2020

CO-DIAGNOSTICS INC.

Logix Smart Coronavirus disease 2019 (COVID-19) Kit

REF **COVID-K-001**

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CO-DIAGNOSTICS, INC.

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CO-DIAGNOSTICS, INC. | 2401 Foothill Dr., Ste D, Salt Lake City, UT 84109 USA

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2401 S. Foothill Dr. Suite D. Salt Lake City, UT 84109 | 801.438.1036 | www.codiagnostics.com

Manufacturer:
Co-Diagnostics, Inc
2401 S Foothill Dr. Ste D
Salt Lake City, UT 84109

Phone: +1 (801) 438-1036
Email: info@codiagnostics.com
Website: www.codiagnostics.com

Authorized Representative:
mdi Europa GmbH
Langenhagener Str. 71
D-30855 Hannover-Langenhagen
Germany

Phone: +49 511 39 08 95 30
Email: info@mdi-europa.com
Website: www.mdi-europa.com

1 INTENDED USE

The **Logix Smart Coronavirus disease 2019 (COVID-19)** kit is an *in vitro* diagnostic test, based on real-time PCR (qPCR) technology, for the qualitative detection of the RNA from SARS-CoV-2 (COVID-19) in lower respiratory specimen (e.g. bronchoalveolar lavage, sputum, tracheal aspirate), upper respiratory tract (e.g. nasopharyngeal fluids, nasal swab), and serum from patients who meet the clinical criteria (e.g. signs and symptoms) for Coronavirus disease 2019 (COVID-19) as established by WHO (WHO, 2020) and the US CDC (CDC, 2020) (e.g. fever, cough, shortness of breath, travel history to China).

2 KIT COMPONENTS

Lid Color	Component	Symbol	Catalog Number	Description	Amount
Black	Logix Smart™ COVID-19 Master Mix	MM	COVID-MM-001	Proprietary blend of CoPrimers™ and PCR reagents	1x500µL (100 reactions)
Red	Logix Smart™ COVID-19 Positive Control	PC	COVID-PC-001	Proprietary blend of target templates	1x500µL (100 reactions)
Clear	Nuclease-Free Water	NTC	GEN-NF-001	DNase/RNase-free water	1x500µL (100 reactions)

- Kit Catalog Number is COVID-K- 001. Contact Sales at 801-438-1036 ext. 02 to order.

3 LOGIX SMART™ COVID-19 STORAGE, HANDLING, & DISPOSAL

- The **Logix Smart™ COVID-19** kit is shipped on dry ice. The components of the kit should arrive frozen. If one or more of the components are not frozen upon receipt, or are compromised during shipment, contact your distributor for assistance.
  - Upon receipt of kit, laboratory should follow internal procedures for quality control.
- All components should be stored below -20°C upon arrival to prevent degradation of reagents.
- Repeated thawing and freezing of components (more than four times) should be avoided, specifically the master mix, as this might affect the performance of the assay. The reagents should be frozen in multiple aliquots if they are to be used intermittently.
- Co-Diagnostics recommends storage between +2°C and +8°C should not exceed a period of 4 hours.
- If you work in an area prone to power outages, it is recommended to have a back-up generator for your freezer as well as a temperature data log system to ensure that the **Logix Smart™ COVID-19** test kit remains frozen at -20°C.
- Protect **Master Mix** from light.
- Expired products should not be used, as the integrity of the components cannot be guaranteed.
- The product is not a biological waste. See Safety Data Sheets for hazard classification. Disposal should be in accordance with applicable regional, national, and local laws and regulations.

4 WARNINGS AND PRECAUTIONS

WARNING!

Read this *Instructions for Use* carefully before using the product. Before first use check the components for:

- Integrity
- Correct labelling
- Frozenness upon arrival

Users should pay attention to the following:

- Use of this product should be limited to personnel instructed and trained in the techniques of real-time PCR and *in vitro* diagnostic procedures.
- Patient samples should always be treated as infectious and/or biohazardous. Use standard precautions.
- Wear protective gloves, lab coat, and eye protection when handling patient samples. Always wear gloves when handling kit components.
- Always use DNase/RNase-free disposable pipette tips with filters.
- Use segregated working areas for sample preparation, reaction setup, and amplification/detection activities. The workflow in the laboratory should proceed in a unidirectional workflow. To prevent contamination, change PPE between areas.
- Store and extract positive materials (specimen, controls, and amplicons) separately from other reagents. Dedicate supplies and equipment to separate working areas and do not move them from one area to another.

