

PrimerDesign™ Ltd

# Quantification of Human Rhinovirus genomes (all serotypes)

5'NCR

For general laboratory and research use only

## Standard Kit





# Contents

<b>Introduction to Human Rhinovirus</b>	<b>3</b>
<b>Specificity</b>	<b>3</b>
<b>Kit Contents</b>	<b>4</b>
<b>Reagents and equipment to be supplied by the user</b>	<b>4</b>
<b>Kit storage and stability</b>	<b>4</b>
<b>Suitable sample material</b>	<b>5</b>
<b>Dynamic range of test</b>	<b>5</b>
<b>Principles of the test</b>	<b>6</b>
<b>Bench side Protocol</b>	<b>8</b>
<b>Amplification Protocol</b>	<b>12</b>
<b>Notices and disclaimers</b>	<b>13</b>
<b>Trademarks</b>	<b>13</b>



## Introduction to Human Rhinovirus

Rhinovirus is a genus of the Picornaviridae family of viruses. Rhinoviruses are the most common viral infective agents in humans, and a causative agent of the common cold. There are over 105 serologic virus types that cause cold symptoms, and rhinoviruses are responsible for approximately 50% of all cases.

Rhinoviruses have single-stranded positive sense RNA genomes of between 7.2 and 8.5kb in length. At the 5' end of the genome is a virus-encoded protein, and like mammalian mRNA, there is a 3' poly-A tail. Structural proteins are encoded in the 5' region of the genome and non structural at the end. This is the same for all picornaviruses. The viral particles themselves are not enveloped and are icosahedral in structure.

Rhinoviruses are composed of a capsid that contains four viral proteins VP1, VP2, VP3 and VP4. VP1, VP2, and VP3 form the major part of the protein capsid. The much smaller VP4 protein has a more extended structure and lies at interface between the capsid and the RNA genome. There are 60 copies of each of these proteins assembled as an icosahedron. Antibodies are a major defense against infection with the epitopes lying on the exterior regions of VP1-VP3.

Rhinoviruses have two main modes of transmission: In the past it was obvious that these viruses were transmitted directly from person-to-person via aerosols of respiratory droplets. However, now they are known to be transmitted indirectly via respiratory droplets that are deposited on the hands and then transported by fingers to the nose or eyes.

Rhinoviruses occur worldwide causing disease especially at schools for example which enhance transmission during fall and winter. They show symptoms such as fever, cough, and nasal congestion. The frequency of colds is high in childhood and decreases during adulthood most probably because of the possession of immunity.

## Specificity

The *PrimerDesign™ Quantification Kit for Human Rhinovirus (HRVsp) Genomes* is designed for the *in vitro* quantification of all HRVsp subtypes. The primers have broad homology with a large range of serotypes included in the NCBI database. However, due to the inherent instability of RNA viral genomes, it is not possible guarantee quantification of all clinical isolates.



## Kit Contents

- Pathogen specific primer/probe mix (150 reactions **BROWN**)
- Pathogen positive control template (for Standard curve **RED**)
- Pathogen RT primer mix (150 reactions **GREEN**)
- RNase/DNase free water

## Reagents and equipment to be supplied by the user

- Real-Time PCR Instrument
- **Mastermix or Mastermix components**  
This kit is designed to work well with all commercially available Mastermixes. However, we recommend the use of PrimerDesign 2x *Precision*<sup>™</sup> Mastermix.
- Pipettors and Tips
- Vortex and centrifuge
- Thin walled 1.5 ml PCR reaction tubes

## Kit storage and stability

This kit is stable at room temperature. Once the lyophilised components have been re-suspended the kit should be stored at -20°C. Unnecessary repeated freeze/thawing should be avoided. Under these conditions reagents are stable for six months from date of purchase.



## Suitable sample material

All kinds of sample material suited for PCR amplification can be used. Please ensure the samples are suitable in terms of purity, concentration, and RNA/DNA integrity. Always run at least one negative control with the samples. To prepare a negative-control, replace the template RNA sample with RNase/DNase free water.

## Dynamic range of test

Under optimal PCR conditions PrimerDesign pathogen detection kits have very high priming efficiencies of >95% and can detect between  $1 \times 10^8$  and  $1 \times 10^2$  copies of target template.



# Principles of the test

## Real-time PCR

A pathogen specific primer and probe mix is provided and the target sequence can be detected through the **FAM** channel.

The primer and probe mix provided exploits the so-called TaqMan<sup>®</sup> principle. During PCR amplification, forward and reverse primers hybridize to the pathogen DNA/cDNA. A fluorogenic probe, is included in the same reaction mixture which consists of an oligonucleotide labeled with a 5'-reporter dye and a downstream, 3'-quencher. During PCR amplification, the probe is cleaved and the reporter dye and quencher are separated. The resulting increase in fluorescence can be detected on a range of real-time PCR platforms.

