appliedbiosystems

SeqStudio™ Flex Series Genetic Analyzer API

USER GUIDE

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Revision	Date	Description
A	28 March 2022	New document for the SeqStudio™ Flex Series Instrument Software API.

Contents

1 Introduction

The SeqStudio™ Flex Series Genetic Analyzer with Instrument Software v1.0 can be integrated with a laboratory information system (LIS) or other program and used to automate a variety of informational and file manipulation tasks. The API conforms to the RESTful API interface. Some example tasks are listed below:

- Query the instrument information and status
- Query the instrument calibrations
- Get the results files/errors
- Import and export plate files
- Import and export library objects (run modules, dye sets, analysis settings, file naming conventions, result groups).

Note: The SeqStudio™ Flex Series Instrument Software API does not support control of the instrument such as starting the runs, cancelling injections, and so on.

All API methods are supported in REST and OData format. Examples:

Format	Syntax
REST[1]	https://<Instrument IP>:443/SeqStudioFlex/v1/heartbeat
OData[2]	https://<Instrument IP>:443/SeqStudioFlex.svc/heartbeat

[1] REpresentational State Transfer
[2] Open Data Protocol

A ZIP file containing specifications and examples is available: **APIDocsAttachments.zip**.

2 Notes on API usage with the SeqStudio™ Flex Series Instrument Software

- Authentication
  - All methods except the heartbeat method require authentication credentials to connect to the instrument. See Chapter 3, “Information required for instrument access”.
  - If the SAE module is enabled on the instrument, only SAE account authentication is accepted on the instrument.
- The instrument software contains self-signed certificate for secure communications (TLS). Therefore, an unknown Certificate Authority (CA) error is displayed when using the API. To avoid the error, you can install CA certificates using the instrument software (from the home screen: **Actions ▸ Support ▸ API Certificates**). When using the default self-signed certificate used by the instrument software, omit the CA validation during the handshake (example for CURL: --insecure option)
- API methods are supported in REST and OData format.

```
API Method REST endpoint : https://<Instrument IP>/SeqStudioFlex/v1/<API
Method>
```

```
API Method REST endpoint for OData : https://<Instrument IP>/
SeqStudioFlex.svc/<API Method>
```

Rest	OData
Request	Request
`curl -X GET -H "Authorization: Basic [QWRtaW46MTExMQ==]" -H "Accept: application/ json" "https://XXX.XX.XX.XXX/ SeqStudioFlex/v1/deviceInfo"`	`$ curl -X GET -H "Authorization: Basic [QWRtaW46MTExMQ==]" -H "Accept: application/ atom+xml" "https://XXX.XX.XX.XXX/ SeqStudioFlex.svc/deviceInfo"`

(continued)

Rest	OData
Response	Response
{"request":"getDeviceInfo","DeviceInfo":{"Instrument Model":"3600","Instrument Name":"212PB-110","Instrument Serial Number":"212PB-110","Versions":{"Firmware":"6648001-01","Instrument Software":"1.1","Data Collection":"1.0.1-46","Instrument Server":"1.0"}}}	<?xml version='1.0' encoding='UTF-8'?><a:entry xmlns:a="http://www.w3.org/2005/Atom" xmlns:m="http://docs.oasis-open.org/odata/ns/metadata" xmlns:d="http://docs.oasis-open.org/odata/ns/data" m:context="$metadata#getDeviceInfo"><a:title/><a:summary/><a:updated>2022-03-03T23:27:38Z</a:updated><a:author><a:name/></a:author><a:category scheme="http://docs.oasis-open.org/odata/ns/scheme" term="#OData.Seychelles.DeviceInfo"/><a:content type="application/xml"><m:properties><d:request>getDeviceInfo</d:request><d:DeviceInfo>{"Instrument Model":"3600","Instrument Name":"212PB-110","Instrument Serial Number":"212PB-110","Versions":{"Firmware":"6648001-01","Instrument Software":"1.1","Data Collection":"1.0.1-46","Instrument Server":"1.0"}}</d:DeviceInfo></m:properties></a:content></a:entry>

3 Information required for instrument access

Basic authentication

Except for the instrument query GET /heartbeat, API methods must specify basic authentication to connect to the instrument.