- Consult appropriate Safety Data Sheets (SDS) for safety. The SDS for the **Logix Smart™ COVID-19** test kit is provided with the shipment. If not provided with shipment the SDS can be retrieved from Co-Diagnostics website at the link: www.codiagnostics.com/resources/safety-data-sheets/
- Do not collect samples for nucleic acid PCR assays in Heparin (green top tube) or EDTA (purple top) tubes as these components are well-known PCR inhibitors. Preferably collect whole blood in serum separator tubes.
- Do not open the reaction tubes/plates post amplification.
- Do not autoclave reaction tubes/plates after the PCR, since this will not degrade the amplified nucleic acid and may pose a contamination risk to the laboratory area.
- Do not use components of the kit that have passed expiration date.
- Discard sample and assay waste according to your local safety regulations.

5 BACKGROUND INFORMATION

5.1 Coronavirus disease 2019 (COVID-19)

- **About:** is a contagious, zoonotic disease that causes respiratory infection varying from common cold symptoms to severe pneumonia and occasionally death. The disease was first reported in 31-Dec-2019 by the Chinese government to the World Health Organization (WHO) after a cluster of pneumonia of unknown cause was identified in the city of Wuhan, Hubei province, China. The virus was found genetically similar to SARS-CoV, responsible for the 2002-2003 outbreak of severe acute respiratory syndrome.
- **The virus:** is a positive-sense, single-stranded RNA virus, from the *Coronaviridae* family, genus Betacoronavirus. Comparisons of genetic sequences between the novel strain and other coronaviruses have shown that the SARS-CoV-2 have similarities to SARS-CoV (79.5%) and bat coronaviruses (96%), the reason why a likely origin in bats have been theorized.
- **Transmission:** Person-to person transmission, especially close contact, has been confirmed in asymptomatic and symptomatic phases of the disease. The degree of transmission on each phase has not been established yet. The incubation period has shown to be from 1 to 12.5 days, however, because SARS had a 14 days incubation period, the CDC and WHO recommends consider 14 days incubation period where self-isolation and quarantine is recommended. There has been reported outliers of 24 days incubation period.
- **Signs and Symptoms:** include fever, fatigue, dry cough, and shortness of breath. Cases of severe infection can result in pneumonia, acute respiratory distress syndrome (ARDS), and kidney failure leading to death in some cases. Based on early evidence, many of those who died had other conditions such as hypertension, diabetes, or cardiovascular disease that impaired their immune system.
- **Detection:** the infection can be confirmed by laboratory testing of sputum, nasopharyngeal and oropharyngeal swabs, bronchoalveolar lavage (BAL), Nasopharyngeal wash/aspirate or nasal aspirate or serum. Detection by means of real-time RT-PCR should be done from first day of onset of symptoms. There is not data supporting until when the coronavirus is totally excreted.

5.2 Patient Sample Selection, Collection, Storage, and Handling Recommendations

The sample selection, collection, storage, and handling play an essential part in the performance of nucleic acid assays. Thus, valuable information is presented here to help laboratories develop better procedures for the analysis of results and troubleshooting other problems.
For more information visit the CDC and WHO websites in the following addresses:

- CDC – Interim Guidelines for Collecting, Handling, and Testing Clinical Specimens from Persons Under Investigation (PUIs) for Coronavirus Disease 2019 (COVID-19) - https://www.cdc.gov/coronavirus/2019-nCoV/lab/guidelines-clinical-specimens.html.
- WHO – Laboratory testing for 2019 novel coronavirus (2019-nCoV) in suspected human cases – Interim guidance of 17 January 2020 - https://www.who.int/publications-detail/laboratory-testing-for-2019-novel-coronavirus-in-suspected-human-cases-20200117

5.2.1 Sample Selection for:

5.2.1.1 COVID-19:

a) Lower respiratory tract:

Bronchoalveolar lavage, tracheal aspirate – collect 2-3 mL into a sterile, leak-proof, screw-cap sputum collection cup or sterile dry container. Refrigerate specimen at 2-8°C and ship overnight to the testing laboratory on ice pack.