## Positive control

For copy number determination, and as a positive control for the PCR set up, the kit contains positive control template. This can be used to generate a standard curve of pathogen copy number / CT value. Alternatively the positive control can be used at a single dilution for a qualitative analysis of the samples. Each time the kit is used, at least one positive control reaction must be included on the run. A positive result indicates that the primers and probes for quantification of the target pathogen gene are working properly in your particular experimental scenario. If a negative result is obtained the test results are invalid and must be repeated. Care should be taken to ensure that the positive control does not contaminate any other kit component which would lead to false positive results. This can be achieved by handling this component in a Post PCR environment.

## Negative control

To confirm absence of contamination, a negative control reaction should be included every time the kit is used. For this reaction, the RNase/DNase free water should be used instead of template. A negative result indicates that the reagents have not become contaminated while setting up the run. If a positive result is obtained the results should be ignored and the test samples repeated. Possible sources or contamination should first be explored and removed.



### **Carry-over prevention using UNG (optional)**

Carry over contamination between PCR reactions can be prevented by including uracil-N-glycosylase (UNG) in the reaction mix. Some commercial mastermix preparations contain UNG or alternatively it can be added as a separate component. UNG can only prevent carry over from PCR reactions that include deoxyuridine triphosphate (dUTP) in the original PCR reaction. PrimerDesign recommend the application of 0.2 U UNG per assay with a 15 minute incubation step at 37°C prior to amplification. The heat-labile UNG is then inactivated during the Taq polymerase activation step (95°C for 10 minutes).



## Bench side Protocol

To minimize the risk of contamination with foreign DNA, we recommend that all pipetting be performed in a PCR clean environment. Ideally this would be a designated PCR cabinet. Filter tips are recommended for all pipetting steps.

### 1. Pulse-spin each tube in a centrifuge before opening.

This will ensure lyophilised primer and probe mix is in the base of the tube and is not spilt upon opening the tube.

### 2. Reconstitute the kit components according to the table below

To ensure complete resuspension, vortex each tube thoroughly, allow to stand for 5 minutes and vortex again before use.

Component	Volume
<b>Pre-PCR box</b>	
Pathogen Primer/Probe mix ( <b>BROWN</b> )	165 µl
Pathogen RT primer mix ( <b>GREEN</b> )	165 µl
<b>Post PCR bottle</b>	
Positive Control Template ( <b>RED</b> ) *	500 µl

\* This component contains high copy number template and is a VERY significant contamination risk. It must be opened and handled in a separate laboratory environment, away from the other components.



## Reverse Transcription

The protocols below are for PrimerDesign *Precision*<sup>™</sup> Reverse Transcription kit. If you are using an alternative RT kit then follow the manufacturer's instruction.

### 1. For each RNA sample prepare a reaction mix according to the table below:

Component	1 reaction
RNA template	X $\mu$ l
Pathogen RT primer mix ( <b>GREEN</b> )	1.0 $\mu$ l
dNTP mix 10mM of each ( <b>ORANGE</b> )	1.0 $\mu$ l
RNAse/DNAse free water ( <b>WHITE</b> )	X $\mu$ l
<b>Final volume</b>	<b>10 <math>\mu</math>l</b>

### 2. Heat samples to 65°C for 5 minutes.

This can be achieved using a thermostatically controlled “hot block” or heated water bath. Do not heat the RNA to a higher temperature as this can lead to RNA degradation.

### 3. Immediately cool the tubes in an ice water bath.

It is important that the samples are transferred directly from 65°C to the ice. Do not allow the samples to cool prior to cooling on ice.

### 4. For each RNA sample prepare a reaction mix according to the table below:

Component	1 reaction
MMLV 5Xbuffer ( <b>CLEAR</b> )	4.0 $\mu$ l
RNA/DNAse free water ( <b>WHITE</b> )	5.2 $\mu$ l
MMLV enzyme ( <b>CLEAR</b> )	0.8 $\mu$ l
<b>Final volume</b>	<b>10 <math>\mu</math>l</b>

### 5. Add 10 $\mu$ l of this mix to each of the samples on ice.

### 6. Apply a lid to each sample, mix tubes by briefly vortexing and incubate at 42°C for 60 minutes.

This can be achieved using a thermostatically controlled “hot-block” or heated water bath

### 7. Store cDNA samples at -20°C until use.



## Real-time PCR detection

### 1. Prepare a reaction mix according to the tables below:

Include sufficient reactions for the standard curve wells (8 samples in duplicate) and also the negative control.

