are transferred to the QIA Symphony AS module, which then performs assay setup (Figure 3). The assays are then transferred to the Rotor-Gene Q for RT-PCR and data analysis (Figure 4).

A workflow overview is given on pages 18–20. For more information, refer to the detailed protocols in this handbook (pages 31, 37, and 43).



Figure 3. Walkaway automation on QIA Symphony SP/AS instruments. Samples, reagents, and consumables are loaded in the relevant drawers. Sample preparation and assay setup are then fully automated on the QIA Symphony SP/AS instruments.



Figure 4. Transferring the samples to the Rotor-Gene Q. After sample preparation and assay setup, the reactions are loaded in the 72-Well Rotor of the Rotor-Gene Q for real-time PCR analysis.

QIASymphony RGQ workflow overview

QIASymphony SP

Load the "Waste" drawer.



Place the elution rack in the "Eluate" drawer.

Independent operation

Place the elution rack on slot 1.

Integrated operation

Place the elution rack with adapter, including the transfer frame on slot 1.



Load the "Reagents and Consumables" drawer.



Load the "Sample" drawer.



Define a run/batch using the sample preparation user interface.



Start the protocol.



When sample processing is complete either manually remove the elution rack from the “Eluate” drawer (independent operation), or perform direct transfer of the elution rack to the QIASymphony AS via the transfer module (integrated operation).

Independent operation

Remove the eluate slot assignment on the touchscreen, then open the “Eluate” drawer and manually remove the elution rack.

Integrated operation

Press “Transfer” to transfer the elution rack from the QIASymphony SP to the QIASymphony AS.



Download the QIASymphony SP result file.



QIASymphony AS

Switch to the assay setup user interface in the touchscreen.



Start the assay definition process.

Independent operation

Press “New”.

Integrated operation

A message will appear asking whether to use the elution rack as a sample rack. Press “Yes” to confirm.



Define an assay run.

The screens that appear on the touchscreen will guide you step-by-step through the assay definition process.



Load the “Eluate and Reagents” and “Assays” drawer with the appropriate samples, reagents, and consumables.

i For detailed loading information, refer to the “Loading Information” screen. Alternatively, press “Queue” and download the loading information file.



Start the assay run.



After the run is finished, remove the assays. To do this, press “Remove” and then manually remove the assay rack(s) from the “Assays” drawer.



Transfer the assay rack(s) to the Rotor-Gene Q.



Download the QIASymphony AS result file and the cycler file.



Transfer the cycler file to the Rotor-Gene Q.



Rotor-Gene Q

Select or create a temperature profile.



Click “Start Run”.



After the run is finished, analyze the results.



Maintenance

Perform the appropriate maintenance procedures for the QIASymphony SP/AS and the Rotor-Gene Q according to the instrument user manuals.

See Section 8 of the *QIASymphony SP/AS User Manual — General Description* and Section 9 of the *Rotor-Gene Q User Manual* for more details about required daily, regular, and weekly maintenance procedures.

Equipment and Reagents to Be Supplied by User

When working with chemicals, always wear a suitable lab coat, disposable gloves, and protective goggles. For more information, consult the appropriate material safety data sheets (MSDSs), available from the product supplier.

- Pipets (adjustable)* and sterile pipet tips with filters
- Vortex mixer*
- Benchtop centrifuge* with rotor for 2 ml reaction tubes, capable of centrifugation at 6800 x g

For sample preparation

- QIASymphony SP instrument (cat. no. 9001297)*
- QIASymphony DSP Virus/Pathogen Midi Kit (cat. no. 937055)
- Adapters for the QIASymphony SP:
 - Elution Microtube Rack QS (Cooling Adapter, EMT, v2, Qsym, cat. no. 920730)
 - Tube Insert 3B (Insert, 2.0ml v2, samplecarr. (24), Qsym, cat. no. 9242083)
- Consumables for the QIASymphony SP:
 - Sample Prep Cartridges, 8-well (cat. no. 997002)
 - 8-Rod Covers (cat. no. 997004)
 - Filter-Tips, 1500 μ l (cat. no. 997024)
 - Filter-Tips, 200 μ l (cat. no. 990332)
 - Elution Microtubes CL (cat. no. 19588)
 - Tip disposal bags (cat. no. 9013395)
 - Micro tubes 2.0 ml Type H or Micro tubes 2.0 ml Type I (Sarstedt, cat. nos. 72.693 and 72.694, www.sarstedt.com) for use with samples and internal controls

* Ensure that instruments have been checked and calibrated according to the manufacturer's recommendations.

For assay setup

- QIASymphony AS instrument (cat. no. 9001301)*
- Adapters and reagent holders for the QIASymphony AS:
 - Reagent holder 1 QS (Cooling Adapter, Reagent Holder 1, Qsym, cat. no. 9018090)
 - Reagent holder 2 QS (Cooling Adapter, Reagent Holder 2, Qsym, cat. no. 9018089)
 - RG Strip Tubes 72 QS (Cooling Adapter, RG Strip Tubes 72, Qsym, cat. no. 9018092)
- Consumables for the QIASymphony AS:
 - Strip Tubes and Caps, 0.1 ml (cat. no. 981103)
 - Tubes, conical, 2 ml, Qsym AS (cat. no. 997102)[†] or Micro tubes 2.0 ml Type I (Sarstedt, cat. no. 72.694.005, www.sarstedt.com)
 - Tube, conical, 5 ml, Qsym AS (cat. no. 997104)[†] or Tubes with flat base from PP (Sarstedt, cat. no. 60.558.001, www.sarstedt.com)
 - Reagent Bottles, 30 ml, Qsym AS (cat. no. 997108)
 - Elution Microtubes CL (cat. no. 19588)
 - Filter-Tips, 1500 μ l (cat. no. 997024)
 - Filter-Tips, 200 μ l (cat. no. 990332)
 - Filter-Tips, 50 μ l (cat. no. 997120)
 - Tip disposal bags (cat. no. 9013395)

For PCR

- Rotor-Gene Q 5plex HRM instrument*
- Rotor-Gene Q software version 2.02, or higher

* Ensure that instruments have been checked and calibrated according to the manufacturer's recommendations.

[†] Please inquire for availability.

Important Notes

General precautions

Always pay attention to the following:

- Use sterile pipet tips with filters.
- During manual steps, keep tubes closed when possible and avoid contamination.
- Thaw all components thoroughly at room temperature (15–25°C) before starting an assay.
- When thawed, mix the components (by pipetting repeatedly up and down or by pulse vortexing) and centrifuge briefly. Ensure that no foam or bubbles are present in the reagent tubes.
- Do not mix components from kits with different lot numbers.
- Make sure that the required adapters are precooled to 2–8°C.
- Work quickly and keep PCR reagents on ice or in the cooling block before loading.
- Proceed continuously from one part of the workflow to the next. Do not exceed 30 minutes of transfer time between each module (QIA Symphony SP to QIA Symphony AS to Rotor-Gene Q).

Specimen collection, storage, and transport

 All samples have to be treated as potentially infectious material.

Only the following sample materials are permissible, for which the following rules and particular instructions regarding collection, transport, and storage have to be strictly observed.

 Current studies refer to human EDTA plasma as the most suitable sample materials for HIV detection. Therefore, we recommend the use of these materials with the *artus* HI Virus-1 QS-RGQ Kit.

The internal validation of the *artus* HI Virus-1 QS-RGQ Kit has been performed using human EDTA plasma samples. Other sample materials are not validated. Please use only the recommended RNA isolation kit (see “Protocol: RNA Isolation on the QIA Symphony SP”, page 31) for sample preparation.

Using certain sample materials, particular instructions regarding collection, transport, and storage have to be strictly observed.

Specimen collection

Each blood withdrawal causes an injury of blood vessels (arteries, veins, capillaries). Only innocuous and sterile material should be used. For blood withdrawal appropriate disposables are available. For vein punctures, too fine capillary needles should not be employed. Venous blood withdrawal should be carried out on the appropriate parts of the elbow bend, the forearm, or the back of the hand. Blood has to be withdrawn with standard specimen collection tubes (red cap, Sarstedt or equivalent tube of another manufacturer). A volume of 5–10 ml EDTA blood should be withdrawn. Tubes should be mixed overhead directly after sample collection (8 x, do not agitate).

i Samples from heparinized humans must not be used (see “Interfering substances”, page 25).

Sample storage

Whole blood should be separated into plasma and cellular components by centrifugation for 20 minutes at 800–1600 x g within 6 hours. The isolated plasma has to be transferred into sterile polypropylene tubes. The sensitivity of the assay can be reduced if you freeze the samples as a matter of routine or store them for a longer period of time. Virus encapsulated RNA is stable for days if stored at 4°C, for weeks if stored at –20°C, and even for months and years when stored at –70°C.*

Sample transport

Sample material should be transported in a shatterproof transport container as a matter of principle. Thus, a potential danger of infection due to a leakage of sample can be avoided. The samples should be transported following the local and national instructions for the transport of pathogen material.†

The samples should be shipped within 6 hours. It is not recommended to store the samples where they have been collected. It is possible to ship the samples by mail, following the legal instructions for the transport of pathogen material. We recommend the sample transport with a courier. The blood samples should be shipped cooled (2–8°C) and the separated plasma deep frozen (–15 to –30°C).

* Arbeitskreis Blut, V17 (09.1997), Bundesgesundheitsblatt 11/1997, p. 452–456.

† International Air Transport Association (IATA). Dangerous Goods Regulations.

Interfering substances

Elevated levels of albumin (≤ 6 g/dl), bilirubin (≤ 30 mg/dl), and lipids (≤ 1 g/dl triglyceride), and hemolytic samples (≤ 2 g/dl hemoglobin) do not influence the system. Heparin (≥ 10 IU/ml) affects the PCR. Samples that have been collected in tubes containing heparin as an anticoagulant should not to be used. Also, samples of heparinized patients must not be used.

Getting started on the QIA Symphony SP/AS instruments

Close all drawers and the hoods.

Switch on the QIA Symphony SP/AS instruments, and wait until the “Sample Preparation” screen appears and the initialization procedure has finished.

Log into the instrument (drawers will unlock).

Loading reagent cartridges (RC) into the “Reagents and Consumables” drawer

Reagents for purification of nucleic acids are contained in an innovative reagent cartridge (RC) (see Figure 5). Each trough of the reagent cartridge (RC) contains a particular reagent, such as magnetic particles, lysis buffer, wash buffer, or elution buffer. Partially used reagent cartridges (RC) can be reclosed with Reuse Seal Strips for later reuse, which avoids generation of waste due to leftover reagents at the end of the purification procedure.

