

QIAcuity® Lab Automation Service User Guide

Extension to the *QIAcuity User Manual* for the QIAcuity Software version 3.5.0.0 (LTS)

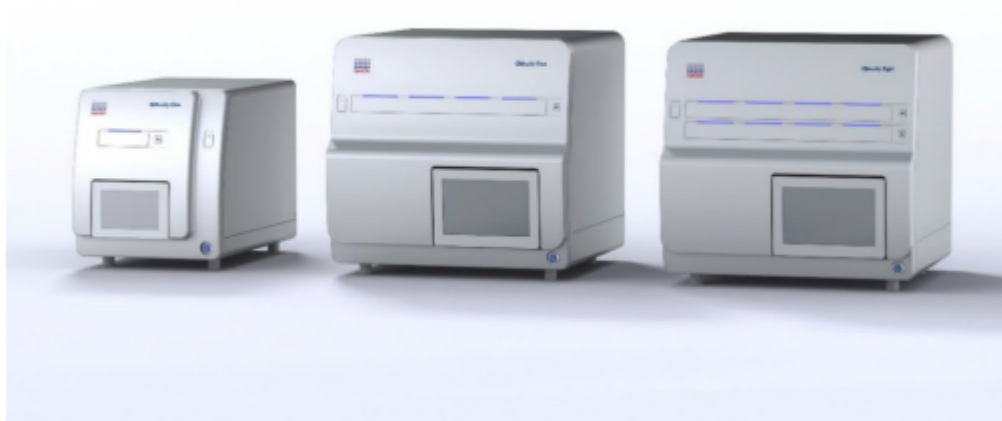


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1. Introduction

1.1. General information

1.1.1. 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 molecular biology and the use of QIAGEN products. If you have any questions or experience any difficulties regarding the QIAcuity Lab Automation Service or QIAGEN products in general, 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, contact QIAGEN Technical Service.

1.1.2. Policy statement

It is the policy of QIAGEN to improve products as new techniques and components become available. QIAGEN reserves the right to change specifications at any time. In an effort to produce useful and appropriate documentation, we appreciate your comments on this user manual. Please contact QIAGEN Technical Service.

1.2. Intended use of the QIAcuity Lab Automation Service

The QIAcuity Lab Automation Service is an extension of the regular QIAcuity systems to allow the third-party Lab Automation software controlling a robot to interact with the QIAcuity systems, run dPCR experiments, and perform analysis without human interaction. The QIAcuity Lab Automation Service is compatible to all QIAcuity systems, QIAcuity One, QIAcuity Four, and QIAcuity Eight, and several QIAcuity systems can be controlled in parallel.

The QIAcuity Lab Automation Service is part of the regular QIAcuity Software since version 3.1. The data created with the QIAcuity Lab Automation Service software are compatible starting with the QIAcuity Software Suite version 3.1 and higher.

1.3. Requirements for the QIAcuity Lab Automation Service

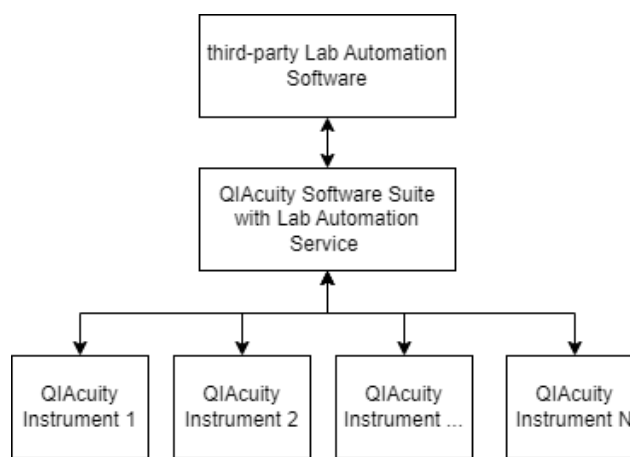
For requirements related to the QIAcuity users, the recommended notebook as well as the instrument related requirements for site, power, and grounding, please refer to the latest version of the *QIAcuity User Manual* (www.qiagen.com/HB-2717-012).

