Primer Design Ltd

R01067

# Norovirus Genogroups I and II

## Kit version: 2

## Target region:

RNA polymerase gene

## genesig® COMPLETE Kit

150 tests

GENESIG

Kits by Primerdesign

For general laboratory and research use only

# Introduction to Norovirus Genogroups I and II

Norovirus is known to cause acute gastroenteritis. It is a small (27-38 nm), round, non-enveloped RNA virus belonging to the Caliciviridae family and is responsible for over 80% of non-bacterial outbreaks of gastroenteritis in the world. It affects individuals of all ages, with a distinct seasonal link to winter. It has a genome of 7.6 kb that is positive sense and has a single stranded linear confirmation. It encodes a major structural protein (VP1) of about 58 to 60 kDa and a minor capsid protein (VP2).

Transmission occurs predominantly through ingestion of contaminated water, food and airborne transmission, as well as contact with contaminated surfaces. The ease with which norovirus is transmitted and the low infectious dose required to establish an infection result in extensive outbreaks in numerous environments, such as hospitals, hotels and schools. There is no antiviral drug available to treat this infection and little is known about its pathogenicity. However, it has been observed that the virus can be taken up by enterocytes where translation of viral non-structural proteins can occur; it damages and alters intestinal microvilli, leaving them blunt and broadened, thus inhibiting absorption; it causes crypt cell hyperplasia and leads to apoptosis of enterocytes.

An incubation period of 24-48 hours is usual. Infection is characterized by the acute onset of nausea, vomiting, abdominal cramps, aching limbs, raised temperature and diarrhoea that generally last for about 48 hours. However, more severe and prolonged infection may be observed in children and the elderly. There are now ten recognised norovirus genogroups, of which three (GI, GII, and GIV) are known to affect humans. Of these three genogroups GI and GII are responsible for the majority of human infections and, since 2002 variants of the GII.4 genotype have been the most common cause of norovirus outbreaks. There have been 51 different genotypes identified within the genogroups, with a wide degree of genetic variability present even within each genotype.

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# Specificity

The genesig® COMPLETE Kit for Norovirus Genogroups I and II is designed for the in vitro quantification of Norovirus GI and GII genomes. The kit is designed to have a broad detection profile. Specifically, the primers will detect over 95% of sequences available on the NCBI database at the time of last review.

The Norovirus GII assays is predicted to cross react with Noroviruses GIX, GVI and GIV. Newly emerging evidence suggests that there will be some cross reactivity with bacteriophages found in the human gut, however the effect of this is predicted to be negligible in samples from patients suffering from gastrointestinal infections.

The dynamics of genetic variation means that new sequence information may become available after the initial design. If you require further information or have a specific question about the detection profile of this kit then please send an e-mail to techsupport@primerdesign.co.uk and our team will answer your question.

# Kit contents

- **1x Norovirus G1_v3.0 primer/probe mix (150 reactions, BROWN)**
  FAM labelled
- **1x Norovirus G2_v2.0 primer/probe mix (150 reactions, BROWN)**
  FAM labelled
- **1x Norovirus G1_v3.0 positive control template (RED)**
- **1x Norovirus G2_v2.0 positive control template (RED)**
- **2x Internal extraction control primer/probe mix (150 reactions, BROWN)**
  VIC labelled as standard
- **1x Internal extraction control RNA (150 reactions, BLUE)**
- **1x Endogenous control primer/probe mix (150 reactions, BROWN)**
  FAM labelled, Target: Human ACTB as standard
- **6x Lyophilised OneStep Master Mix (GOLD)**
- **7x oasig™ resuspension buffer (BLUE)**
  for resuspension of the lyophilised master mix (and lyophilized ROX, if required)
- **1x oasig™ lyophilised ROX (BROWN)**
  ROX passive reference dye that if required can be added to Lyophilised OneStep Master Mix
- **1x RNase/DNase free water (WHITE)**
  for resuspension of primer/probe mixes
- **3x Template preparation buffer (YELLOW)**
  for resuspension of internal control template, positive control template and standard curve preparation

# Reagents and equipment to be supplied by the user

**Real-time PCR Instrument**

**Extraction kit**
This kit is recommended for use with genesig® Easy DNA/RNA extraction kit or exsig®Mag. However, it is designed to work well with all processes that yield high-quality nucleic acid with minimal PCR inhibitors.