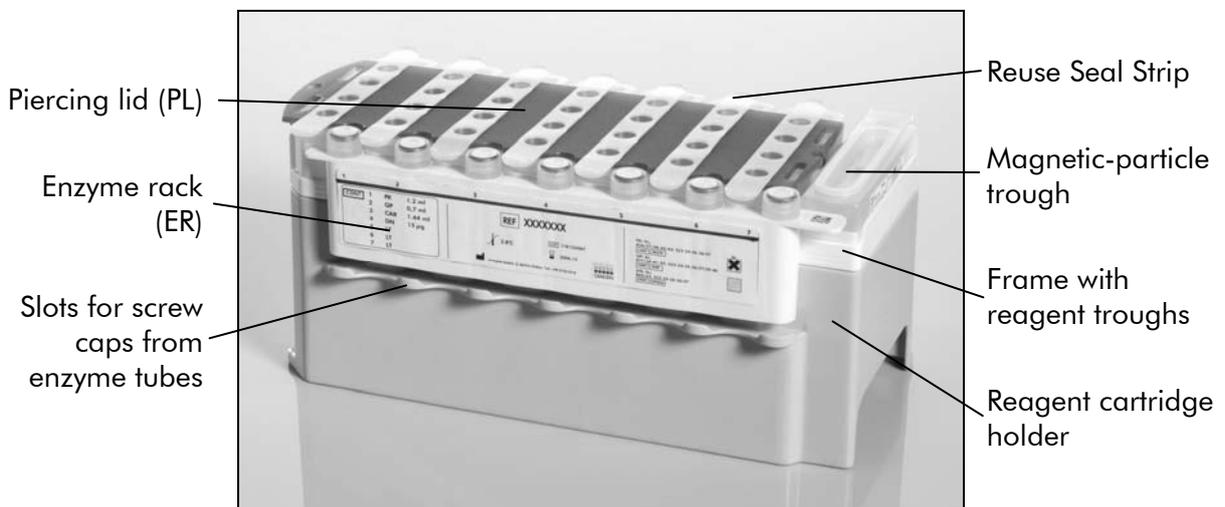


Figure 5. QIA Symphony reagent cartridge (RC). The reagent cartridge (RC) contains all reagents required for the purification procedure.

Before starting the procedure, ensure that the magnetic particles are fully resuspended. Remove the magnetic-particle trough from the reagent cartridge frame, vortex it vigorously for at least 3 minutes, and replace it in the reagent cartridge frame before the first use. Place the reagent cartridge (RC) into the reagent cartridge holder. Place the enzyme rack (ER) into the reagent cartridge holder. Before using a reagent cartridge (RC) for the first time, place the piercing lid (PL) on top of the reagent cartridge (RC) (Figure 6).

i The piercing lid (PL) is sharp. Take care when placing it onto the reagent cartridge (RC). Make sure to place the piercing lid (PL) onto the reagent cartridge (RC) in the correct orientation.

After the magnetic-particle trough cover is removed and the enzyme rack tubes are opened (screw caps can be stored in dedicated slots, see Figure 5), the reagent cartridge (RC) is subsequently loaded into the “Reagents and Consumables” drawer.

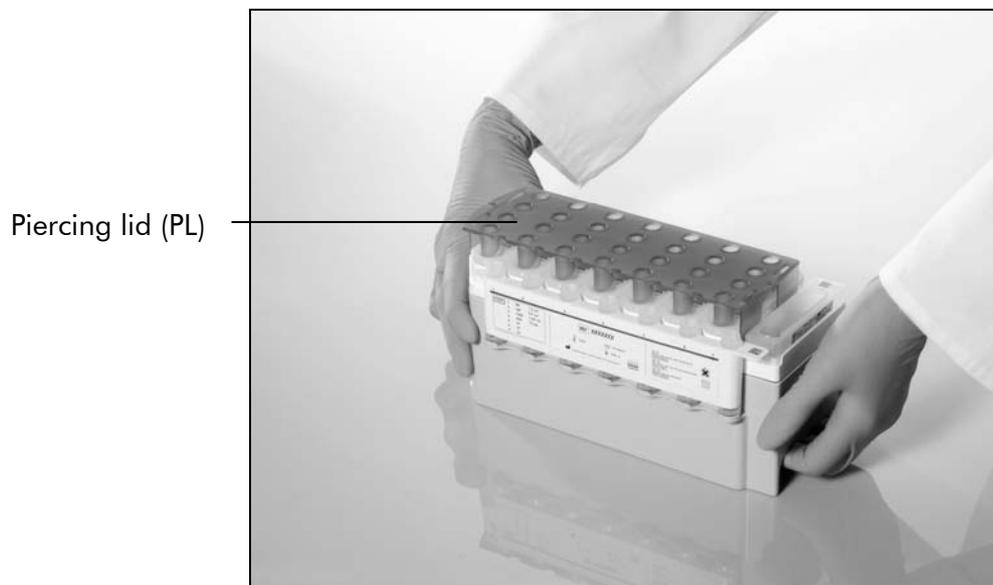


Figure 6. Easy worktable setup with reagent cartridges (RC).

Partially used reagent cartridges (RC) can be stored until needed again, see “Storage” in the *QIA Symphony DSP Virus/Pathogen Handbook*.

Loading plasticware into the “Reagents and Consumables” drawer

Sample prep cartridges, 8-Rod Covers (both preracked in unit boxes), and disposable filter-tips (200 μ l tips provided in blue racks, 1500 μ l tips provided in black racks) are loaded into the “Reagents and Consumables” drawer.

i Ensure that the covers of the unit boxes are removed before loading the unit boxes into the “Reagents and Consumables” drawer.

i Tips have filters to help prevent cross-contamination.

Tip rack slots on the QIA Symphony SP worktable can be filled with either type of tip rack. The QIA Symphony SP will identify the type of tips loaded during the inventory scan.

i Do not refill tip racks or unit boxes for sample prep cartridges or 8-Rod Covers manually before starting another protocol run. The QIA Symphony SP can use partially used tip racks and unit boxes.

Loading the “Waste” drawer

Sample prep cartridges and 8-Rod Covers used during a run are re-racked in empty unit boxes in the “Waste” drawer. Make sure that the “Waste” drawer contains sufficient empty unit boxes for plastic waste generated during the protocol run.

i Ensure that the covers of the unit boxes are removed before loading the unit boxes into the “Waste” drawer. If you are using 8-Rod Cover boxes for collecting used sample prep cartridges and 8-Rod Covers, ensure that the box spacer has been removed.

A bag for used filter-tips must be attached to the front side of the “Waste” drawer.

i The presence of a tip disposal bag is not checked by the system. Make sure that the tip disposal bag is properly attached before starting a protocol run. For more information, see the user manuals provided with your instrument. Empty the tip bag after a maximum of 96 samples have been processed to avoid a tip jam.

A waste container collects liquid waste generated during the purification procedure. The “Waste” drawer can only be closed if the waste container is in place. Dispose of the liquid waste according to your local safety and environment regulations. Do not autoclave the filled waste bottle. Empty the waste bottle after a maximum of 96 samples have been processed.

Loading the “Eluate” drawer

Load the required elution rack into the “Eluate” drawer. Use “Elution slot 1” with the corresponding cooling adapter. For integrated operation, place the elution rack with adapter, including the transfer frame on slot 1.

Inventory scan

Before starting a run, the instrument checks that sufficient consumables for the queued batch(es) have been loaded into the corresponding drawers.

Preparation of sample material

The QIA Symphony DSP Virus/Pathogen Midi Kit is suitable for use with human plasma samples. Prevent formation of foam in or on the samples. Samples should be equilibrated to room temperature (15–25°C) before starting the run.

Preparing carrier RNA (CARRIER)–Buffer AVE (AVE) mixtures

 Carrier RNA (CARRIER) must be used.

To prepare a carrier RNA (CARRIER) stock solution, add 1350 µl Buffer AVE (AVE) (provided in 2 ml vials) to the tube containing 1350 µg lyophilized carrier RNA (CARRIER) to obtain a solution of 1 µg/µl. Dissolve the carrier RNA (CARRIER) thoroughly, divide it into conveniently sized aliquots, and store at 2–8°C for up to 2 weeks.

Calculating the volume of carrier RNA (CARRIER) mixture per tube

The minimum volume of carrier RNA (CARRIER)–Buffer AVE (AVE) mixture must include sufficient additional volume to take into account liquid loss due to pipetting and evaporation. See Table 6 for volumes to use for analysis with the *artus* HI Virus-1 QS-RGQ Kit.

Tubes containing carrier RNA (CARRIER)–Buffer AVE (AVE) and internal control mixtures are placed in a tube carrier. The tube carrier containing the carrier RNA (CARRIER)–Buffer AVE (AVE) mixture(s) must be placed in slot A of the sample drawer. Up to 8 tubes of the mixture can be used per batch and up to 24 tubes can be used per run of 4 batches.

Using an internal control

An internal control (HI Virus-1 RG IC) is supplied with the *artus* HI Virus-1 QS-RGQ Kit. This allows the user both to control the RNA isolation procedure and to check for possible PCR inhibition.

Using the QIA Symphony DSP Virus/Pathogen Midi Kit in combination with the *artus* HI Virus-1 QS-RGQ Kit requires introduction of the internal control (HI Virus-1 RG IC) into the purification procedure to monitor the efficiency of sample preparation and downstream assay.

Internal controls must be added with carrier RNA (CARRIER)–Buffer AVE (AVE) mixture, and the total volume of the internal control–carrier RNA (CARRIER)–Buffer AVE (AVE) mixture remains 120 µl.

For this application, add the internal control to the isolation as shown in Table 6. This represents addition of internal control to the isolation at a ratio of

0.1 μl per 1 μl elution volume. We recommend preparing fresh mixtures for each run just before use.

Table 6. Preparation of internal control–carrier RNA (CARRIER)

Component	Volume (μl)
Stock carrier RNA (CARRIER)	5
Internal control*	9
Buffer AVE	106
Final volume per sample (excluding dead volume)	120
Total volume for n samples[†]	(n x 120) + 360[‡]

* The calculation of the amount of internal control is based on the initial elution volumes (90 μl). Additional void volume depends on the type of sample tube used.

[†] Do not fill more than 1.92 ml (corresponding to a maximum of 13 samples; this volume is specific for Micro tubes 2.0 ml Type H and Micro tubes 2.0 ml Type I, Sarstedt cat. nos. 72.693 and 72.694).

[‡] Internal control mixture corresponding to 3 additional samples (i.e., 360 μl) is required (this volume is specific for Micro tubes 2.0 ml Type H and Micro tubes 2.0 ml Type I, Sarstedt cat. nos. 72.693 and 72.694).

Assay Control Sets and Assay Parameter Sets

Assay Control Sets are the combination of a protocol plus additional parameters, such as internal control, for sample purification on the QIA Symphony SP. A default Assay Control Set is preinstalled for each protocol.