2. General Description

2.1. QIAcuity Lab Automation Service principle

The goal of the QIAcuity Lab Automation Service is to provide the possibility for third-party Lab Automation Software that is controlling one or multiple robots to interact with the QIAcuity systems to run fully automated experiments, without human interaction.

The QIAcuity Lab Automation Service is available via a RESTful API that is accessible over HTTPS protocol. Using the API requires authentication by an API key, which can be obtained in the configuration environment of the QIAcuity Software Suite. Communication works according to the following scheme:



3. Installation Procedures

3.1. Installation and uninstallation of the QIAcuity Software Suite with the QIAcuity Lab Automation Service

The QIAcuity Lab Automation Service is part of the regular QIAcuity Software Suite version 3.5, so it is installed together with Software Suite and the same restrictions in terms of fresh installation and upgrade should be followed.

In terms of the QIAcuity Software Suite with the QIAcuity Lab Automation Service installation, uninstallation, as well as the recommended notebook requirements, please refer to the latest *QIAcuity User Manual* (www.qiagen.com/HB-2717-012), Sections 4.4.6 Installing a fresh copy of the QIAcuity Software Suite and 4.6 Uninstalling the QIAcuity Software Suite.

3.2. Installation of the Control Software with the QIAcuity Lab Automation Service

The QIAcuity Software Suite version 3.5 with the Lab Automation Service is a prerequisite for installing the QIAcuity Control Software version 3.5.

The Software Suite should be installed first (otherwise, no connection between the Software Suite and Control Software can be established).

Please refer to Section 4.7 Upgrading the instrument software to a newer version of the latest *QIAcuity User Manual* to get guidance about the Control Software installation.

Note: Only users with Administrator and Lab Leader role can perform software updates.

3.3. Configuring the QIAcuity Software Suite to use the QIAcuity Lab Automation Service

To start using the QIAcuity Lab Automation Service, it needs to be enabled in the Software Suite's configuration page. Once enabled, an API key will be presented. The Lab Automation Service API will be immediately accessible with this API key. The key can be generated again at any point in time. Previously generated keys will no longer work.

Note: "Manage Lab Automation" permission is required to follow next steps of configuration. Please refer to Section 7.2.2 User management of the *QIAcuity User Manual* for further information.

System configuration [PC software] 1/5

hide descriptions

☐ Registered Instruments

User can see list of registered instruments.

☐ Manage Archive

User can edit Archive location, detach Archive, turn on/off and configure automatic archiving.

☒ Manage Lab Automation

User can manage Lab Automation

☐ Audit Trail configuration

☐ View Audit Trail

User can see the list of Audit Trail events, search for specific event, check details of the event and export it to PDF.

☐ Turn Audit Trail on and off

User can turn on/off the Audit Trail (events tracker).

To enable Lab Automation:

1. Go to **Configuration** and select **Lab Automation** from panel on the left side.

Plates

Templates

Disk Space

Archive

Tools

Configuration

Admin

Configuration

Instrument name

Lab Automation API

Archive

Lab Automation API ☐ OFF

User Management

Audit Trail

Lab Automation

2. Toggle **ON** the Lab Automation API.

Plates

Templates

Disk Space

Archive

Tools

Configuration

Admin

Configuration

Instrument name

Lab Automation API

Archive

Lab Automation API ☒ ON

User Management

Account Security

Lab Automation API key
@@@LoC+@&1zZx5%iedol+c#B4sAagQDC

Download key

Audit Trail

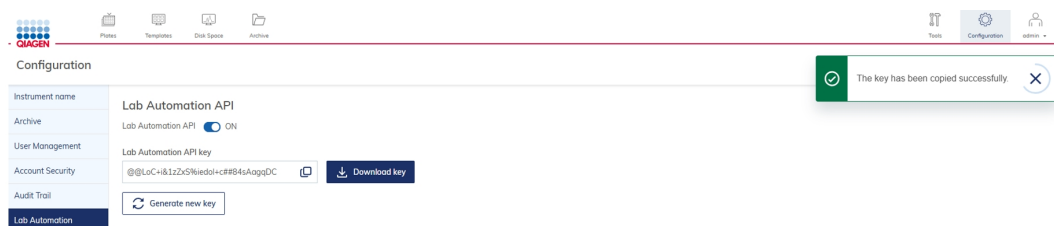
Lab Automation

Generate new key

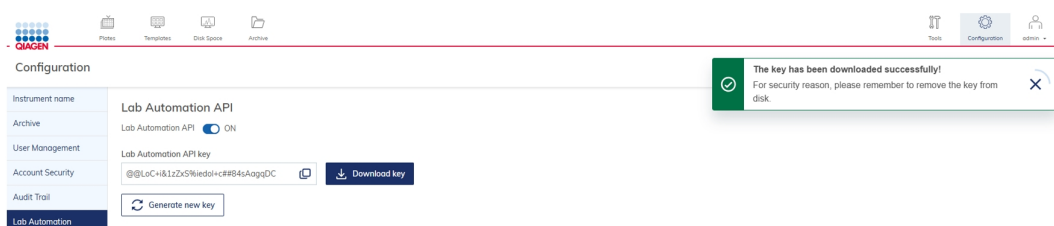
Lab Automation Application has been enabled successfully!

3. The Lab Automation API Key will be presented in the dedicated field below. User can use one of the following methods to obtain the key:

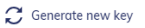
- a. Copy that key to Windows® clipboard using icon  or using Ctrl + C system shortcut.

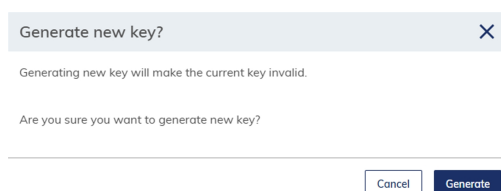


- b. Download the key in .txt file using the  button – the file named “lab_automation_api_key.txt” containing only the key will be automatically generated and downloaded.



4. Generated Lab Automation API key should be used in Customer’s Lab Automation software to establish connection between the Software Suite and Lab Automation. After this step, the QIAcuity Lab Automation Service is configured and ready to use.

Generate new key using  button. The system will generate a new key, the current key will become invalid automatically, and all connected Lab Automations will lose connection. User will be presented with prompt for confirmation.



3.4. Configuring the Control Software to use the QIAcuity Lab Automation Service

Direct configuration of the Lab Automation Service is performed from the Software Suite perspective. No additional steps are required on the instrument.

4. Operating Procedures

4.1. Use of the Lab Automation Service with the QIAcuity Control Software

The instrument is automatically operated via Lab Automation API, which is in charge of remotely booking, opening, and closing the drawer.

The drawer is booked by Lab Automation Software for its exclusive use, and when the booking is active, it is not possible to manually operate the drawer. However, if the logged-in user has a permission to cancel the booking, they may attempt to open the drawer manually and then they will be presented with pop-up window with information that opening/closing the drawer will cancel the booking established by the QIAcuity Lab Automation Service. Therefore, it will put the instrument in normal-use state.

Standard User without Lab Automation Service permission cannot abort the drawer booking, except on situation when the instrument lost connection with the Software Suite.

4.2. Automatic data analysis

Starting with QIAcuity Software Suite version 3.5, the Analysis Template feature used in previous software versions has been replaced by Analysis Rules. The purpose remains the same—to enable automatic analysis of experiment data—but the implementation has changed. Analysis Rules are supported in both the QIAcuity Software Suite and the QIAcuity Lab Automation Service. For more information, refer to Section 7.4.7 Analysis rules section of the *QIAcuity User Manual* (www.qiagen.com/HB-2717-012).

4.2.1. Compatibility

Full Analysis Rules functionality is supported only in the Lab Automation Service of Software Suite version 3.5. This ensures that results generated using advanced analysis features are accurate and complete.