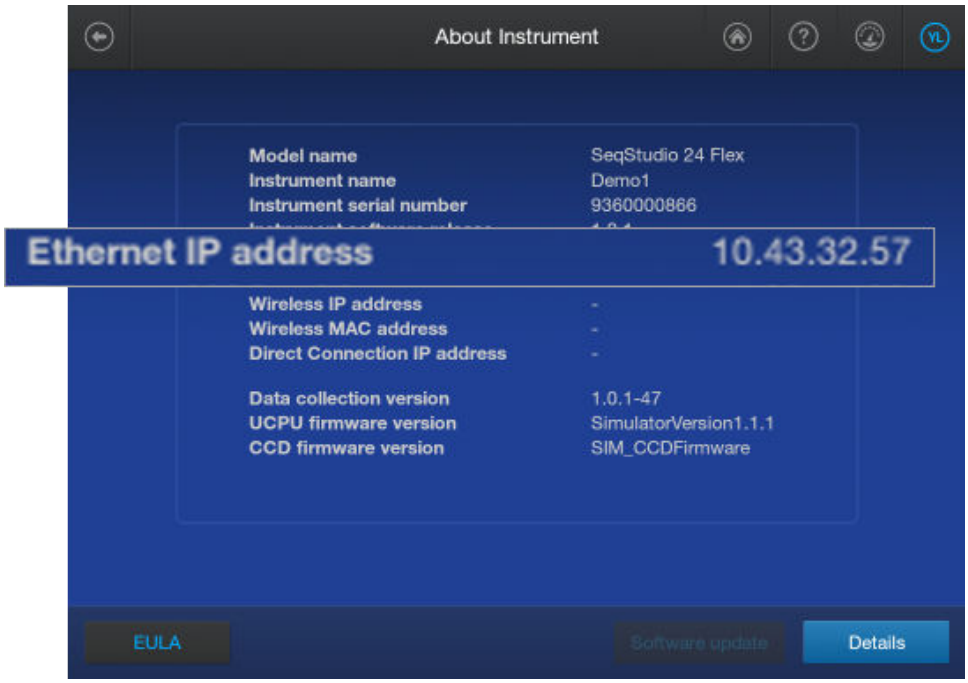
```
// Configure HTTP basic authorization: BasicAuth
        HttpBasicAuth BasicAuth = (HttpBasicAuth)
defaultClient.getAuthentication("BasicAuth");
        BasicAuth.setUsername("YOUR USERNAME");
        BasicAuth.setPassword("YOUR PASSWORD");
```

If the SAE module is enabled on the instrument, only SAE account authentication is accepted on the instrument.

IP address of an instrument

To obtain the IP address, sign in to the instrument.

In the home screen, tap ⋯ **Actions** ▸ **Settings** ▸ **About** .



4 List of API methods

This document describes a subset of the available API methods. For a complete list, refer to the HTML API specification files in **APIDocsAttachments.zip**, in the **/Specifications** folder.

Note: The SeqStudio™ Flex Series Instrument Software API does not support control of the instrument such as starting the runs, cancelling injections, and so on.

Category	Methods
Check instrument status	"GET /heartbeat" on page 9 "GET /instrumentStatus" on page 10 "GET /drawerStatus" on page 11
Send the plate files to the instrument:	"POST/ pushPlate" on page 15
Obtain results and a list of instrument errors	"GET/ resultsLocation" on page 17 "GET /getresultfiles" on page 19 "GET/ instrumentErrors" on page 13

5 Instrument query—API methods

GET /heartbeat

Table 1 GET /heartbeat

Attribute	Description
Description	Use this API method to check the status of the API server (web server) of the instrument.
Request type	GET
URL (API REST endpoint)	REST: `https://<Instrument IP>/SeqStudioFlex/v1/heartbeat` OData: `https://<Instrument IP>/SeqStudioFlex.svc/heartbeat`
Request parameters	None
Response status (possible responses)	**200**—Success
Example request	`$curl -X GET -H "Accept: application/json" "https://<IP Address>/SeqStudioFlex.svc/heartbeat"`