Assay Parameter Sets are the combination of an assay definition with additional parameters defined, such as replicate count and number of assay standards, for assay setup on the QIA Symphony AS.

Yields of nucleic acids

Eluates prepared with carrier RNA (CARRIER) may contain much more carrier RNA (CARRIER) than target nucleic acids. We recommend using quantitative amplification methods to determine yields.

Storing nucleic acids

For short-term storage of up to 24 hours, we recommend storing purified nucleic acids at 2–8°C. For long-term storage of over 24 hours, we recommend storage at –20°C.

Setting the threshold for the PCR analysis

The optimal threshold settings for a given combination of Rotor-Gene Q instrument and *artus* QS-RGQ Kit should be set empirically by testing each individual combination since it is a relative value depending on the overall diagnostic workflow. As a starting point, the threshold can be set at a preliminary value of 0.04 for the analysis of the first PCR run, but this value should be fine-tuned in a comparative analysis of the next runs of the workflow. The threshold should be set manually just above the background signal of the negative controls and negative samples. The mean threshold value calculated from these experiments will most likely work for the majority of future runs, but the user should nevertheless review the generated threshold value at regular intervals. The threshold value will usually be in the range of 0.03–0.05 and should be rounded to no more than three decimal places.

Quantitation

The quantitation standards (HI Virus-1 RG QS 1–4) in the *artus* HI Virus-1 QS-RGQ Kit are treated as previously purified samples and the same volume is used (20 μ l). To generate a standard curve on Rotor-Gene Q Instruments, all 4 quantitation standards should be used and defined in the “Edit Samples” dialog box on the Rotor-Gene Q instrument as standards with the specified concentrations (see the instrument user manual).

 The quantitation standards are defined as IU/ μ l.* The following equation has to be applied to convert the values determined using the standard curve into IU/ml of sample material:

$$\text{Result (IU/ml)} = \frac{\text{Result (IU/}\mu\text{l)} \times \text{Initial Elution Volume (90 } \mu\text{l)}^\dagger}{\text{Sample Volume (ml)}}$$

As a matter of principle the initial sample volume should be entered in the equation above. This has to be considered when the sample volume has been changed prior to the nucleic acid extraction (e.g., reducing the volume by centrifugation or increasing the volume by adding to the volume required for the isolation).

Conversion factor

1 IU/ml corresponds to 0.45 copies/ml for detection of HIV-1 RNA on the Rotor-Gene Q. The conversion factor is an approximation based on an average factor across the assay's dynamic range.

* The standard has been calibrated using the International HIV standard (WHO).

† The calculation is based on the initial elution volumes (90 μ l).

Protocol: RNA Isolation on the QIA Symphony SP

The QIA Symphony DSP Virus/Pathogen Midi Kit (QIAGEN, cat. no. 937055) is validated for viral RNA purification from human EDTA plasma for use with the *artus* HI Virus-1 QS-RGQ Kit. General information about the protocol is shown in Table 7.

Table 7. General protocol information

Kit	QIA Symphony DSP Virus/Pathogen Midi Kit
Sample material	Plasma
Sample volume (including excess volume)	1200 μ l
Protocol name	Cellfree1000_V4_DSP*
Default Assay Control Set	Cellfree1000_V4_DSP <i>artus</i> HIV*
Elution volume	60 μ l
Required software version	Version 3.1 or higher

* V4 or higher, as required by the software version used.

Important points before starting

- Ensure that you are familiar with operating the QIA Symphony SP/AS instruments. Refer to the user manuals supplied with your instruments for operating instructions.
- Before beginning the procedure, read “Important Notes”, pages 23–30.
- Before using a reagent cartridge (RC) for the first time, check that Buffers QSL2 and QSB1 in the cartridge (RC) do not contain a precipitate. If necessary, remove the troughs containing Buffers QSL2 and QSB1 from the reagent cartridge (RC) and incubate for 30 minutes at 37°C with occasional shaking to dissolve precipitate. Make sure to replace the troughs in the correct positions. If the reagent cartridge (RC) is already pierced, make sure that the troughs are sealed with Reuse Seal Strips and incubate the complete reagent cartridge (RC) for 30 minutes at 37°C with occasional shaking in a water bath.[†]
- Try to avoid vigorous shaking of the reagent cartridge (RC) otherwise foam may be generated, which can lead to liquid-level detection problems.

[†] Ensure that instruments have been checked, maintained, and calibrated regularly according to the manufacturer’s instructions.

- All components of the QIA Symphony DSP Virus/Pathogen Midi Kit have been shown to be stable onboard the QIA Symphony SP/AS instruments for at least the normal time required to process 96 samples.

Things to do before starting

- Prepare all required mixtures, including mixtures containing carrier RNA (CARRIER) and internal controls just before starting. For more information, see “Preparing carrier RNA (CARRIER)–Buffer AVE (AVE) mixtures”, page 28, and “Using an internal control”, page 28.
- Make sure that the piercing lid (PL) is placed on the reagent cartridge (RC) and the lid of the magnetic-particle trough has been removed or, if using a partially used reagent cartridge (RC), make sure the Reuse Seal Strips have been removed.
- Before starting the procedure, ensure that the magnetic particles are fully resuspended. Vortex the trough containing the magnetic particles vigorously for at least 3 minutes before first use.
- Before loading the reagent cartridge (RC), remove the cover from the trough containing the magnetic particles and open the enzyme tubes. Make sure that the enzyme rack has been equilibrated to room temperature (15–25°C). Make sure that the piercing lid (PL) is placed on the reagent cartridge (RC) or, if using a partially used reagent cartridge, make sure the Reuse Seal Strips have been removed.
- If samples are bar coded, orient samples in the tube carrier so that the bar codes face the bar code reader within the “Sample” drawer at the left side of the QIA Symphony SP.

Procedure

- 1. Close all drawers and the hoods of the QIA Symphony SP/AS instruments.**
- 2. Switch on the instruments, and wait until the “Sample Preparation” screen appears and the initialization procedure has finished.**
The power switch is located at the bottom, left corner of the QIA Symphony SP.
- 3. Log in to the instruments.**
- 4. Ensure the “Waste” drawer is prepared properly (see Table 8), and perform an inventory scan of the “Waste” drawer, including the tip chute and liquid waste. Replace the tip disposal bag if necessary.**

Table 8. Preparing the “Waste” drawer

Unit box holder 1–4	Empty unit boxes
Waste bag holder	Apply waste bag
Liquid waste bottle holder	Empty and install liquid waste bottle

5. Load the required elution rack into the “Eluate” drawer.

Use only “Elution slot 1” with the corresponding cooling adapter (Cooling Adapter, EMT, v2, Qsym, cat. no. 920730). For integrated operation, place the elution rack with adapter, including the transfer frame on slot 1.

6. Load the required reagent cartridge(s) (RC) and consumables into the “Reagents and Consumables” drawer (see Tables 9 and 10).

 Numbers of filter-tips given may differ from the numbers displayed in the touchscreen depending on settings.

Table 9. Preparing the “Reagents and Consumables” drawer

RC Position 1 and 2	Load 1 reagent cartridge (RC) for up to 48 samples or 2 new reagent cartridges (RC) for up to 96 samples
Tip rack holder position 1–4	Load sufficient racks of disposable filter-tips, 200 μ l (see Table 10)
Tip rack holder position 5–18	Load sufficient racks of disposable filter-tips, 1500 μ l (see Table 10)
Unit box holder position 1–3	Load 3 unit boxes containing sample prep cartridges
Unit box holder position 4	Load 1 unit box containing 8-Rod Covers

Table 10. Required plasticware for 1–4 sample batches

	One batch, 24 samples*	Two batches, 48 samples*	Three batches, 72 samples*	Four batches, 96 samples*
Disposable filter-tips, 200 μl^{†‡}	28	52	76	100
Disposable filter-tips, 1500 μl^{†‡}	113	206	309	402
Sample prep cartridges[§]	21	42	54	72
8-Rod Covers[¶]	3	6	9	12

* Use of more than one internal control tube per batch and performing more than one inventory scan requires additional disposable filter tips.

† There are 32 filter-tips/tip rack.

‡ Number of required filter-tips includes filter-tips for 1 inventory scan per reagent cartridge.

§ There are 28 sample prep cartridges/unit box.

¶ There are twelve 8-Rod Covers/unit box.

- 7. Perform an inventory scan of the “Reagents and Consumables” drawer.**
- 8. Place the samples into the appropriate tube carrier, and load them into the “Sample” drawer (see Table 11).**

Table 11. Loading samples into the “Sample” drawer

Sample type	Plasma
Sample volume (including excess volume)	1200 μ l
Sample tubes	Micro tubes 2.0 ml Type H or Micro tubes 2.0 ml Type I (Sarstedt, cat. nos. 72.693 and 72.694)
Insert	Tube Insert 3B (cat. no. 9242083)

9. Place the tube(s) containing the carrier RNA (CARRIER)–Buffer AVE (AVE) mixture, including internal control, into the tube carrier and load into slot A of the “Sample” drawer.

For more information about preparing the mixture, see “Preparing carrier RNA (CARRIER)–Buffer AVE (AVE) mixtures”, page 28, and “Using an internal control”, page 28.

10. Using the touchscreen, enter the required information for each batch of samples to be processed.

Enter the following information:

- Sample information
- Protocol to be run (choose Assay Control Set “Cellfree1000_V4_DSP artus HIV”^{*} from category “artus_QS-RGQ”)
- Elution volume 60 μ l (see Table 12) and output position “slot 1”
- Tube(s) containing the carrier RNA (CARRIER)–Buffer AVE (AVE) mixture, including internal control (choose IC name “Cellfree1000_V4_DSP artus HIV”^{*})

After information about the batch has been entered, the status changes from “LOADED” to “QUEUED”. As soon as one batch is queued the “Run” button appears.

Table 12. Preselected elution volume

Preselected elution volume (μ l) [†]	Initial elution volume (μ l) [‡]
60	90

[†] The elution volume preselected for the protocol. This is the minimum accessible volume of eluate in the final elution tube.

[‡] The initial volume of elution solution required to ensure that the actual volume of eluate is the same as the preselected volume.

11. Press the “Run” button to start the purification procedure.

All processing steps are fully automated. At the end of the protocol run, the status of the batch changes from “RUNNING” to “COMPLETED”.

^{*} V4 or higher, as required by the software version used.

- 12. When sample processing is complete, either manually remove the elution rack from the “Eluate” drawer (independent operation), or perform direct transfer of the elution rack to the QIASymphony AS via the transfer module (integrated operation).**

For independent operation, remove the elution rack from the slot on the touchscreen, and then open the “Eluate” drawer and manually remove the elution rack.

For integrated operation, press “Transfer” to transfer the elution rack from slot 1 of the QIASymphony SP to slot 2 of the QIASymphony AS.