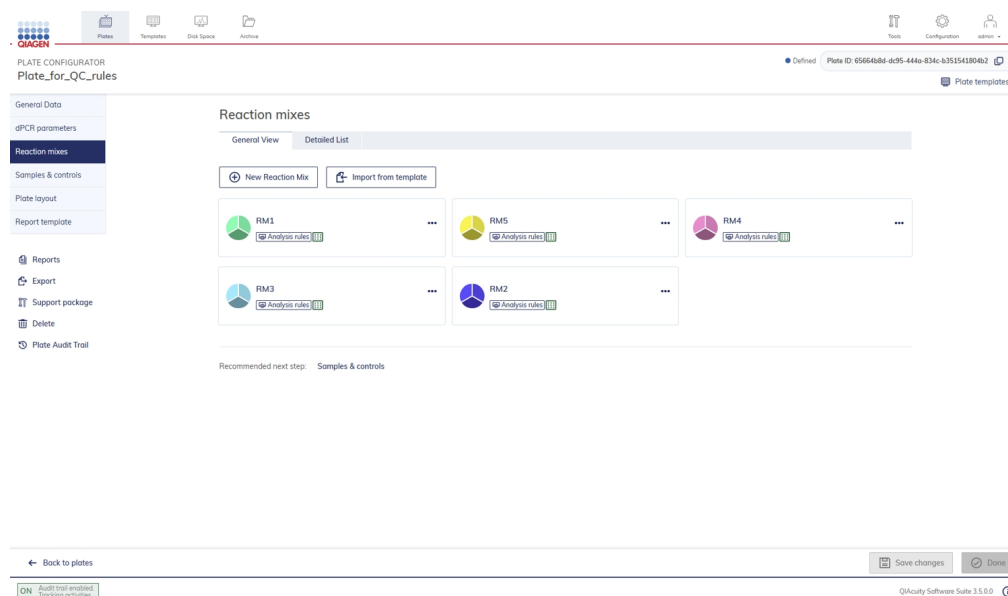
Existing Lab Automation setups remain compatible, provided that they do not use the Analysis template functionality introduced in QIAcuity Software Suite version 3.2. Analysis templates are not compatible with Analysis Rules in QIAcuity Software Suite version 3.5. If a previous version of the Lab Automation Service attempts to call an endpoint using the Analysis Template option, the request fails and an error message instructs the user to upgrade to QIAcuity Lab Automation Service version 3.5.

4.2.2. General principles

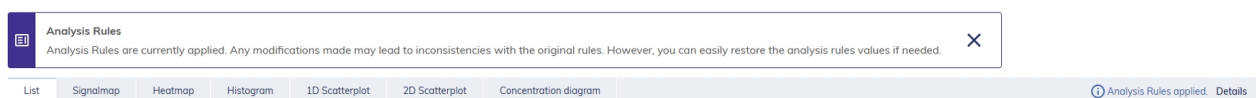
The Analysis Rules concept enables users to define analysis settings for each Reaction Mix in JSON format, assign the configuration to a specific experiment and trigger the analysis process.

Note: To perform this operation, the customer's Lab Automation software must be authenticated using a Lab Automation API key.

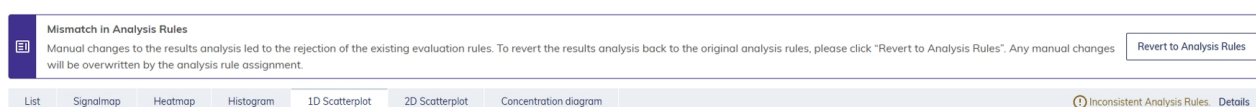
When Analysis Rules are successfully applied to a Reaction Mix, an  indicator is displayed for that Reaction Mix in the QIAcuity Software Suite.