**Pipettors and filter tips**

**Vortex and centrifuge**

**1.5 ml microtubes, qPCR plates or reaction tubes**

# Kit storage and stability

This kit is stable for shipping at ambient temperature but should be stored at -20°C upon arrival. Once the lyophilised components have been resuspended, they should not be exposed to temperatures above -20°C for longer than 30 minutes at a time and unnecessary repeated freeze/thawing should be avoided. The kit is stable for six months from the date of resuspension under these circumstances.

If a standard curve dilution series is prepared this can be stored frozen for an extended period. If you see any degradation in this serial dilution a fresh standard curve can be prepared from the positive control.

Primer Design Ltd does not recommend using the kit after the expiry date stated on the pack.

# Suitable sample material

This kit can be used with all types of samples from various origins. Please ensure that the extracted nucleic acid samples are suitable in terms of purity, concentration, and RNA integrity. An internal extraction control is provided to test for non-specific PCR inhibitors.

# Dynamic range of test

Under optimal PCR conditions the kit can achieve priming efficiencies between 90-110% and detect less than 100 copies of target template. If running a positive control standard curve for a quantitative result, and an efficiency of between 90% to 110% is not achieved, then the run should be repeated with a freshly prepared standard curve.

# Principles of the test

## Real-time PCR

A target specific primer and probe mix is provided, and this can be detected through the FAM channel.

The primer and probe mix provided exploits the so-called TaqMan® principle. During PCR amplification, forward and reverse primers hybridize to the target cDNA. A fluorogenic probe is included in the same reaction mixture which consists of a DNA probe labelled with a 5′-dye and a 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 qPCR platforms.

## Positive control

For copy number determination and as a positive control for the PCR set up, the kit contains a positive control template. This can be used to generate a standard curve of target copy number/Cq value. Alternatively, the positive control can be used at a single dilution where full quantitative analysis of the samples is not required. Each time the kit is used, at least one positive control reaction must be included in the run. A positive result indicates that the primers and probes for detecting the target gene worked properly in that 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. Care should also be taken to avoid cross-contamination of other samples when adding the positive control to the run. This can be avoided by sealing all other samples and negative controls before pipetting the positive control into the positive control well.

## Negative control

To validate any positive findings 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. It is also known as a No Template Control or NTC.

## Internal RNA extraction control

When performing RNA extraction, it is often advantageous to have an exogenous source of RNA template that is spiked into the lysis buffer. This control RNA is then co-purified with the sample RNA and can be detected as a positive control for the extraction process. Successful co-purification and qPCR for the control RNA also indicates that PCR inhibitors are not present at a high concentration.

A separate primer and probe mix is supplied with this kit to detect the exogenous RNA using qPCR. The primers are present at PCR limiting concentrations which allows multiplexing with the target sequence primers. Amplification of the control RNA does not interfere with detection of the target RNA even when present at low copy number. The Internal control is detected through the VIC channel and gives a Cq value of 28+/-3 depending on the level of sample dilution.

## Endogenous control

A primer/probe mix for detection of the endogenous control gene is included in the kit, which allows confirmation of a valid biological sample from the host. Detection of the endogenous control is through the FAM channel, and it is therefore NOT possible to perform a multiplex reaction with the target specific primer/probe mix. Amplification of the endogenous control may depend on the sample type used. Please note that if samples from a different species are used, the endogenous control may not be appropriate, but the internal extraction control is advised to be use.

## ROX passive reference dye

The kit includes a tube of lyophilised ROX dye which can be added if required for use on hardware platforms that recommend ROX as a passive reference dye.