Sputum – have the patient rinse the mouth with water and then expectorate deep cough sputum directly into a sterile, leak-proof, screw-cap sputum collection cup or sterile dry container. Refrigerate specimen at 2-8C and ship overnight to the testing laboratory on ice pack.

b) Upper respiratory tract

Nasopharyngeal swab AND oropharyngeal swab (NP/OP swab) – use only synthetic fiber swabs with plastic shafts. Do not use calcium alginate swabs or swabs with wooden shafts, as they may contain substances that inactivate some viruses and inhibit PCR testing. Place swabs immediately into sterile tubes containing 2-3 mL of viral transport media. NP and OP specimens should be kept in separate vials. Refrigerate specimen at 2-8°C and ship overnight to the testing laboratory on ice pack.
Note: Nasopharyngeal swab: Insert a swab into the nostril parallel to the palate. Leave the swab in place for a few seconds to absorb secretions/ Swab both nasopharyngeal areas with the same swab.
Oropharyngeal swab (e.g., throat swab): Swab the posterior pharynx, avoiding the tongue.

Nasopharyngeal wash/aspirate or nasal aspirate – collect 2-3 mL into a sterile, leak-proof, screw-cap sputum collection cup or sterile dry container. Refrigerate specimen at 2-8°C and ship overnight to the testing laboratory on ice pack.

c) Serum: collect serum in red topped separator tubes. Allow blood to clot at room temperature for 15 to 30 minutes, centrifuge at 1,000 to 2,000 x g for 10 minutes

in a refrigerated centrifuge. Serum is the supernatant. Transfer the supernatant to new tube.

5.2.2 **Sample Storage:** Samples are best kept refrigerated at 2-8°C and tested immediately. If there is a delay on testing, serum should be separated from whole blood and stored frozen. Stored samples can be aliquoted in 0.5 mL aliquots. The WHO recommends that all types of specimens may be kept at -20°C for up to 7 days. For storage longer than 7 days, specimens should be frozen at -70°C

5.2.3 **Sample Handling:** real-time RT-PCR analysis on clinical samples from patients who are suspected or confirmed to be infected with *COVID-19 (SARS-CoV-2)* coronavirus should be conducted under in a biosafety cabinet Class 2 in a Biosafety Level 2 (BSL-2) containment facility as described in the *WHO Laboratory Biosafety Manual, 3rd ed.* Any testing for the presence of *virus name(s)* viruses should be performed in appropriately equipped laboratories by staff trained in the relevant technical and safety procedures. National guidelines on laboratory biosafety should be followed in all circumstances (WHO, 2020).

6 PRODUCT DESCRIPTION

The **Logix Smart™ COVID-19** test kit is an *in vitro* diagnostic test, based on real-time polymerase chain reaction technology. It tests for the presence or absence of ribonucleic acid (RNA) of strain SARS-CoV-2 coronavirus. Specifically, in lower and upper respiratory tract and serum samples from patients suspected of Coronavirus disease 2019 (COVID-19) viral infection.
The **Logix Smart™ COVID-19** test includes an internal control to identify possible qPCR inhibition, confirm the integrity of the reagents, and verify the quality of sample extraction. The **Logix Smart™ COVID-19** test also includes a positive control which includes two synthetic RNA molecules carrying sequences that are homologous to Coronavirus disease 2019 (COVID-19) and are targeted by this assay. Positive controls represent a source of cross-contamination. Precautions should be taken to prevent and minimize the risk.

CoPrimers™ included in the **Logix Smart™ COVID-19** test are:

- CoPrimers™ that are targeting COVID-19 are labelled with the FAM™ fluorophore
- CoPrimers™ that are targeting the Internal Positive Control (IPC) DNA are labelled with CAL Fluor® Red 610 fluorophore

CoPrimer™ of the **Logix Smart™ COVID-19** test is based on current sequence alignments of SARS-CoV-2. This allows for the RNA detection and differentiation (COVID-19). Co-Diagnostics will perform routine in silico analysis and post-market surveillance to ensure that in the case of new mutations in the virus during the outbreak, a proper update of the test will be performed, and customers will be properly notified.