We recommend immediately (≤ 30 min) proceeding with assay setup on the QIASymphony AS after the run has finished. Depending on temperature and humidity, eluates left in the QIASymphony SP after the run is completed may experience condensation or evaporation.

For short-term storage of up to 24 h, we recommend storing purified nucleic acids at 2–8°C. For long-term storage of over 24 h, we recommend storage purified nucleic acids at –20°C.

Result files are generated for each elution rack.

- 13. If a reagent cartridge (RC) is only partially used, seal it with the provided Reuse Seal Strips and close tubes containing proteinase K with screw caps immediately after the end of the protocol run to avoid evaporation.**

 For more information about storage of partially used reagent cartridges (RC), see “Storage” in the *QIASymphony DSP Virus/Pathogen Handbook*.

- 14. Discard used sample tubes, plates, and waste according to your local safety regulations.**

See the *QIASymphony DSP Virus/Pathogen Handbook* for safety information.

- 15. Close the instrument drawers, and proceed with assay setup on the QIASymphony AS (page 37).**

- 16. Clean the QIASymphony SP during the assay setup on the QIASymphony AS or later.**

For integrated operation, clean all instruments at the end of the completed workflow.

Follow the maintenance instructions in the *QIASymphony SP/AS User Manual — General Description*. Make sure to carry out maintenance regularly to minimize the risk of cross-contamination.

Protocol: Assay Setup on the QIAasymphony AS

The QIAasymphony AS carries out assay setup for 6–72 reactions. Samples processed on the QIAasymphony SP can be transferred automatically to the QIAasymphony AS (integrated operation). For extra flexibility, the QIAasymphony SP and AS can also be operated independently.*

Details of the assay are shown in Table 13.

Table 13. Assay parameters using the *artus* HI Virus-1 QS-RGQ Kit

Process information	Details
Sample input material	Eluate
Master mix volume	30 μ l
Template volume	20 μ l
Number of reactions	6–24 or 6–72 [†]
Runtime [‡]	For 6 reactions: approximately 9 minutes For 72 reactions: approximately 35 minutes
Required software version	Version 3.1 or higher

[†] When running multiple assay runs, ensure that the limit of 72 reactions and 1 assay rack adapter is not exceeded. Avoid extended incubation time (>30 min) between completion of the assay run and transfer to the Rotor-Gene Q.

[‡] Assays were run with each reaction unique (no replicates), and master mix was prepared by the instrument.

Important points before starting

- Before beginning the procedure, read “Important Notes”, pages 23–30.
- The reagent volumes are optimized for 24 or 72 reactions per kit per run (cat. nos. 4513363 and 4513366, respectively).
- Before each use, all reagents need to be thawed completely, mixed (by repeated up and down pipetting or by quick vortexing), and centrifuged for at least 3 s at 6800 x g. Avoid foaming of the reagents.

* The QIAasymphony SP and AS remain physically connected during independent operation.

- Eluates from the sample preparation and all components of the *artus* HI Virus-1 QS-RGQ Kit have been shown to be stable onboard the instrument for at least the normal time required for sample purification for 96 samples and assay setup of 72 assays, including up to 30 min transfer time from the QIASymphony SP to the QIASymphony AS and up to 30 min transfer time from the QIASymphony AS to the Rotor-Gene Q.
- Work quickly and keep PCR reagents on ice or in the cooling block before loading.

Procedure

1. **Insert the tip chute.**
2. **Discard the tip disposal bag.**
3. **Install an empty tip disposal bag.**
4. **Switch to the assay setup user interface by pressing the “Switch” button in the status bar.**
5. **Start the assay definition process.**
For independent operation, press “New”.
For integrated operation, a message will appear asking whether to use the elution rack as a sample rack. Press “Yes” to confirm.
 The screens on the touchscreen guide the user through the assay definition process in a step-by-step fashion.
6. **Assign the sample rack to a “Sample” slot by selecting the rack file from the respective run on the QIASymphony SP.**
 If the elution rack has been automatically transferred to the QIASymphony AS, the rack file will be automatically assigned and the “Sample Rack(s)” screen of the assay setup user interface will already be filled out.
7. **Check sample rack for sample, EC+ and EC– positions, sample IDs, and volumes.**
8. **Select the Assay Parameter Set to use in the run (see Table 14).**

Table 14. Assay information using the *artus* HI Virus-1 QS-RGQ Kit

Release information	Details
Category	artus QS-RGQ
Assay Parameter Set	artus HIV-1 QS-RGQ_V1

* V1 or higher, as required by the software version used.

9. Assign the Assay Parameter Set to samples.

The Assay Parameter Set defines the parameters of the assay setup.

10. Define assay rack(s). At this stage, assay rack(s) can be loaded onto the "Assay" slot(s) (see Table 16).

11. Check the temperature of the cooling positions.

When the target cooling temperatures are reached, the slots will appear green.

12. Combine all tubes of HI Virus-1 RG Master A in a single kit into one tube before use. Combine all tubes of HI Virus-1 RG Master B in a single kit into one tube before use.

 Viscous reagents can be difficult to handle with manual pipets. Make sure to transfer the entire volume of the Master in the tube.

13. Fill each reagent tube with the required volume of appropriate reagent according to the loading information given by the instrument software.

 Before each use, all reagents need to be thawed completely, mixed (by repeated up and down pipetting or by quick vortexing), and centrifuged for at least 3 s at 6800 x g. Avoid bubbles or foaming, which could cause detection errors. Work quickly and keep PCR components on ice or in the cooling block before loading.

14. Place the reagent tubes, without lids, into the appropriate positions of precooled adapters for reagents (see Table 15).

Table 15. Consumables

Consumables	Name on touchscreen	For use with adapter/reagent holder
Strip Tubes and Caps, 0.1 ml (250)	QIA#981103 *StripTubes 0.1	RG Strip Tubes 72 QS
Tubes, conical, 2 ml, Qsym AS (500)*†	QIA#997102 *T2.0 ScrewSkirt†	Reagent holder 1 QS Reagent holder 2 QS
Tube, conical, 5 ml, Qsym AS (500)*†	QIA#997104 *T5.0 ScrewSkirt†	Reagent holder 1 QS Reagent holder 2 QS
Reagent Bottles, 30ml, Qsym AS (50)*	QIA#997108 *Bottle 30ml‡	Reagent holder 2 QS
Elution Microtubes CL (24 x 96)	QIA#19588 * EMTR	Elution Microtube Rack QS

* For master mix components, system-prepared master mix, assay standards, and assay controls.

† Alternatively, the Sarstedt tubes described on page 22 can be used.

‡ The suffix "(m)" in the touchscreen indicates that liquid level calculations for the respective tube have been optimized for reagents forming a concave meniscus.

15. Open the "Eluate and Reagents" and "Assays" drawers.

16. Load the prepared reagent adapter into the appropriate slot. Enter a kit bar code for the assay through the "List view" of the "Loading Reagents" screen.

17. If not already done, place the Strip Tubes into the precooled RG Strip Tubes 72 QS adapter (see Table 16), and place into the appropriate slot(s).

Table 16. Adapters and reagent holders

Rack/reagent holder	Name	Number required[§]
Sample rack	Elution Microtube Rack QS	1
Reagent holders	Reagent holder 1 QS	1
Assay racks	RG Strip Tubes 72 QS	1

[§] Calculated for an assay run with 72 reactions.

18. If the elution rack has not already been transferred to the QIASymphony AS (see step 12 of the purification protocol, page 36), place the Elution Microtubes CL into the precooled Elution Microtube Rack QS adapter (see Table 16), and place the prepared adapter into the slot indicated.

For independent operation, remove the elution rack from the slot on the touchscreen, and then open the “Eluate” drawer of the QIASymphony SP and manually remove the elution rack.

19. Load disposable filter-tips into the “Eluate and Reagents” and “Assays” drawers, according to the required number of each tip type (see Tables 17 and 18).

Load tip racks starting with tip slots 1, 2, and 3 in the “Eluate and Reagents” drawer, and then load tip racks into tip slots 7, 8, and 9 in the “Assays” drawer.

Table 17. Filter-tips

Consumables	Name on touchscreen
Filter-Tips, 1500 μ l (1024)	1500 μ l
Filter-Tips, 200 μ l (1024)	200 μ l
Filter-Tips, 50 μ l (1024)	50 μ l

Table 18. Consumables consumption*

Consumable	Number for 24 reactions	Number for 72 reactions
Filter-Tips, 1500 μ l	5	6
Filter-Tips, 200 μ l	10	10
Filter-Tips, 50 μ l	25	73
Tip Disposal Bags	1	1

* This table provides example consumables consumption for an assay run with the following specifications: 19 or 67 templates, 4 assay standards, one no template control (NTC), samples with internal control (IC), master mix prepared by the instrument.

① Filter-tip consumption can be affected by some processes on the QIASymphony AS (e.g., liquid-level detection).

20. Close the “Eluate and Reagents” and “Assays” drawers.

21. Upon closing each drawer, press “Yes” to start the inventory scan for each drawer.

The inventory scan checks the slots, adapters, filter-tips, and the tip chute. If required, correct any errors.

22. Press “Queue”. Monitoring of the cooling starts.

23. Wait until the target cooling temperatures are reached.

When the target cooling temperatures are reached, the slots will appear green.

24. Press “Run” to start the run.

25. After the run is finished, press “Remove” in the assay setup “Overview” screen. Open the “Assays” drawer and unload the assay rack(s).

26. Download the result and cyler files.

27. Proceed to “Protocol: RT-PCR and Data Analysis on the Rotor-Gene Q”, page 43.

28. Perform the regular maintenance of the QIASymphony AS during the PCR run on the Rotor-Gene Q or later.

For integrated operation, clean all instruments at the end of the completed workflow.

Follow the maintenance instructions in the *QIASymphony SP/AS User Manual — General Description*. Make sure to carry out maintenance regularly to minimize the risk of cross-contamination.

Protocol: RT-PCR and Data Analysis on the Rotor-Gene Q

i Important points before starting

- Before beginning the procedure, read “Important Notes”, pages 23–30.
- Take time to familiarize yourself with the Rotor-Gene Q before starting the protocol. See the instrument user manual.
- Make sure that at all 4 quantitation standards as well as at least one negative control (Water, PCR grade) are included per PCR run. To generate a standard curve, use all 4 quantitation standards supplied (HI Virus-1 QS 1–4) for each PCR run.