# Resuspension protocol

To minimize the risk of contamination with foreign RNA/DNA, we recommend that all pipetting is performed in a PCR clean environment. Ideally this would be a designated PCR lab or 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/probe mix or template is in the base of the tube and is not lost upon opening the tube.

2. **Resuspend the primer/probe mixes in the RNase/DNase free water supplied, according to the table below:**
   To ensure complete resuspension, allow primer/probe mix to rehydrate for 10 minutes at room temperature. Vortex each tube thoroughly, followed by pipetting up and down 10 times. Failure to mix well can produce poor kit performance.

| Component - resuspend in water | Volume |
|---|---|
| **Pre-PCR pack** | |
| Norovirus G1_v3.0 primer/probe mix (**BROWN**) | 165 µl |
| Norovirus G2_v2.0 primer/probe mix (**BROWN**) | 165 µl |
| Internal extraction control primer/probe mix (**BROWN**) | 165 µl |
| Endogenous control primer/probe mix (**BROWN**) | 165 µl |

3. **Resuspend the internal control template and positive control template in the template preparation buffer supplied, according to the table below:**
   To ensure complete resuspension, vortex each tube thoroughly.

| Component - resuspend in template preparation buffer | Volume |
|---|---|
| **Pre-PCR heat-sealed foil** | |
| Internal extraction control RNA (**BLUE**) | 600 µl |
| **Post-PCR heat-sealed foil** | |
| Norovirus G1_v3.0 Positive Control Template (**RED**) * | 500 µl |
| Norovirus G2_v2.0 Positive Control Template (**RED**) * | 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.

4. **Resuspend the lyophilised OneStep Master Mix in oasig resuspension buffer, according to the table below:**

| Component – resuspend in oasig resuspension buffer | Volume |
|---|---|
| Lyophilised OneStep Master Mix (**GOLD**) | 525 µl |

**Please note:** if the kit is intended to be used with platforms that use ROX as a passive reference dye, please proceed to the **ROX Passive Reference Dye Handling Protocol** at the end of this handbook.

# RNA extraction

The internal extraction control RNA can be added either to the RNA lysis/extraction buffer or to the RNA sample once it has been resuspended in lysis buffer.

**DO NOT add the internal extraction control RNA directly to the unprocessed biological sample as this will lead to degradation and a loss in signal.**

1. **Add 4µl of the Internal extraction control RNA (BLUE) to each sample in RNA lysis/extraction buffer.**

2. **Complete RNA extraction according to the manufacturer's protocols.**

# OneStep RT-qPCR detection protocol

**For optimum performance and sensitivity.**
All pipetting steps and experimental plate set up should be performed on ice. After the plate is prepared proceed immediately to the OneStep amplification protocol. Prolonged incubation of reaction mixes at room temperature can lead to PCR artifacts that reduce the sensitivity of detection.

1. **For each RNA sample prepare a reaction mix according to the table below:**
   Include sufficient reactions for positive and negative controls.

| Component | Volume |
|---|---|
| Lyophilised OneStep Master Mix (GOLD) | 10 µl |
| Norovirus G1_v3.0 or Norovirus G2_v2.0 primer/probe mix (BROWN) | 1 µl |
| Internal extraction control primer/probe mix (BROWN) | 1 µl |
| RNase/DNase free water (WHITE) | 3 µl |
| **Final Volume** | **15 µl** |

2. **(Optional- if you wish to run an endogenous control reaction for each sample, you will need to purchase additional Master Mix for this). For each RNA sample prepare an endogenous control reaction according to the table below.**
   This control reaction will provide useful information regarding the quality of the biological sample.

| Component | Volume |
|---|---|
| Lyophilised OneStep Master Mix (GOLD) | 10 µl |
| Endogenous control primer/probe mix (BROWN) | 1 µl |
| RNase/DNase free water (WHITE) | 4 µl |
| **Final Volume** | **15 µl** |

3. **Pipette 15µl of these mixes into each well according to your experimental plate set up.**

4. **Pipette 5µl of RNA template into each well, according to your experimental plate set up.**
   For negative control wells use 5 µl of RNase/DNase free water (**WHITE**). For positive control wells use 5 µl of the positive control template (**RED**). The final volume in each well is 20 µl.