Appropriate information and a status indicator are also displayed in the Analysis view:



If the user overwrites Analysis Rules by making manual changes during analysis (e.g., by manually changing a threshold in a 1D Scatterplot), the Analysis Rules status changes to indicate that the analysis no longer matches the configured Analysis Rules. In addition, a **Revert to Analysis Rules** button becomes available, allowing the user to discard the manual changes and restore the settings defined by the Analysis Rules.



4.2.3. Analysis rules

Configuring Analysis Rules

Analysis Rules are assigned to a plate and organized by Reaction Mix name. Each Reaction Mix contains:

- Thresholding configuration for each channel.
- Quality Control (QC) validation rules per channel.
- Strategy rules that define how QC failures are handled.

For more information, refer to Section 7.4.7 Analysis Rules of the *QIAcuity User Manual*.

At a high level, Analysis Rules in the QIAcuity Lab Automation Service are defined under the `reactionMixAutomationRules` object. Each key represents a Reaction Mix name (string).

Each Reaction Mix contains:

- `thresholdingMethods`
- `qualityControlValidationRules`

To assign Analysis Rules to a plate, use the `AssignAnalysisTemplateV2` endpoint.

For each channel (excitation + emission), threshold behavior is configured using one of the following propagation modes.

1. `WITH_PROPAGATION`

A single threshold configuration is applied to all sample types (unknown samples, positive controls, negative controls, and NTCs). The threshold is calculated from the specified control type and propagated to all wells.

Supported thresholding configuration types:

- a. `POSITIVE_CONTROL` – Threshold derived from positive control wells.
- b. `NEGATIVE_CONTROL` – Threshold derived from negative control wells.
- c. `NON_TEMPLATE_CONTROL` – Threshold derived from NTC wells.

2. `WITHOUT_PROPAGATION`

Separate threshold configurations are defined for each sample type:

- a. `thresholdingConfigForSample` – Unknown samples (`UNKNOWN_SAMPLE`)
- b. `thresholdingConfigForPositiveControl` – Positive controls (`POSITIVE_CONTROL`)
- c. `thresholdingConfigForNegativeControl` – Negative controls (`NEGATIVE_CONTROL`)
- d. `thresholdingConfigForNtc` – NTCs (`NON_TEMPLATE_CONTROL`)

Four sample/control types are supported:

1. `UNKNOWN_SAMPLE` – well with sample or reaction mix only
2. `POSITIVE_CONTROL` – well with Positive Control
3. `NEGATIVE_CONTROL` – well with Negative Control
4. `NON_TEMPLATE_CONTROL` – well with NTC

Supported thresholding methods:

1. Auto Threshold

- Type: AUTO_THRESHOLD
- Supported for: UNKNOWN_SAMPLE

2. Auto Threshold with offset

- Type: AUTO_THRESHOLD_OFFSET
- Supported for: POSITIVE_CONTROL, NEGATIVE_CONTROL, NON_TEMPLATE_CONTROL
- Parameter:
 - **offset**: Decimal value from -255 to 255 (maximum 2 decimal places)

3. Numeric

- Type: NUMERIC
- Supported for: UNKNOWN_SAMPLE, POSITIVE_CONTROL, NEGATIVE_CONTROL, NON_TEMPLATE_CONTROL
- Parameter:
 - **threshold**: Decimal value from 0 to 255 (maximum 2 decimal places)

4. Numeric for Amplitude Multiplexing

- Supported only for channels configured for Amplitude Multiplexing
- Type: NUMERIC_AMPLITUDE_MULTIPLEXING
- Supported for: UNKNOWN_SAMPLE, POSITIVE_CONTROL, NON_TEMPLATE_CONTROL
- Parameters:
 - Can only be used with WITHOUT_PROPAGATION
 - **lowThreshold** < **highThreshold** < **doublePositiveThreshold**
 - **lowThreshold**: Decimal value from 0 to 255 (maximum 2 decimal places)
 - **highThreshold**: Decimal value from 0 to 255 (maximum 2 decimal places)
 - **doublePositiveThreshold**: Decimal value from 0 to 255 (maximum 2 decimal places)