Procedure

1. **Close the PCR tubes, and place them in the 72-Well Rotor of the Rotor-Gene Q. Make sure to transfer the Rotor-Gene Q 4-strip tubes in the correct orientation, so that the position indices of the cooling adapter and the rotor match. Make sure that the locking ring (accessory of the Rotor-Gene Instrument) is placed on top of the rotor to prevent accidental opening of the tubes during the run.**
2. **Transfer the cycler file from the QIA Symphony AS to the Rotor-Gene Q computer.**
3. **For the detection of HIV-1 RNA, create a temperature profile according to the following steps.**

Setting the general assay parameters	Figures 7, 8, 9
Reverse transcription of the RNA	Figure 10
Initial activation of the hot-start enzyme	Figure 11
Amplification of the cDNA	Figure 12
Adjusting the fluorescence channel sensitivity	Figure 13
Starting the run	Figure 14

All specifications refer to the Rotor-Gene Q software version 2.02. Please find further information on programming Rotor-Gene Q instruments in the instrument user manual. In the illustrations these settings are framed in bold black.

4. First, open the “New Run Wizard” dialog box (Figure 7). Check the “Locking Ring Attached” box and click “Next”.

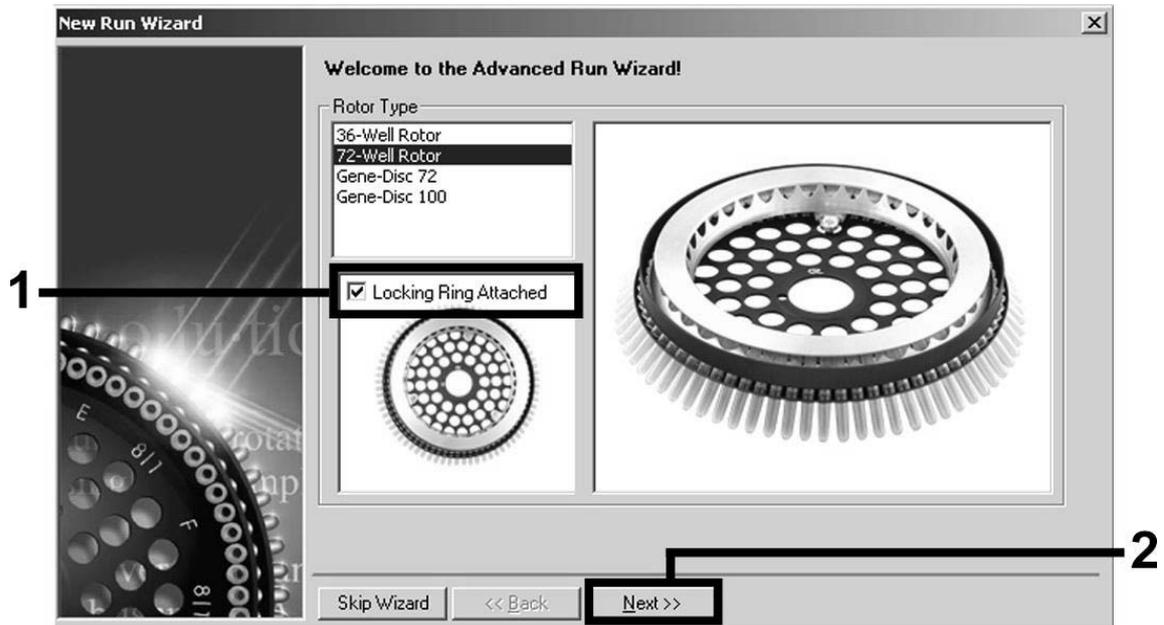


Figure 7. The “New Run Wizard” dialog box.

5. Select 50 for the PCR reaction volume and click “Next” (Figure 8).

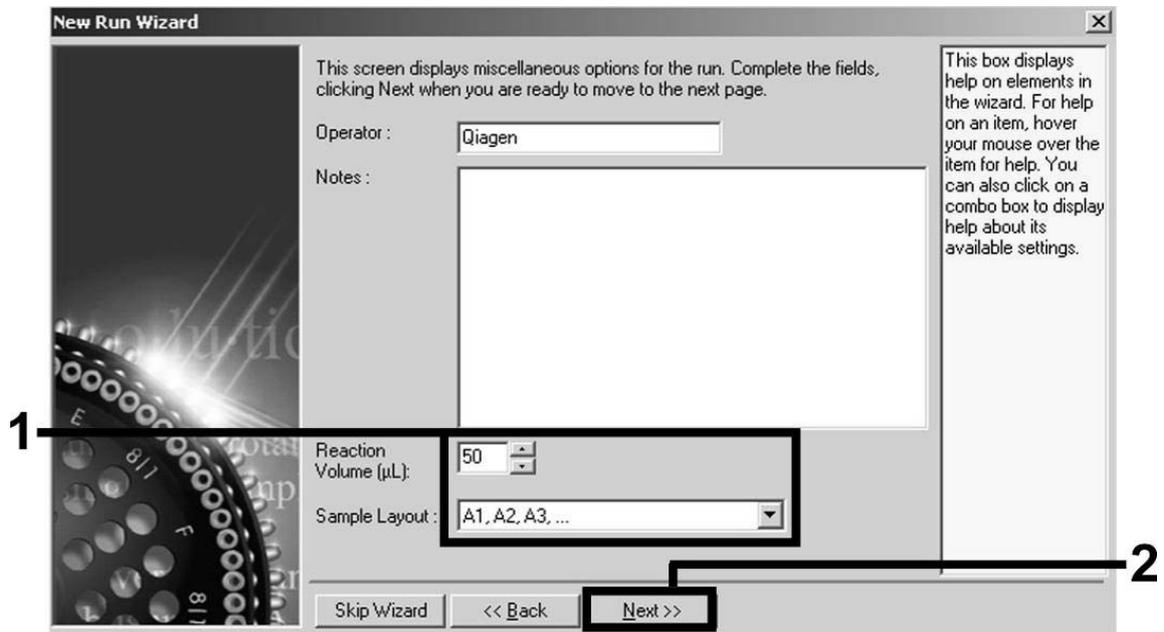


Figure 8. Setting the general assay parameters.

- Click the “Edit Profile” button in the next “New Run Wizard” dialog box (Figure 9), and program the temperature profile as shown in Figures 9–12).

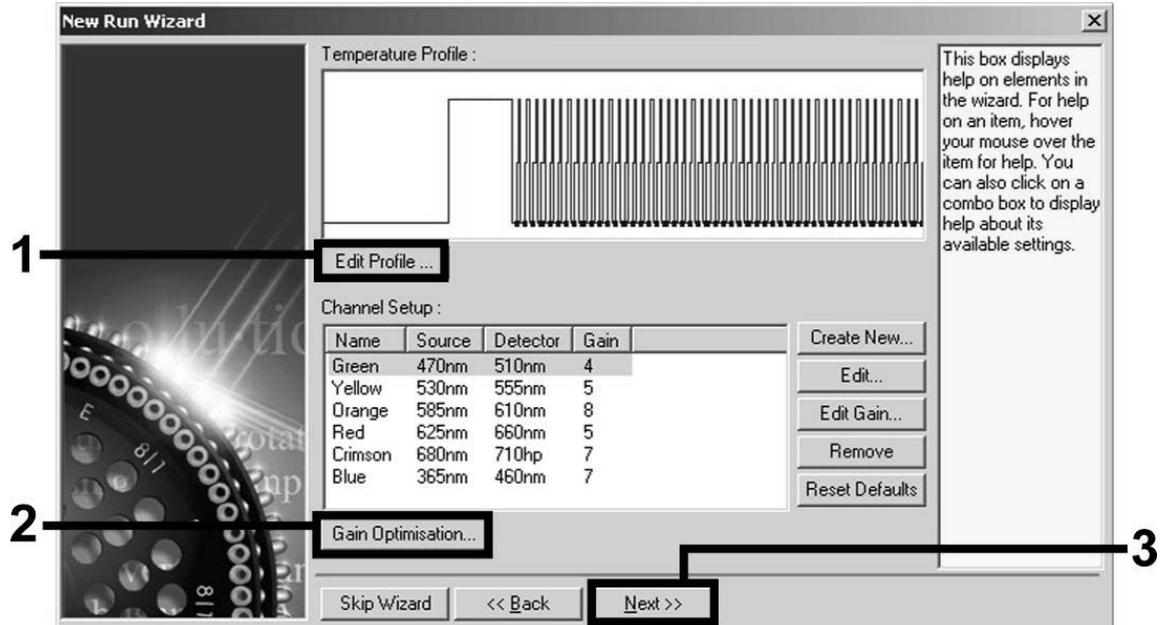


Figure 9. Editing the profile.

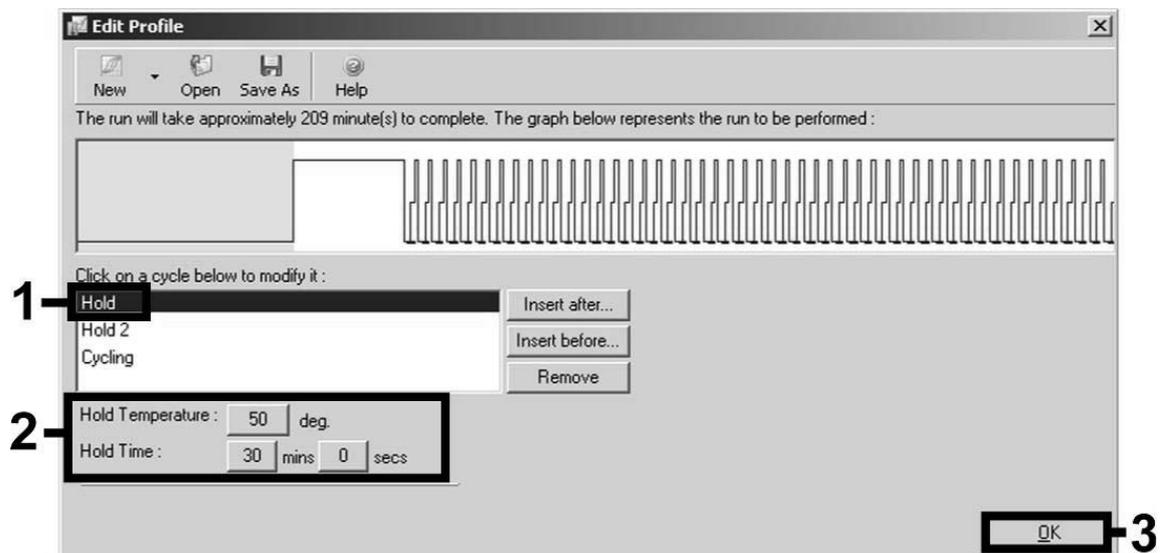


Figure 10. Reverse transcription of the RNA.