#### Pathogen detection mix

Component	1 reaction
2X Precision™ Mastermix	10 µl
Pathogen primer/probe mix ( <b>BROWN</b> )	1.0 µl
RNAse/DNAse Free water	4.0 µl
<b>Final volume</b>	<b>15 µl</b>

2. Pipette 15µl of this mix into each well according to your real-time PCR experimental plate set up.

3. Prepare sample cDNA templates for each of your samples (suggested concentration 5ng/µl) in RNAse/DNAse free water.

If the concentration of RNA that was used to make the cDNA is not known, then dilute your RT reaction mix 1:20 (10µl of sample DNA and 90µl of water)

4. Pipette 5µl of diluted cDNA template into each well, according to your experimental plate set up.

For negative control wells use 5µl of RNAse/DNAse free water. The final volume in each well is 20µl



## 5. Preparation of standard curve dilution series

- 1) Pipette 900µl of RNase/DNase free water into 7 tubes and label 2-8
- 2) Pipette 100µl of Positive Control Template (**RED**) into tube 2
- 3) Vortex thoroughly
- 4) Change pipette tip and pipette 100µl from tube 2 into tube 3
- 5) Vortex thoroughly

Repeat steps 4 and 5 to complete the dilution series

Standard Curve	Copy Number
Tube 1 Positive control ( <b>RED</b> )	$2 \times 10^7$ per µl
Tube 2	$2 \times 10^6$ per µl
Tube 3	$2 \times 10^5$ per µl
Tube 4	$2 \times 10^4$ per µl
Tube 5	$2 \times 10^3$ per µl
Tube 6	$2 \times 10^2$ per µl
Tube 7	20 per µl
Tube 8	2 per µl

## 6. Pipette 5µl of standard template into each well, according to your experimental plate set up.

The final volume in each well is 20µl



# Amplification Protocol

Amplification conditions using **PrimerDesign 2X Precision™ MasterMix**.

	Step	Time	Temp
	UNG treatment (if required) **	15 mins	37°C
	Enzyme Activation (if required)***	10 mins	95°C
50 cycles	Denaturation	10s	95°C
	<b>DATA COLLECTION*</b>	60s	60°C

\* Fluorogenic data for the control DNA should be collected during this step through the FAM channel

\*\* Required if your mastermix includes UNG to prevent PCR carryover contamination

\*\*\* Not all Mastermixes require this enzyme activation step. Follow the manufactures instructions for your mastermix.



## Notices and disclaimers

During the warranty period PrimerDesign pathogen detection kits allow precise and reproducible data recovery combined with excellent sensitivity. For data obtained by violation to the general GLP guidelines and the manufacturer's recommendations the right to claim under guarantee is expired.

Black Hole Quencher™, "BHQ", "CAL Fluor", "Quasar" and "Pulsar" are registered trademarks of Biosearch Technologies, Inc., Novato, CA. This technology is protected by U.S. and World-wide patents either issued or in application and is licensed and sold under agreement with Biosearch Technologies, Inc. These products are sold exclusively for R&D use by the purchaser. They may not be used for human or veterinary *in vitro* diagnostic (IVD) applications and they may not be re-sold, distributed or re-packaged without express written authorization from Biosearch

PCR is a proprietary technology covered by several US and foreign patents. These patents are owned by Roche Molecular Systems Inc. and have been sub-licensed by PE Corporation in certain fields. Depending on your specific application you may need a license from Roche or PE to practice PCR. Additional information on purchasing licenses to practice the PCR process may be obtained by contacting the Director of Licensing at Roche Molecular Systems, 1145 Atlantic Avenue, Alameda, CA 94501 or Applied Biosystems business group of the Applied Corporation, 850 Lincoln Centre Drive, Foster City, CA 94404. In addition, the 5' nuclease assay and other homogeneous amplification methods used in connection with the PCR process may be covered by U.S. Patents 5,210,015 and 5,487,972, owned by Roche Molecular Systems, Inc. and by U.S. Patent 5,538,848, owned by The Perkin-Elmer Corporation. The purchase of Biosearch Technologies products does not, either expressly or by implication, provide a license to use this or other patented technology. Licensing information can be obtained by contacting the Director of Licensing, Applied Biosystems, 850 Lincoln Centre Drive, Foster City, CA 94404 or the Licensing Department at Roche Molecular Systems Inc., 1145 Atlantic Avenue, Alameda, CA 94501."

## Trademarks

PrimerDesign™ is a trademark of PrimerDesign Ltd.

The PCR process is covered by US Patents 4,683,195, and 4,683,202 and foreign equivalents owned by Hoffmann-La Roche AG.

ABI, ABI PRISM®, GeneAmp® and MicroAmp® are registered trademarks of the Applied Genomics (Applied Biosystems Corporation).

BIOMEK® is a registered trademark of Beckman Instruments, Inc.; iCycler™ is a registered trademark of Bio-Rad Laboratories, Rotor-Gene is a trademark of Corbett Research. LightCycler™ is a registered trademark of the Idaho Technology Inc.

GeneAmp®, TaqMan® and AmpliTaqGold® are registered trademarks of Roche Molecular Systems, Inc.,

The purchase of the PrimerDesign™ reagents cannot be construed as an authorization or implicit license to practice PCR under any patents held by Hoffmann-La Roche Inc.