The test is a one-step reverse transcription qPCR test utilizing PCR amplification of the targets, and simultaneous detection of PCR amplicons by fluorescent dye labelled CoPrimers™. The test contains internal controls that monitor the performance of the test. All kit components are manufactured ready to use immediately upon arrival.

7 MATERIALS AND DEVICES (REQUIRED BUT NOT PROVIDED)

- Appropriate 2-channels real-time PCR instrument, compatible with the fluorophores used in this test.

- Three real-time PCR instruments have been used and tested with the product, the CoDx Box™ thermocycler (Bio Molecular Systems), MIC 4 qPCR (Bio Molecular Systems), and the Eco 48 (Cole-Parmer). Other validation exercises will include testing more thermocyclers.

- Appropriate nucleic acid extraction system or kit
- Vortex mixer
- Centrifuge with a rotor for 2 mL reaction tubes
- Pipettes (adjustable)
- Pipette tips with filters (disposable)
- Powder-free gloves (disposable)
- Ice
- Biosafety cabinet, ideally BSL-2 facility.

Before performing any testing or running any patient sample, verify that all instruments have been properly installed, calibrated, and maintained according to the manufacturer's instructions and recommendations. Do **not** use instruments with outdated calibration.

8 PROCEDURE

The World Health Organization recommends recording the full name, date of birth, contact information, and the time and date of collection of the patient sample. Additionally, the following information could also be collected:

- Symptoms, date of onset, duration of symptoms, contact with known COVID-19 cases (e.g. family member, recent travel history);
- Comprehensive travel history (dates, place, duration of visit); and
- Vaccination history, especially any vaccinations for flaviviruses including yellow fever virus, Japanese encephalitis virus, and dengue virus.

8.1 Patient Sample Collection

CDC recommends collecting both nasopharyngeal AND oropharyngeal swab (NP/OP swab) when collecting upper respiratory swabs for investigation of COVID-19. If the user would like additional information on when and how to collect the sample, refer to *section 5.5* above.

- **COVID-19:** Collect lower respiratory specimen (e.g. bronchoalveolar lavage, sputum, tracheal aspirate), upper respiratory tract (e.g. nasopharyngeal fluids, nasal swab), and serum.

8.2 Sample Preparation

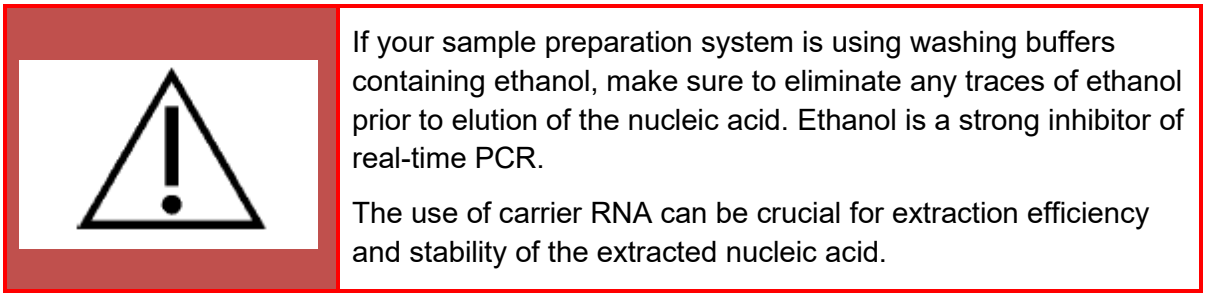
The quality of the extraction of the RNA from the samples is essential for the performance of **Logix Smart™ COVID-19**. The extraction protocol to be followed should be performed following manufacturer's instructions or an internally validated protocol. However, due to the mucoid and mucopurulent, therefore, viscous nature of sputum specimen a pre-processing of the samples is recommended before extraction. A protocol provided by the CDC and evaluated for COVID-19 for the

processing of sputum samples is available by the CDC in the following link: https://www.cdc.gov/coronavirus/2019-ncov/downloads/processing-sputum-specimens.pdf (CDC, 2020). The extraction method validated with **Logix Smart™ COVID-19** and recommended by Co-Diagnostics, Inc. is the example: QIAamp® Viral RNA Mini Kit (QIAGEN).