## 5. (Optional) Standard curve preparation for quantitative analysis.

For quantitative analysis of the samples a standard curve dilution series can be prepared using the positive control template (**RED**). This is not required for qualitative analysis.

### 5.1 Reaction mix preparation for the standard curve.

Include sufficient reactions for each dilution of the standard curve.

| Component | Volume |
|---|---|
| Lyophilised OneStep Master Mix (**GOLD**) | 10 µl |
| Norovirus G1_v3.0 or Norovirus G2_v2.0 primer/probe mix (**BROWN**) | 1 µl |
| RNase/DNase free water (**WHITE**) | 4 µl |
| **Final Volume** | **15 µl** |

### 5.2 Preparation of a 10-fold standard curve dilution series.

**a.** Pipette 90 µl of template preparation buffer (**YELLOW**) into 5 tubes and label them tube 2-6. The neat positive control tube (**RED**) is considered tube 1.

**b.** Pipette 10 µl of positive control template (**RED**) into tube 2.

**c.** Vortex thoroughly.

**d.** Change pipette tip and pipette 10 µl from tube 2 into tube 3.

**e.** Vortex thoroughly

Repeat steps d and e to complete the dilution series.

| Standard Curve | Copy Number |
|---|---|
| Tube 1 Positive control (**RED**) | 2 x $10^5$ per µl |
| Tube 2 | 2 x $10^4$ per µl |
| Tube 3 | 2 x $10^3$ per µl |
| Tube 4 | 2 x $10^2$ per µl |
| Tube 5 | 20 per µl |
| Tube 6 | 2 per µl |

### 5.3. Pipette 15 µl of reaction mix and 5 µl of the respective standard into each well for the standard curve according to your plate set up.

The final volume in each well is 20µl.

# OneStep RT-qPCR Amplification Protocol

Recommended amplification conditions when using Lyophilised OneStep Master Mix.

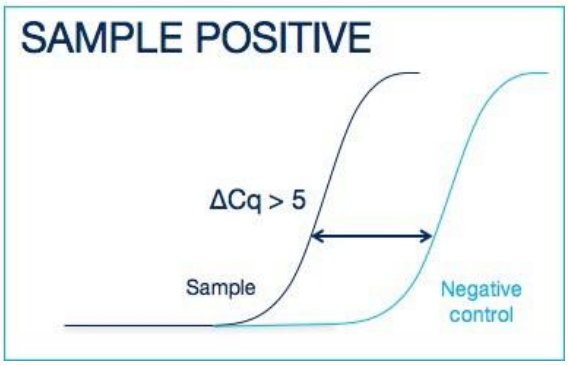
| | Step | Time | Temp |
|---|---|---|---|
| | Reverse Transcription | 10 min | 55 °C |
| | Enzyme activation | 2 min | 95 °C |
| Cycling x50 | Denaturation | 10 s | 95 °C |
| | **DATA COLLECTION *** | 60 s | 60 °C |

* Fluorogenic data should be collected during this step through the FAM and VIC channels