5. PCT (Positive Control Threshold)

- type: PCT
- Supported for: POSITIVE_CONTROL
- Parameter:
 - **offset**: Decimal value from -255 to 255 (maximum 2 decimal places)

6. NCT (Negative Control Threshold)

- Type: NCT
- Supported for: `NEGATIVE_CONTROL`, `NON_TEMPLATE_CONTROL`
- Parameter:
 - `offset`: Decimal value from -255 to 255 (maximum 2 decimal places)

7. DMM (Delta Min Max)

- Type: DMM
- Supported for: `UNKNOWN_SAMPLE`, `POSITIVE_CONTROL`
- Parameters:
 - `fallbackMin`: Decimal value from 0 to 255 (maximum 2 decimal places)
 - `fallbackMax`: Decimal value from 0 to 255 (maximum 2 decimal places)
 - `ratio`: Integer from 0 to 100

8. DBA (Delta Bandwidth Average)

- Type: DBA
- Supported for: `UNKNOWN_SAMPLE`, `POSITIVE_CONTROL`
- Parameters:
 - `fallbackAvgNegativeBand`: Decimal value from 0 to 255 (maximum 2 decimal places)
 - `fallbackAvgPositiveBand`: Decimal value from 0 to 255 (maximum 2 decimal places)
 - `ratio`: Integer from 0 to 100

Quality Control (QC) validation rules are configured for each channel separately for Samples and Controls. Four validation strategies are supported:

1. `INVALIDATE_WELL` – Excludes the entire well from analysis if any channel fails the validation rule.
2. `INVALIDATE_CHANNEL` – Excludes only the affected channel from analysis if the validation rule fails.
3. `WARNING_WELL` – Keeps the well in the analysis but marks the entire well with a warning if the validation rule fails.
4. `WARNING_CHANNEL` – Keeps the affected channel in the analysis but marks the channel with a warning if the validation rule fails.

The following QC validation rules are supported:

1. `samples.minimumValidPartitionsPercentage`

Defines the minimum percentage of valid partitions required for sample wells. The value must be an integer from 0 to 100.

2. `controls.minimumValidPartitionsPercentage`

Defines the minimum percentage of valid partitions required for control wells. The value must be an integer from 0 to 100.

3. `controls.negativeControlMaxPartitions`

Defines the maximum number of positive partitions permitted in negative control wells. The value must be an integer from 1 to 8000.

4. `controls.positiveControlExpectedConcentration`

Defines the expected concentration or concentration range for positive control wells. Values must be decimal numbers between 0.5 and 15,000 with a maximum of 2 decimal places.

- If only the minimum value is provided, it is treated as the minimum expected concentration.
- If only the maximum value is provided, it is treated as the maximum expected concentration.
- If both values are provided, they define the expected concentration range.
- When both values are specified, the minimum value must be lower than the maximum value.

Retrieving results

Use the `GetExperimentResultsV2` endpoint to retrieve analysis results for an experiment and determine whether results were automated.

When Analysis Rules are used, one of the following `thresholdStrategy` values is included:

- `ANALYSIS_RULES_AUTO_THRESHOLD`
- `ANALYSIS_RULES_NUMERIC`
- `ANALYSIS_RULES_PCT`
- `ANALYSIS_RULES_NCT`
- `ANALYSIS_RULES_DBA`
- `ANALYSIS_RULES_DMM`
- `FALLBACK_FROM_ANALYSIS_RULES`

Quality Control status for each channel is available in:

`results[].concentrations[].qualityControlValidationResults`

If no QC rules were applied, `qualityControlValidationResults` returns null. The response contains the following data:

1. `type` – QC validation rule type:
 - `MINIMUM_VALID_PARTITIONS_PERCENTAGE_FOR_SAMPLE`
 - `MINIMUM_VALID_PARTITIONS_PERCENTAGE_FOR_CONTROL`
 - `MAXIMUM_POSITIVE_PARTITIONS_NUMBER_FOR_NEGATIVE_CONTROL`
 - `CONCENTRATION_RANGE_FOR_POSITIVE_CONTROL`
2. `strategy` – Validation strategy.
3. `failedValidationRules` – List of validation rules that failed for the channel, including:
 - `type` – Validation rule type.
 - `channels` – Channels evaluated by the rule.
 - `passed` – Validation result (true or false).
4. `propagatedFailedValidationRules` – List of QC rule failures propagated from other wells, including:
 - `qualityControlValidationRuleType` – Type of propagated QC rule.
 - `propagationSource` – Source of the propagated failure:
 - `REPLICATE` – Failure propagated from a replicate well.
 - `CONTROL` – Failure propagated from a well with the same Reaction Mix.

For additional technical guidance and examples, refer to Appendix A – QIAcuity Software Suite API v3.5.0.0.

4.3. Automatic RFU export

user can define to export additional **json** file with export of RFU values. Data included in such export are the same as in case of regular RFU in application, but optionally, user can define for which wells results should be generated.

Please refer to Section 7.6.15.7.4. RFU values of the latest *QIAcuity User Manual* to get guidance how this functionality works on UI.

For more technical guidance and examples, please refer Appendix A – QIAcuity Software Suite API v3.5.0.0.

4.4. Multiple occupancy

The QIAcuity Lab Automation Service enables users to retrieve Multiple Occupancy analysis results for a specified experiment based on the selected channel configuration. The exported data use the same format as the standard export in the QIAcuity Software Suite and supports optional sorting and calculation of mean values for replicate groups.

To retrieve Multiple Occupancy analysis results, at least two channels must be specified. If fewer than two channels are provided, the request returns an error.

For additional technical guidance and examples, refer to Appendix A – QIAcuity Software Suite API v3.5.0.0.

4.5. Audit trail

In the QIAcuity Software Suite, Audit trail events coming from third-party Lab Automation actions in the QIAcuity system are distinguished from ones coming from regular users by indicating them in the column "Initiated by" as Lab Automation.

QIAGEN

Plates

Templates

Disk Space

Archive

Tools

Configuration

admin

Configuration

Instrument name

Archive

User Management

Audit Trail

Lab Automation

Events list

Audit trail tracker settings

Event list

Start date *
24/10/2023

End date *
22/11/2023

Search for
Instrument ID / Plate ID / User login / Role name

Category
Suite / Instrument / Plate

Event type
e.g. Calibration

Initiated by
User login

Clear all filters

Events (30/286)

Export to PDF

Date and time	Initiated by User Login	Category	Event type	Affected entity	Instrument ID	
22/11/2023, 16:37:49 UTC+01:00	Lab Automation	Plate	Thermocycler used	90e7f754-d916-45a9-b82b-9dc4b62f314f (Plate ID)	qiacuity-flash-wro-li	check details
22/11/2023, 16:37:27 UTC+01:00	admin	Instrument	Update plate	37718746-511c-4d4c-afb5-37e7a7cd3515 (Plate ID)	qiacuity-flash-wro-li	check details
22/11/2023, 16:37:16 UTC+01:00	admin	Plate	Set plate ownership	37718746-511c-4d4c-afb5-37e7a7cd3515 (Plate ID)	-	check details
22/11/2023, 16:37:16 UTC+01:00	admin	Plate	Create plate	37718746-511c-4d4c-afb5-37e7a7cd3515 (Plate ID)	-	check details
22/11/2023, 16:36:33 UTC+01:00	Lab Automation	Instrument	Experiment run (plate)	90e7f754-d916-45a9-b82b-9dc4b62f314f (Plate ID)	qiacuity-flash-wro-li	check details
22/11/2023, 16:36:01 UTC+01:00	admin	Instrument	Update plate	90e7f754-d916-45a9-b82b-9dc4b62f314f (Plate ID)	qiacuity-flash-wro-li	check details
22/11/2023, 16:35:55 UTC+01:00	Lab Automation	Instrument	Drawer opening/closing during run	-	qiacuity-flash-wro-li	check details
22/11/2023, 16:35:47 UTC+01:00	Lab Automation	Instrument	Drawer opening/closing during run	-	qiacuity-flash-wro-li	check details

ON

Audit trail enabled.
Tracking activities.