- Cat No. 52904 for 50 extractions
- Cat. No. 52906 for 250 extractions

Alternative nucleic acid extraction systems and kits might also be appropriate. The suitability of the other nucleic acid extraction procedure for use with **Logix Smart™ COVID-19** must be validated by the user.

Extraction of RNA using the QIAamp® Viral RNA Mini Kit must be performed following the manufacturer's instructions using 140 µL of sample, and a modified elution using 60 µL of buffer AVE. It is highly recommended prior to the elution of nucleic acids to ensure the removal of all ethanol. For column-based kits that include washing with buffers containing ethanol, an additional centrifugation step (see extraction procedure) using a new collection tube is recommended.



If your sample preparation system is using washing buffers containing ethanol, make sure to eliminate any traces of ethanol prior to elution of the nucleic acid. Ethanol is a strong inhibitor of real-time PCR.

The use of carrier RNA can be crucial for extraction efficiency and stability of the extracted nucleic acid.

8.3 Logix Smart™ COVID-19 Reagent Setup

- When preparing reagents, clean all working surfaces with a fresh 10% bleach solution followed by molecular grade alcohol or another equivalent method of cleaning, that disinfects and degrades nucleic acids.
- All **Logix Smart™ COVID-19** Master Mix, Positive Control (PC), no template control nuclease-free water (NTC), and sample tubes should be vortexed for 3 seconds, and briefly spun down before using to ensure properly mixed reagents, and to remove any condensation or residue from the lids.
- Thaw all reagents and samples on **ice**, or on a cold block, before starting setup.

8.4 Reaction Setup

8.4.1 Every reaction setup should include enough reaction wells for the number of patient samples and at least one positive and one NTC (**# patient samples + 2 = total reaction wells needed**). Example: 5 patient samples to test + 1 PC well + 1 NTC well = 7 total reaction wells.

8.4.2 All pipetting should be done on **ice,** if possible. Pipetting of PC and sample elution is recommended to be done in a separate area, or at a separate time, of the Master Mix and NTC. Change pipette tips in-between patient sample elution and change pipette tips after pipetting each component. Pipet PC last if possible, to avoid contamination events.

8.4.3 Pipet 5 µL of **Master Mix** into each well being used in an appropriate optical plate or optical reaction tube (example: CoDx Box real-time PCR instrument uses 48-well reaction tubes).

8.4.4 Pipet 5 µL of patient sample (elution from nucleic acid extraction) or 5 µL of a control (**NTC** and **PC**) to the appropriate well(s). At least one positive and one NTC control must be included in each run.

8.4.5 Seal the reaction plate with an optical adhesive film or the reaction tubes with appropriate lids.

8.4.6 Place plate or tubes into real-time PCR instrument in the correct orientation and start run.

8.5 PCR Instrument Setup

8.5.1 If using Co-Diagnostics Inc. CoDx Box, contact the Laboratory 801-438-1036 ext. 04 or at: www.codiagnostics.com/contact/ for the template file for download. The template file comes pre-programmed with the PCR instrument setup described in this section. When not using a template, or when using another device, use the settings outlined below to program the PCR instrument.

8.5.1.1 In order to achieve optimal performance from the test, it is important to make sure that the instrument is compatible with the conditions outlined below.

8.5.2 Define the following settings:

Reaction Volume	10 µL
Ramp Rate	Default
Passive Reference	None

8.5.3 Program PCR instrument with the cycling conditions below:

	Stage	Cycles	Temperature	Time
Reverse Transcription	Hold	1	45˚C	15 minutes
Initial Denaturation	Hold	1	95˚C	2 minutes
Amplification	Cycling	50	95˚C	3 seconds
			55˚C	32 seconds

8.5.1 Ensure that the PCR instrument being used is compatible with fluorophores below. Some devices may not have options for the quencher. If needing help or have questions, contact Co-Diagnostics Inc. technical support at 801-438-1036 ext. 04 or at: www.codiagnostics.com/contact/.

8.5.2 Define the fluorescence detectors (dyes):

Target	Detector Name	Reporter	Quencher
COVID-19 specific RNA	COVID-19	FAM™	BHQ® - 1
RNaseP specific DNA (IPC)	RNaseP	CAL Flour® Red 610	BHQ® - 2

- When the run is finished, ensure that the run file is saved.