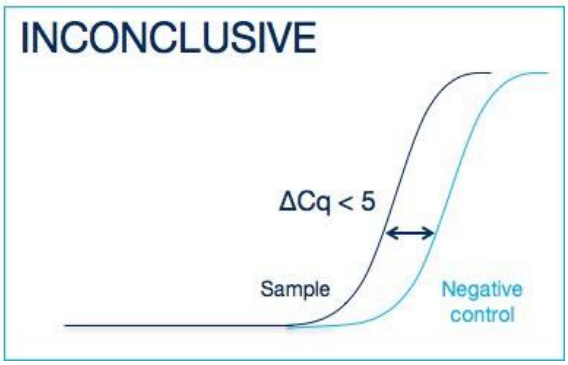
# Interpretation of results

| Target (FAM) | Internal control (VIC) | Positive control | Negative control | Interpretation |
|---|---|---|---|---|
| **≤ 30** | **+ / -** | **+** | **-** | **POSITIVE QUANTITATIVE RESULT** calculate copy number |
| **> 30** | **+** | **+** | **-** | **POSITIVE QUANTITATIVE RESULT** calculate copy number |
| **> 30** | **-** | **+** | **-** | **POSITIVE QUALITATIVE RESULT** do not report copy number as this may be due to poor sample extraction |
| **-** | **+** | **+** | **-** | **NEGATIVE RESULT** |
| **+ / -** | **+ / -** | **+** | **≤ 35** | **EXPERIMENT FAILED** due to test contamination |
| **+ / -** | **+ / -** | **+** | **> 35** | ***** |
| **-** | **-** | **+** | **-** | **SAMPLE PREPARATION FAILED** |
| **+ / -** | **+ / -** | **-** | **+ / -** | **EXPERIMENT FAILED** |

*Where the test sample is positive and the negative control is positive with a Cq > 35, the sample must be reinterpreted based on the relative signal strength of the two results:




If the sample amplifies > 5 Cq earlier than the negative control, then the sample should be reinterpreted (via the table above) with the negative control verified as negative.




If the sample amplifies < 5 Cq earlier than the negative control, then the positive sample result is invalidated, and the result should be determined inconclusive due to test contamination. The test for this sample should be repeated.

## Positive Control

The positive control template is expected to amplify between Cq 16 – 23 in the FAM channel. Failure to satisfy this quality control criterion is a strong indication that the experiment has been compromised and should be repeated.

## Internal PCR control

The Cq value obtained with the internal control will vary significantly depending on the extraction efficiency, the quantity of RNA added to the RT and PCR reaction and the individual machine settings. Cq values of 28±3 are within the normal range. When amplifying a target sample with a high genome copy number, the internal extraction control may not produce an amplification plot. This does not invalidate the test and should be interpreted as a positive experimental result.

## Endogenous control

The signal obtained from the endogenous control primer and probe set will vary according to the amount of biological material present in a given sample. An early signal indicates the presence of a good yield of biological material. A late signal suggests that little biological material is present in the sample.

## ROX Reference Dye Handling Protocol

ROX is recommended for platforms that use ROX as a passive reference dye. Use table 1, below, to see if ROX addition is required for your hardware platform. If ROX is required, then follow the instructions below.

- Resuspend the Lyophilised ROX (**BROWN**) in the correct volume of the oasig™ resuspension buffer (**BLUE**) according to table 1 below.
- Add resuspended ROX to each Master Mix ampoule at the correct level.

**Table 1. ROX addition**

| Real time PCR platform | ROX re-suspension volume | ROX addition per Master Mix ampoule |
|---|---|---|
| Applied Biosystems 7700, 7000, and 7900, 7300 StepOne, StepOnePLUS and ViiA7 platforms, Roche capillary Lightcyclers. | 100µl | 20µl |
| All Stratagene platforms | 200µl | 15µl |
| Applied Biosystems 7500 platform Quantstudio™ | 700µl | 10µl |
| All Other machines | NOT REQUIRED | NOT REQUIRED |

Once ROX passive reference dye is added to the Lyophilised OneStep Master Mix (**GOLD**), then proceed with the rest of the protocol.

# Notices and disclaimers

This product is developed, designed and sold for research purposes only. It is not intended for human diagnostic or drug purposes or to be administered to humans unless clearly expressed for that purpose by the Food and Drug Administration in the USA or the appropriate regulatory authorities in the country of use. During the warranty period Primer Design Ltd genesig® 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. 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 Applera 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.

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