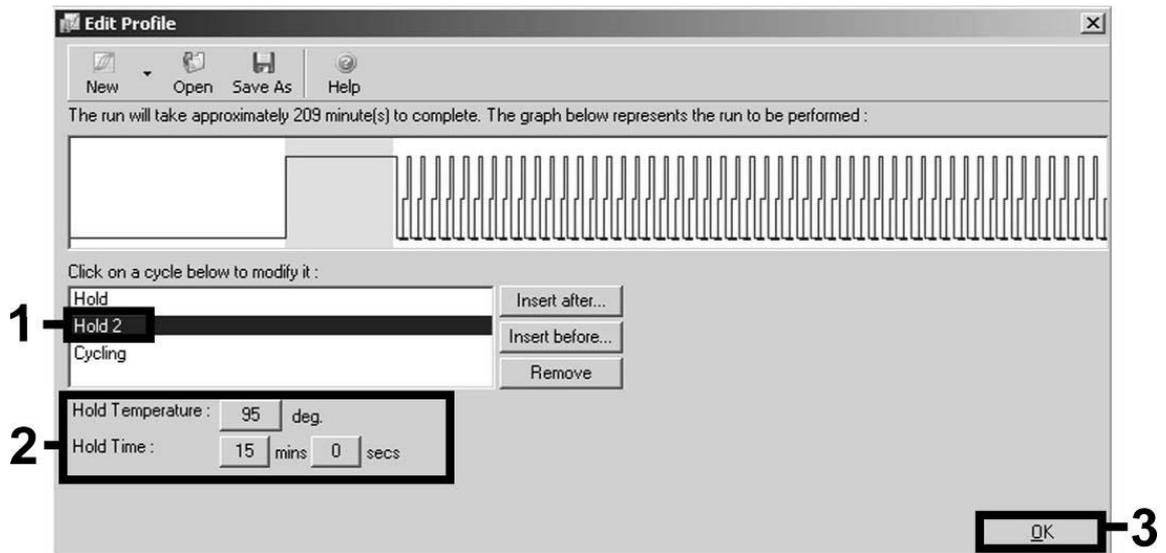


Figure 11. Initial activation of the hot-start enzyme.

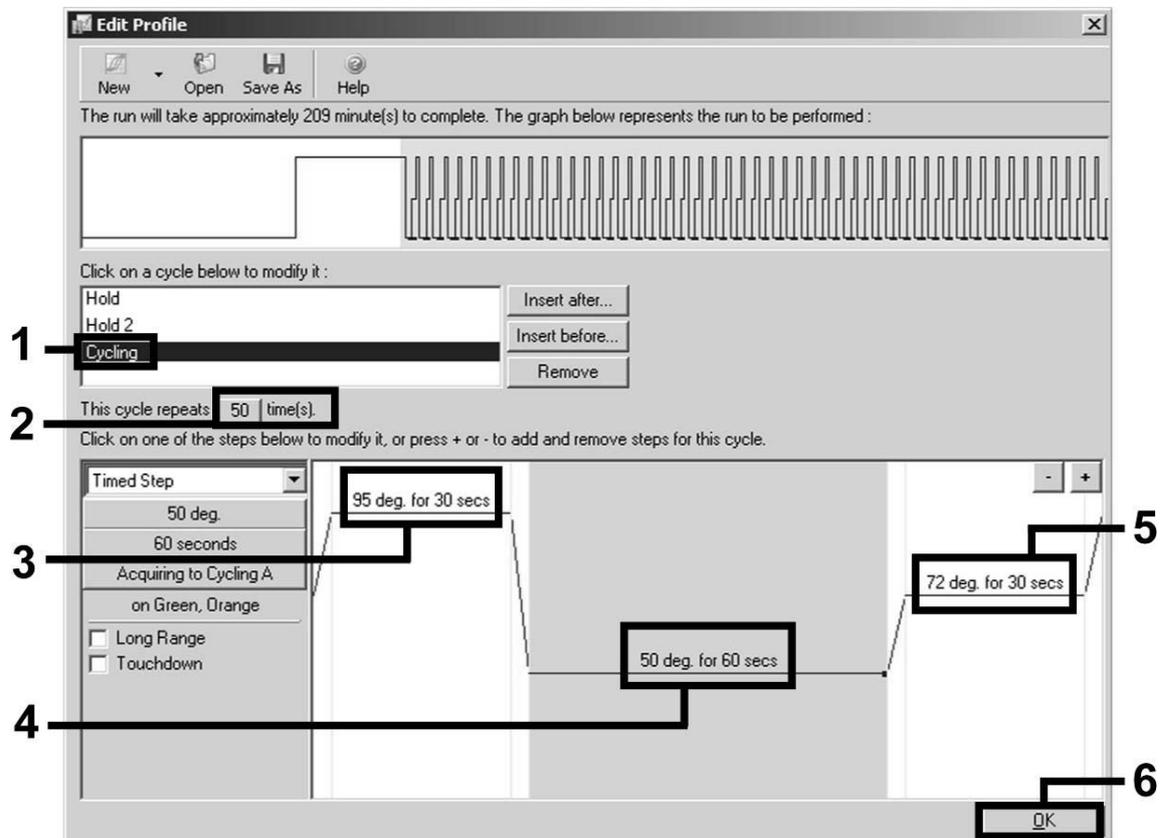


Figure 12. Amplification of the cDNA.

7. The detection range of the fluorescence channels has to be determined according to the fluorescence intensities in the PCR tubes. Click "Gain Optimisation" in the "New Run Wizard" dialog box (see Figure 9) to open the "Auto-Gain Optimisation Setup" dialog box. Set the calibration temperature to 50 to match the annealing temperature of the amplification program (Figure 13).

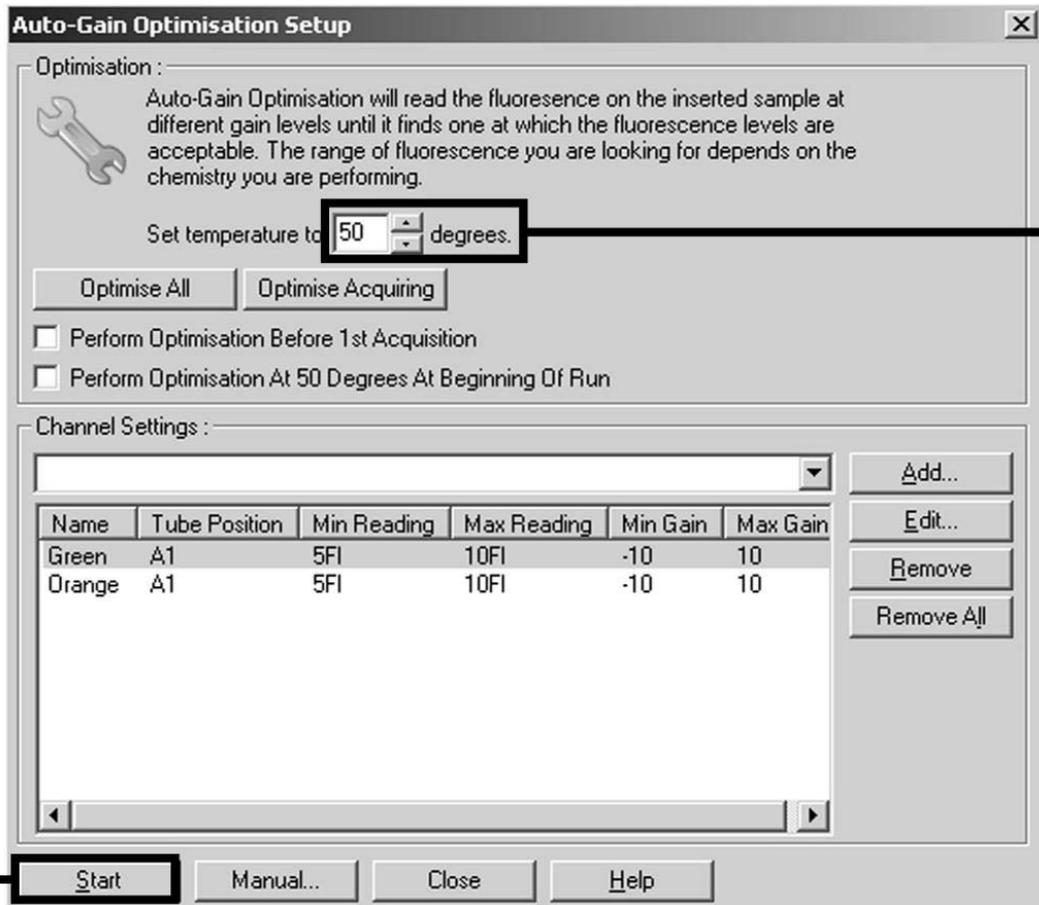


Figure 13. Adjusting the fluorescence channel sensitivity.

8. The gain values determined by the channel calibration are saved automatically and are listed in the last menu window of the programming procedure (Figure 14). Click “Start Run”.

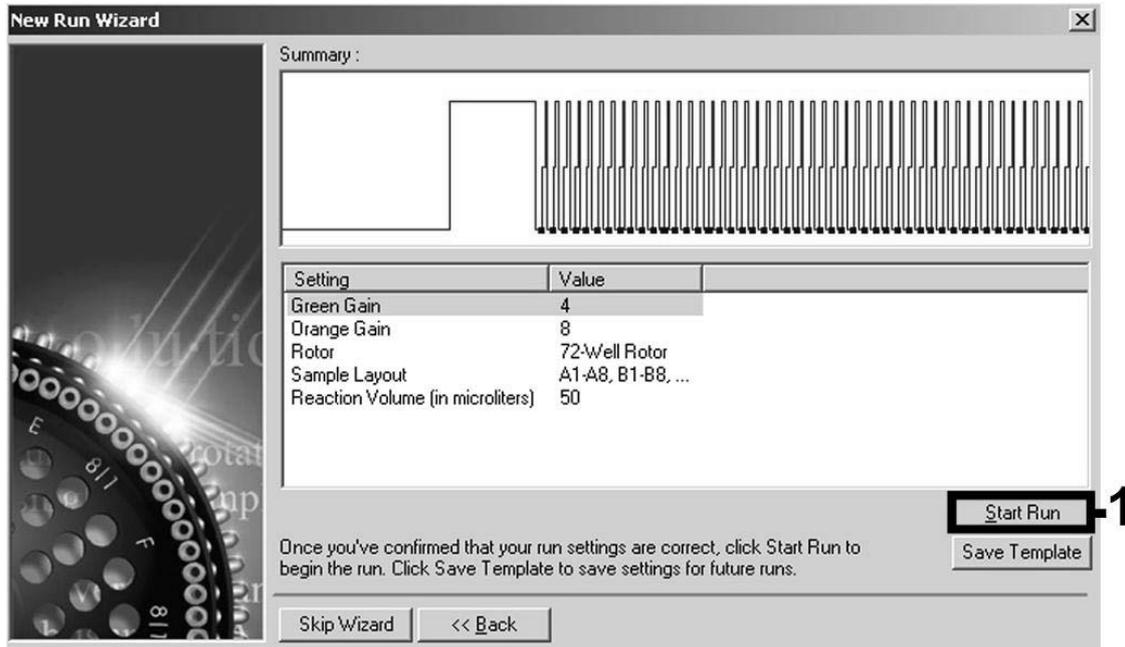


Figure 14. Starting the run.