9 DATA ANALYSIS

For basic information regarding data analysis on specific real-time PCR instruments please refer to the user manual of the respective instrument.

Verification and validation studies performed for **Logix Smart™ Coronavirus disease 2019 (COVID-19) (COVID-K-001)** were conducted following Good Laboratory Practices for Molecular Biology assays (Viana & Wallis, 2011). If these conditions are not met, the performance will show higher variability due to user errors while conducting the experiment.

9.1 Validity of Diagnostic Test Runs

9.1.1 Valid Diagnostic Test Run

- Check to see that both the positive and no template control passed.

9.1.1.1 The following control conditions must be met:

Control Type	Control Name	Purpose of Control	COVID-19 FAM channel	Internal Control (RNaseP) CF610 channel
COVID-19 Positive Control	COVID-19 (FAM™)	Verifies the performance of the master mix	+	+
	RNaseP (CF®610)			
No Template Control	Master Mix + Water	Verifies the reagents are free of contamination	-	-

- If controls pass, interpret the sample results.

9.1.2 Invalid Diagnostic Test Run

9.1.2.1 If any of the controls fail, the run is invalid. Document the run and initiate troubleshooting.

9.2 Interpretation of Results

Once the controls have passed, the unknown samples can be interpreted based on three possible outcomes:

- Positive
- Negative
- Inconclusive

A **Positive** result will show an amplification curve or cycle threshold value for COVID-19 at or below 45 cycles. Amplification curves greater than 45 cycles for COVID-19 are in the uncertainty zone. The presence of a curve, with a Cq at or below 45 cycles, for a sample in the COVID-19, indicates a positive result. The amplification of the RNaseP (IPC) shows that the extraction was successful.

A **Negative** result will show no amplification for COVID-19 coronavirus; however, occasionally amplification greater than 45 cycles occurs in COVID-19 or RNaseP channels. Any amplification curves greater than 45 cycles for COVID-19 are outside of the detection limits for the assay. The absence of a curve for COVID-19 indicates a negative result ONLY when the RNaseP (IPC) marker is positive.

An **Inconclusive** result will result if any of the controls fail. See troubleshooting.

The interpretation of results can be translated to the following table:

	Sample Result		Logix Smart™ COVID-19 Positive Control	No Template Control (NTC) (Master Mix + Water)	Interpretation of Results
	COVID-19 (SARS-CoV-2)	Internal Positive Control (RNaseP) CF610 channel			
Instrument Reading	+	+	+	-	COVID-19 +
	-	+	+	-	COVID-19 -
	Any Result (+/-)	-	+	-	Inconclusive: See Troubleshooting
		+	-	-	
		+	+	+	

Anything before 45 cycles is considered a positive reading (+). Anything after 45 cycles is considered a negative reading (-). When possible, always check that the medical history and/or symptoms match with the final result prior to treatment.

10 TROUBLESHOOTING

Co-Diagnostics Inc. values customer feedback and wants to be informed of any issues with the **Logix Smart™ COVID-19** test kit**,** even if the recommended steps for troubleshooting solves the issue. To give feedback please fill out the Customer Feedback Form by visiting codiagnostics.com/contact/feedback/

10.1 Stability

Real-time and accelerated shelf-life and in-use stability studies are currently under testing. Presently, the expiration date of this product has been established as 12 months. It is not recommended to use expired kit reagents, as doing so may lead to inaccurate results.

Always use the most recent version of this document for updates as more stability information will be added when studies are completed.

10.2 User Errors

Good Laboratory Practices for Molecular Biology Diagnostics (Viana & Wallis, 2011) are necessary for the use of this product. This product is not intended to be used by untrained personnel.

It is essential for the user to have some molecular biology experience and be familiar with proper pipetting technique to prevent errors, such as splashes, crossover contamination, and errors on volume selection. Pipette tips must be replaced after every pipetting. Gloves must be replaced often. Equipment, such as pipettes and real-time PCR instruments, should be calibrated when applicable.