QIAcuity Software Suite 2.5.0.0

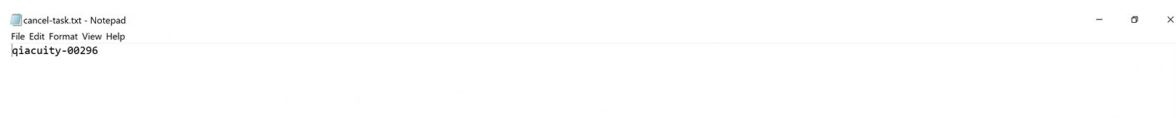
5. Troubleshooting

5.1. Clearing command queue

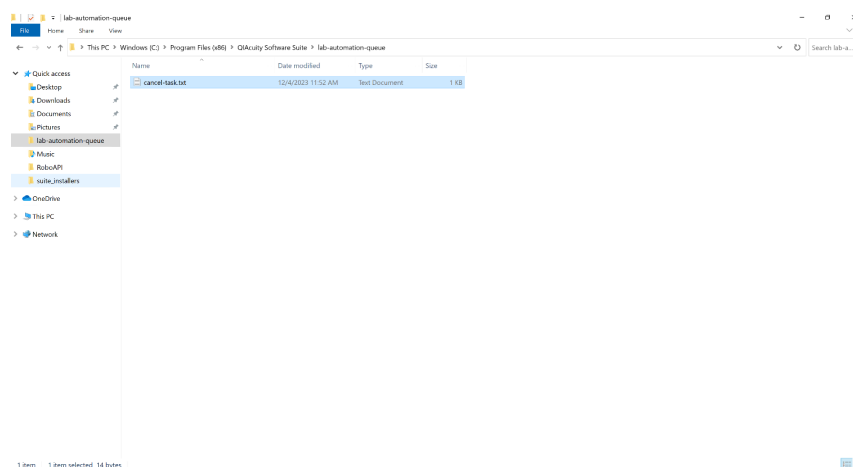
In case a user recognizes the situation when new commands are sent and no action is performed by the instrument, it might indicate that the instrument gets stuck in processing command queued by Lab Automation. There is a possibility to clear its command queue:

Note: When user is unsure on how to proceed, they should contact QIAGEN Technical Service to assist.

1. User needs to prepare or obtain from QIAGEN Technical Service the file:
 - Name of the file is always **cancel-task.txt**, and this name should not be changed manually by the user.
 - The content of the file is always the instrument ID, which is connected and for which command queue should be cleared. The file cannot contain any whitespaces, and the content should not be changed manually by the user.



2. User needs to copy and paste the file into the dedicated folder in the QIAcuity Software Suite: **C:\Program Files (x86)\QIAcuity Software Suite\lab-automation-queue**



Note: User shall never modify (delete, move, etc.) folder **C:\Program Files (x86)\QIAcuity Software Suite\lab-automation-queue**; otherwise, the folder will lose proper system permissions and it can cause the whole QIAcuity system to be corrupted, which will require reinstallation.

3. When file is correctly pasted into the above directory, the system will automatically clear the command queue on the desired instrument and file will be automatically deleted.

Appendix A – QIAcuity Software Suite API v3.5.0.0

Download the QIAcuity Software Suite API document (www.qiagen.com/QIAcuity-Software-Suite-API-v3.5.0.0).

Document Revision History

Revision	Description
July 2026	Content adjusted to Software Release 3.5
August 2025	Content adjusted to Software Release 3.2
May 2025	Content adjusted to Software Release 3.1.1

For up-to-date licensing information and product-specific disclaimers, see the respective QIAGEN kit handbook or user manual. QIAGEN kit handbooks and user manuals are available at www.qiagen.com or can be requested from QIAGEN Technical Services or your local distributor.

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