9. After starting the run, import the information from the cycler file by clicking the  (“Open”) button, or edit the samples manually.
10. After the run is finished, analyze the data. The following results (10a, 10b, and 10c) are possible.

Examples of positive and negative PCR reactions are given in Figure 15 and Figure 16.

Table 19 shows guidelines for interpretation of quantitative results.

- 10a. A signal is detected in fluorescence channel Cycling Green.
The result of the analysis is positive: the sample contains HIV-1 RNA.

In this case, the detection of a signal in the Cycling Orange channel is dispensable, since high initial concentrations of HIV-1 RNA (positive signal in the Cycling Green channel) can lead to a reduced or absent fluorescence signal of the internal control in the Cycling Orange channel (competition).

10b. In fluorescence channel Cycling Green no signal is detected. At the same time, a signal from the internal control appears in the Cycling Orange channel.

In the sample no HIV-1 RNA is detectable. It can be considered negative.

In the case of a negative HI Virus-1 RT-PCR, the detected signal of the internal control rules out the possibility of RT-PCR inhibition.

i However, if the C_T value for the internal control of a negative sample is more than 3 cycles higher than the C_T value for the internal control of the no template control in the run ($C_{T\ IC\ Sample} - C_{T\ IC\ NTC} > 3$), then the sample should be treated as invalid. No result can be concluded.

10c. No signal is detected in the Cycling Green or in the Cycling Orange channels.

No result can be concluded.

Information regarding error sources and their solution can be found in "Troubleshooting Guide", page 51.

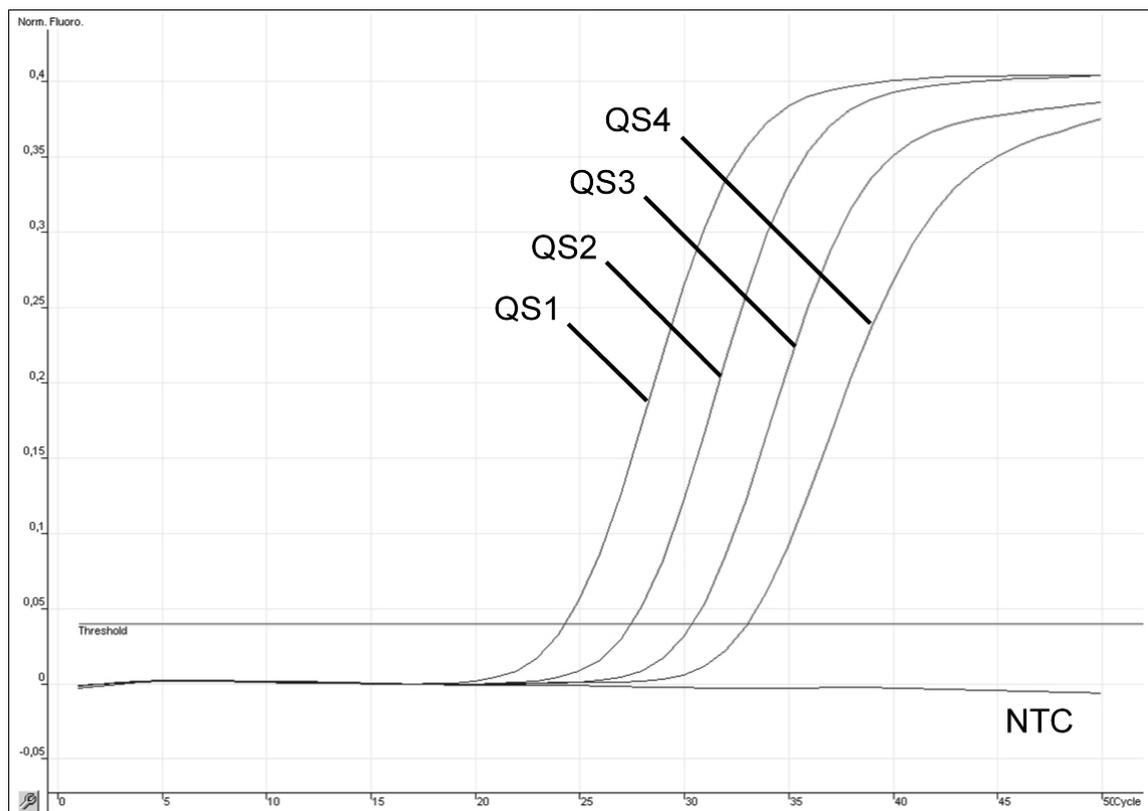


Figure 15. Detection of the quantitation standards (HI Virus-1 RG QS 1–4) in fluorescence channel Cycling Green. NTC: No template control (negative control).

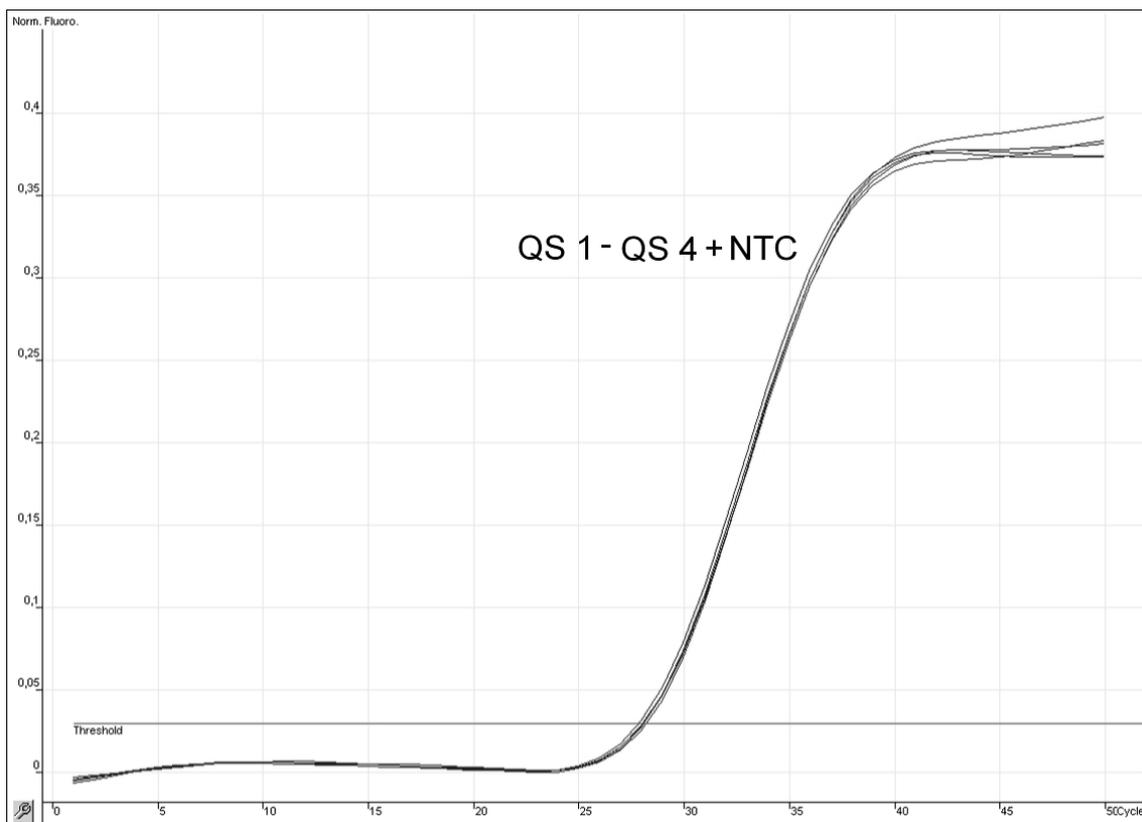


Figure 16. Detection of the internal control (IC) in fluorescence channel Cycling Orange with simultaneous amplification of the quantitation standards (HI Virus-1 RG QS 1–4). NTC: No template control (negative control).

Table 19. Interpretation of quantitative results

Result	Interpretation
HIV RNA >76.4 IU/ml*	The result is within the determined test range. The detection probability of HIV RNA is >95%. The positive test result is statistically ensured.
HIV RNA <76.4 IU/ml*	The result is outside the determined test range. The reproducibility of the positive result is not assured.
HIV RNA negative	No HIV RNA was detected.

* Limit of detection. See "Analytical sensitivity", page 10.

Troubleshooting Guide

This troubleshooting guide may be helpful in solving any problems that may arise. For more information, see also the Frequently Asked Questions page at our Technical Support Center: www.qiagen.com/FAQ/FAQList.aspx. The scientists in QIAGEN Technical Services are always happy to answer any questions you may have about either the information and protocols in this handbook or sample and assay technologies (for contact information, see back cover or visit www.qiagen.com).

Comments and suggestions

General handling

Error message displayed in the touchscreen

i If an error message is displayed during a protocol run, refer to the user manuals supplied with your instruments.

Precipitate in reagent trough of opened cartridge of the QIASymphony DSP Virus/Pathogen Midi Kit

a) Buffer evaporation

i Excessive evaporation may lead to increased salt concentration or decreased alcohol concentrations in buffers. Discard reagent cartridge (RC). Make sure to seal buffer troughs of a partially used reagent cartridge (RC) with Reuse Seal Strips when not being used for purification.

b) Storage of reagent cartridge (RC)

i Storage of reagent cartridge (RC) under 15°C may lead to formation of precipitates. If necessary, remove the troughs containing Buffers QSL2 and QSB1 from the reagent cartridge (RC) and incubate in a water bath* at 37°C for 30 min with occasional shaking to dissolve precipitate. Make sure to replace the troughs in the correct positions. If the reagent cartridge (RC) is already pierced, make sure that the troughs are reclosed with Reuse Seal Strips and incubate the complete reagent cartridge (RC) in a water bath* at 37°C for 30 min with occasional shaking.

* Ensure that instruments have been checked, maintained, and calibrated regularly according to the manufacturer's instructions.