90 minutes of online training for Good Laboratory Practices for Molecular Genetics Testing (CDC, 2020) is available at the CDC website at the following link https://www.cdc.gov/labtraining/training-courses/good-lab-practices-molecular-genetics-testing.html

10.3 Invalid Results/Inconclusive Results

10.3.1 **Logix Smart™ COVID-19 Positive Control** not amplifying

No amplification from the PC could be the result of one or multiple factors, such as:

- Pipetting errors (pipetting control into the wrong well, missing a well, pipetting inadequate amount of reagent),
- Incorrect placement of plates or tubes into the real-time PCR instrument,
- **Logix Smart™ COVID-19 Master Mix** or **Logix Smart™ COVID-19 Positive Control** degradation (result of reagents being at temperatures above -20°C for an extended period),
- Use of expired reagents,
- or the wrong reagents being used.

Without further evidence, it is best to disregard the results from the patient samples and re-test by re-amplification. If the positive control fails again, then an investigation should be conducted to identify possible causes for error, and the test must be reprocessed from extraction or not, depending on the investigation results and risks identified in the process. If failure of the positive control happens a third time after re-extraction and re-amplification, open a new **Logix Smart™ COVID-19 Positive Control** or **Master Mix**, and retest. If still failing, please contact Co-Diagnostics Inc. technical support by calling 801-438-1036 ext. 04 or contacting us at: www.codiagnostics.com/contact/.

10.3.2 **RNaseP (IPC)** not amplifying in patient samples

No amplification from the RNaseP channel could be the result of one or multiple factors, such as:

- Not enough nuclear material in the patient sample,
- PCR inhibitors such as: ethanol and heparin,
- the extraction was performed incorrectly,
- or the extraction kit used is not compatible or has a step that eliminates RNaseP DNA.

- Note: Positive amplification in the COVID-19, channel indicates a positive result despite the lack of concurrent amplification in the IPC channel. The IPC amplification is dependent on the presence of human genomic DNA (gDNA) in the extraction sample, the amount of which is governed by the type of the patient sample and the extraction procedure used. Samples obtained from culture or sterile/pure sites (e.g. CSF, urine, cell lysates, etc.) may not contain the human RNaseP gene. In such case, the two negative markers indicate a true negative result for Coronavirus disease 2019 (COVID-19) strain SARS-CoV-2.

Negative patient results cannot be trusted and re-testing by re-amplification should be performed. If the IPC fails again, then samples should be re-extracted and re-amplified. If it fails a third time an investigation should be conducted to identify possible causes for error. If the cause for the error is clear, the test can either be singled out as **inconclusive** due to either PCR inhibitors being present or not enough nuclear material being present. If the cause for error is unclear, contact Co-Diagnostics Inc. technical support by calling 801-438-1036 ext. 04 or contacting us at: www.codiagnostics.com/contact/.

10.3.3 **No Template Control** showing amplification

- Amplification of COVID-19 in the No Template Control indicates contamination in one or more of the reagents, incorrect placement of plate or tube into the real-time PCR instrument, or pipetting errors.

None of the results can be trusted and re-testing by re-amplification should be performed. If the NTC fails again, then an investigation should be conducted to identify possible causes for error, and the test must be reprocessed from extraction or not, depending on the investigation results and risks identified in the process. If failure of the NTC, after re-extraction and re-amplification, happens a third time, open a new nuclease-free water and retest. If still failing, please contact Co-Diagnostics Inc. technical support by calling 801-438-1036 ext. 04 or at: www.codiagnostics.com/contact/.

11 LIMITATIONS

- Strict compliance with this document is required for optimal results. Please, always use the most recent version of this document. This can be downloaded for free at: codiagnostics.com/resources/instructions-for-use/
- Use of this product is to be limited to trained and instructed personnel in real-time PCR techniques and IVD procedures.
- Good laboratory practices are essential for the proper performance of this assay. It is also recommended that upon receipt of reagents that a test run be performed to check the purity, integrity, and performance of the reagents prior to testing on patient samples.
- Appropriate specimen collection, transport, storage, and processing procedures is required for optimal results.
- Do not use the **Logix Smart™ COVID-19** kit components directly on the specimens collected. Perform an appropriate nucleic acid extraction prior to using this assay.
- The presence of PCR inhibitors may cause false negatives or invalid results.
- Potential mutations of the target regions of the COVID-19, genome covered by this test kit may result in failure to detect the presence of the pathogens.
- As with any diagnostic test, results of the **Logix Smart™ COVID-19** kit are to be interpreted with consideration of all clinical and laboratory findings.

12 LIMIT OF DETECTION

Diagnostic Evaluation is based on contrived samples with nasopharyngeal fluid, nasal swab, sputum, bronchoalveolar lavage, and serum used for matrix.

Table 12.1 Performance for Logix Smart Coronavirus disease 2019 COVID-19

Application	Specimen	Strain	Estimated LOD
Limit of Detection (copies/mL)	Bronchoalveolar Lavage, Nasopharyngeal fluid, sputum, serum	SARS-CoV-2 (RNA Template)	**1.35×10^3 copies/mL**
	Characteristics		
Intended Use	Qualitative detection of Coronavirus disease 2019 (COVID-19) strain SARS-CoV-2, in patients that meet the clinical criteria for COVID-19 (e.g. fever, cough, shortness of breath, travel history to China) in lower respiratory tract (sputum, bronchoalveolar lavage (BAL), tracheal aspirate), upper respiratory tract (nasopharyngeal and oropharyngeal fluids, nasal swab) and serum.		
User	Trained technician in molecular diagnostics procedures		
Contrived sample used for verification	Synthetic SARS-CoV-2 RNA template		
Analytical Specificity (wet-test or in silico analysis)	**DOES NOT** cross-react with the following microorganism: SARS-CoV, MERS-CoV, Human coronaviruses (HCoV-229E, HCoV-OC43, HCoV-NL63, HCoV-HKU1), Adenovirus, Influenza A H3N2, Novel Influenza A H1N1, Influenza B, Influenza C, Parainfluenza 1, Parainfluenza 2, Parainfluenza 3, Respiratory syncytial virus (subtype A), Respiratory syncytial virus (subtype B), Parechovirus, *Candida albicans*, *Corynebacterium diphtheriae*, Legionella non-pneumophila, *Bacillus anthracis*, *Moraxella catarrhalis*, *Neisseria elongata*, *Neisseria meningitides*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus salivarius*, Leptospirosis, *Chlamydia psittaci*, *Coxiella burnetii* (Q-Fever), *Staphylococcus epidermidis,* Enterovirus, Rhinovirus, *Haemophilus Influenzae*, *Mycobacterium tuberculosis*, *Bordetella parapertussis*, *Mycoplasma pneumoniae*, *Chlamydia pneumoniae*, and *Legionella pneumophila*		
Sensitivity*	99.17%		
Specificity*	100.00%		
Detection details	Gene *RdRp* of strain SARS-CoV-2 responsible for Coronavirus disease 2019 (COVID-19)		
Time to detection	63-90 minutes, depending on the thermocycler used		
Extraction System	QIAamp Viral RNA Mini kit (QIAGEN)		
Thermocycler compatibility	CoDx Box (BMS - Bio Molecular Systems) Mic 4 qPCR (BMS – Bio Molecular Systems) PCRmax Eco48 Real Time qPCR System (Cole-Parmer)		

*Data is based upon 360 measurements on contrived samples.

13 QUALITY CONTROL

In accordance with the Co-Diagnostics, Inc. ISO 13485-certified Quality Management System, each lot of **Logix Smart™ COVID-19** kit is tested against predetermined specifications to ensure consistent product quality.

14 TECHNICAL ASSISTANCE

For technical assistance, please contact our Technical Support:

- Website: http://codiagnostics.com/contact/
- Email: info@codiagnostics.com
- Phone: 801-438-1036 ext. 04

15 REFERENCES

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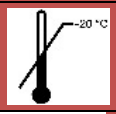
16 TRADEMARKS AND DISCLAIMERS

Registered names, trademarks, etc. used in this document, even if not specifically marked as such, are not to be considered unprotected by law.

Product not available in all countries. Product not for sale in the U.S.

17 LEGEND OF PACKAGE SYMBOLS

IVD	*In vitro* diagnostics
REF	Catalog number
LOT	Batch Code
CAP	Cap color
COMP	Component
CONT	Content/Volume
NUM	Number
	Use-by-date
	Contains sufficient for X tests/ reactions X = 20 sample size X = 100 regular size
	Protect from light
	Temperature limit
	Consult Instructions for Use
	Non-Sterile product – Do not sterilize
	Manufacturer
EC REP	Authorized representative in the European Community
CE	CE-Marking for IVD in compliance to EU Directive 98/79/EC