Comments and suggestions

Low yield of nucleic acids

- a) Magnetic particles were not completely resuspended **i** Before starting the procedure, ensure that the magnetic particles are fully resuspended. Vortex for at least 3 min before use.
- b) Frozen samples were not mixed properly after thawing **i** Thaw frozen samples with mild agitation to ensure thorough mixing.
- c) Carrier RNA (CARRIER) not added **i** Reconstitute carrier RNA (CARRIER) in Buffer AVE (AVE) and mix with appropriate volume of Buffer AVE (AVE) as described in "Preparing carrier RNA (CARRIER)–Buffer AVE (AVE) mixtures" starting on page 28. Repeat the purification procedure with new samples.
- d) Degraded nucleic acids **i** Samples were stored incorrectly or subjected to too many freeze–thaw cycles. Repeat the purification procedure with new samples.
- e) Incomplete sample lysis **i** Before use, check that Buffer QSL2 and QSB1 do not contain precipitates. If necessary, remove the troughs containing Buffers QSL1 and QSB1 from the reagent cartridge (RC) and incubate for 30 min at 37°C with occasional shaking to dissolve precipitate. If the reagent cartridge (RC) is already pierced, make sure that the troughs are reclosed with Reuse Seal Strips, and incubate the complete reagent cartridge (RC) for 30 min at 37°C with occasional shaking in a water bath.*
- f) Clogging of pipet tip due to insoluble material **i** Insoluble material was not removed from the sample prior to starting the QIA Symphony purification procedure. To remove insoluble material for viral applications, centrifuge the sample at 3000 x g for 1 min, and transfer the supernatant to a new sample tube.

* Ensure that instruments have been checked, maintained, and calibrated regularly according to the manufacturer's instructions.

Comments and suggestions

QIA Symphony AS detects insufficient Master

Not all of the Master transferred to tube

i Combine all tubes of HI Virus-1 RG Master A in a single kit into one tube before use. Combine all tubes of HI Virus-1 RG Master B in a single kit into one tube before use. Viscous reagents can be difficult to handle with manual pipets. Make sure to transfer the entire volume of the Master in the tube.

i For viscous reagents, we recommend aspirating an extra volume of 5% when using manual pipets (e.g., adjust the pipet to 840 μ l for an 800 μ l volume).

i Alternatively, after slowly dispensing the liquid and performing a blowout at the target tube's wall, remove the tip from the liquid, release the pipet plunger, and wait for an additional 10 s. Residual liquid will flow down the tip and can be blown out by pressing the pipet plunger a second time. The use of PCR grade filter-tips labeled as "low retention" can improve the recovery of liquid.

No signal with positive controls (HI Virus-1 RG QS 1–4) in fluorescence channel Cycling Green

a) The selected fluorescence channel for PCR data analysis does not comply with the protocol

i For data analysis select the fluorescence channel Cycling Green for the analytical HI Virus-1 PCR and the fluorescence channel Cycling Orange for the internal control PCR.

b) Incorrect programming of the temperature profile of the Rotor-Gene instrument

i Compare the temperature profile with the protocol. See "Protocol: RT-PCR and Data Analysis on the Rotor-Gene Q", page 43.

c) Incorrect configuration of the PCR

i Make sure that assay setup was performed correctly and that the correct Assay Parameter Set was used. Repeat the PCR, if necessary. See "Protocol: Assay Setup on the QIA Symphony AS", page 37.

Comments and suggestions

- d) The storage conditions for one or more kit components did not comply with the instructions given in "Storage" (page 6) **i** Check the storage conditions and the expiration date (see the kit label) of the reagents and use a new kit, if necessary.
- e) The *artus* HI Virus-1 QS-RGQ Kit has expired **i** Check the storage conditions and the expiration date (see the kit label) of the reagents and use a new kit, if necessary.

Weak or no signal of the internal control of a negative plasma sample subjected to purification using the QIA Symphony DSP Virus/Pathogen Midi Kit in fluorescence channel Cycling Orange and simultaneous absence of a signal in channel Cycling Green

- a) The PCR conditions do not comply with the protocol **i** Check the PCR conditions (see above) and repeat the PCR with corrected settings, if necessary.
- b) The PCR was inhibited **i** Make sure that you use the validated isolation method (see "Protocol: RNA Isolation on the QIA Symphony SP", page 31) and closely follow the instructions.
- c) RNA was lost during extraction **i** An absent signal of the internal control can indicate the loss of RNA during the extraction. Make sure that you use the validated isolation method (see "Protocol: RNA Isolation on the QIA Symphony SP", page 31) and closely follow the instructions.
i See also "Low yield of nucleic acids", above.
- d) The storage conditions for one or more kit components did not comply with the instructions given in "Storage" (page 6) **i** Check the storage conditions and the expiration date (see the kit label) of the reagents and use a new kit, if necessary.

Comments and suggestions

- e) The *artus* HI Virus-1 QS-RGQ Kit has expired
- ⓘ Check the storage conditions and the expiration date (see the kit label) of the reagents and use a new kit, if necessary.

Signals with the negative controls in fluorescence channel Cycling Green of the analytical PCR

- a) Contamination occurred during preparation of the PCR
- ⓘ Repeat the PCR with new reagents in replicates.
- ⓘ If possible, close the PCR tubes directly after addition of the sample to be tested.
- ⓘ Make sure that work space and instruments are decontaminated at regular intervals.
- b) Contamination occurred during extraction
- ⓘ Repeat the extraction and PCR of the sample to be tested using new reagents.
- ⓘ Make sure that work space and instruments are decontaminated at regular intervals.

References

QIAGEN maintains a large, up-to-date online database of scientific publications utilizing QIAGEN products. Comprehensive search options allow you to find the articles you need, either by a simple keyword search or by specifying the application, research area, title, etc.

For a complete list of references, visit the QIAGEN Reference Database online at www.qiagen.com/RefDB/search.asp or contact QIAGEN Technical Services or your local distributor.

Ordering Information

Product	Contents	Cat. no.
<i>artus</i> HI Virus-1 QS-RGQ Kit (24)	For 24 reactions: 2 Masters, 4 Quantitation Standards, Internal Control, Water (PCR grade)	4513363
<i>artus</i> HI Virus-1 QS-RGQ Kit (72)	For 72 reactions: 2 Masters, 4 Quantitation Standards, Internal Control, Water (PCR grade)	4513366
QIASymphony DSP Virus/Pathogen Midi Kit — for automated purification of viral nucleic acids or pathogen DNA from 1–96 samples		
QIASymphony DSP Virus/Pathogen Midi Kit (96)	For up to 96 preps of 1000 μ l each: Includes 2 reagent cartridges and enzyme racks and accessories	937055
QIASymphony RGQ system		
QIASymphony RGQ, System	QIASymphony SP, QIASymphony AS, Rotor-Gene Q MDx 5plex HRM, required accessories and consumables, installation and training	9001850
QIASymphony SP/AS instruments and accessories		
QIASymphony SP	QIASymphony sample prep module, 1-year warranty on parts and labor	9001297
QIASymphony AS	QIASymphony assay setup module, 1-year warranty on parts and labor	9001301
Sample Prep Cartridges, 8-well (336)	8-well sample prep cartridges for use with the QIASymphony SP	997002
8-Rod Covers (144)	8-Rod Covers for use with the QIASymphony SP	997004
Cooling Adapter, EMT, v2, Qsym	Cooling adapter for EMT racks; for use with the QIASymphony SP/AS instruments (software version 3.1 or higher)	920730
Reuse Seal Set (20)	Reuse seal sets for sealing partly used QIASymphony reagent cartridges	997006

Product	Contents	Cat. no.
Insert, 2.0ml v2, samplecarr. (24), Qsym	Secondary tube adapter (for 2 ml screw-cap tubes, tube insert 3b) for use with the QIASymphony SP tube carrier	9242083
Elution Microtubes CL (24 x 96)	Nonsterile polypropylene tubes (0.85 ml maximum capacity, less than 0.7 ml storage capacity, 0.4 ml elution capacity); 2304 in racks of 96; includes cap strips	19588
Cooling Adapter, Reagent Holder 1, Qsym	Adapter for holding 18 x 2 ml conical tubes, and 6 x 5 ml conical tubes; for use with the QIASymphony SP/AS instruments (software version 3.1 or higher)	9018090
Cooling Adapter, Reagent Holder 2, Qsym	Adapter for holding 18 x 2 ml conical tubes, 2 x 5 ml conical tubes, and 2 x Reagent Bottles, 30 ml; for use with the QIASymphony SP/AS instruments (software version 3.1 or higher)	9018089
Cooling Adapter, RG Strip Tubes 72, Qsym	Adapter for holding 18 strips of 4 tubes; for use with the QIASymphony SP/AS instruments (software version 3.1 or higher)	9018092
Tubes, conical, 2 ml, Qsym AS (500)	Conical tubes (2 ml) for holding reagent; for use with the QIASymphony AS	997102*
Tube, conical, 5 ml, Qsym AS (500)	Conical tubes (5 ml) for holding reagent; for use with the QIASymphony AS	997104*
Reagent Bottles, 30 ml, Qsym AS (50)	Reagent bottles (30 ml) with lids; for use with the QIASymphony AS	997108
Filter-Tips, 1500 μ l (1024)	Disposable Filter-Tips, racked; (8 x 128). For use with the QIASymphony SP	997024
Filter-Tips, 200 μ l (1024)	Disposable Filter-Tips, racked; (8 x 128). For use with the QIAcube and the QIASymphony SP	990332

* Please inquire for availability.

Product	Contents	Cat. no.
Filter-Tips, 50 μ l (1024)	Disposable Filter-Tips, racked (8 x 128). For use with the QIA Symphony AS	997120
Tip Disposal Bags (15)	Tip disposal bags for use with the QIA Symphony SP/AS instruments	9013395
Rotor-Gene Q and accessories		
Rotor-Gene Q MDx 5plex HRM System	Real-time PCR cycler and High Resolution Melt analyzer with 5 channels (green, yellow, orange, red, crimson) plus HRM channel, laptop computer, software, accessories, 1-year warranty on parts and labor	Inquire
Rotor-Gene Q MDx 5plex HRM Platform	Real-time PCR cycler and High Resolution Melt analyzer with 5 channels (green, yellow, orange, red, crimson) plus HRM channel, laptop computer, software, accessories, 1-year warranty on parts and labor; includes installation and training	Inquire
Rotor-Gene Q 5plex HRM System	Real-time PCR cycler and High Resolution Melt analyzer with 5 channels (green, yellow, orange, red, crimson) plus HRM channel, laptop computer, software, accessories, 1-year warranty on parts and labor	9001650
Rotor-Gene Q 5plex HRM Platform	Real-time PCR cycler and High Resolution Melt analyzer with 5 channels (green, yellow, orange, red, crimson) plus HRM channel, laptop computer, software, accessories, 1-year warranty on parts and labor; includes installation and training	9001580
Strip Tubes and Caps, 0.1 ml (250)	250 strips of 4 tubes and caps for 1000 reactions	981103
Strip Tubes and Caps, 0.1 ml (2500)	10 x 250 strips of 4 tubes and caps for 10,000 reactions	981106

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Spain ■ Orders 91-630-7050 ■ Fax 91-630-5145 ■ Technical 91-630-7050

Sweden ■ Orders 020-790282 ■ Fax 020-790582 ■ Technical 020-798328

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