Example response	**200**—Success
	`{`
	`"request": "heartbeat",`
	`"response": "OK"`
	`}`

GET /instrumentStatus

Table 2 GET /instrumentStatus

Attribute	
API function (description)	Use this API method to check the status of the instrument.
Request type	GET
URL (API REST endpoint)	REST: `https://<Instrument IP>/SeqStudioFlex/v1/instrumentStatus` OData: `https://<Instrument IP>/SeqStudioFlex.svc/instrumentStatus`
Request parameters	None
Basic authentication required in header	Yes
Response status (possible responses)	• **200**—Success • **400**—Bad request • **401**—Unauthorized • **500**—Internal server error
Example request	`$curl -X GET -H "Authorization: Basic [QWRtaW46MTExMQ==]" -H "Accept: application/json" "https://XXX.XX.XX.XXX/SeqStudioFlex/v1/instrumentStatus"`

Example response (success)	**200**—Success
	When the instrument is in the idle state:
	`"request": "getInstrumentStatus",`
	`"Status": "IDLE"`
	`}`
	When the instrument is in the running state:
	`"request": "getInstrumentStatus",`
	`"Status": "RUNNING"`
	`}`

Example response (failure)	**400**—Bad request
	`{`
	`"Message": "Missing Authorization details. Please use proper credentials"`
	`}`
	401—Unauthorized
	`{`
	`"Message": "Username or Password incorrect. Please use proper credentials"`
	`}`

GET /drawerStatus

Table 3 GET /instrumentStatus

Attribute	
API function (description)	Use this API Method to check the state of the drawer or plates in the instrument
Request type	GET
URL (API REST endpoint)	REST: `https://<Instrument IP>/SeqStudioFlex/v1/drawerStatus` OData: `https://<Instrument IP>/SeqStudioFlex.svc/drawerStatus`
Request parameters	None
Basic authentication required in header	Yes
Response status (possible responses)	• **200**—Success • **400**—Bad request • **401**—Unauthorized • **500**—Internal server error
Example request	`$curl -X GET -H "Authorization: Basic [QWRtaW46MTExMQ==]" -H "Accept: application/json" "https://172.19.21.136/SeqStudioFlex/v1/drawerStatus"`

Example response (success)	**200**—Success
	`{`
	`"request": "drawerStatus",`
	`"DrawerStatus": {`
	`"platesStatus": [`
	`{`
	`"arrayCount": 0,`
	`"autoAnalysis": false,`
	`"calibrationPlate": false,`
	`"cloudEnabled": false,`
	`"injectionStat": 0,`
	`"ownerName": "User1",`
	`"plateEndTime": 1646435040000,`
	`"plateFormat": "REGULAR_96",`
	`"plateName": "Plate_20220216_145536",`
	`"plateNotificationStatus": false,`
	`"platePosition": "A",`
	`"plateStartTime": 1646432274935,`
	`"plateType": "FRAGMENT",`
	`"status": "COMPLETED",`
	`"timeRemainingPlateToFinish": 0,`
	`"timeZone": "America/Los_Angeles",`
	`"timestamp": 1646433040376,`
	`"totalInjection": 0`
	`}`, *(continued on next page)*

Table 3 GET /instrumentStatus *(continued)*

Attribute	
Example response (success) *(continued)*	**200**—Success *(continued)* { "arrayCount": 0, "autoAnalysis": false, "calibrationPlate": false, "cloudEnabled": false, "injectionStat": 0, "ownerName": "", "plateEndTime": 1646434980000, "plateFormat": "REGULAR_96", "plateName": "Plate_20220210_043326", "plateNotificationStatus": false, "platePosition": "B", "plateStartTime": 1646432977391, "plateType": "SEQUENCING", "status": "RUNNING", "timeRemainingPlateToFinish": 1932, "timeZone": "America/Los_Angeles", "timestamp": 1646433040376, "totalInjection": 0 }, { "arrayCount": 0, "calibrationPlate": false, "cloudEnabled": false, "injectionStat": 0, "plateEndTime": 0, "plateNotificationStatus": false, "platePosition": "C", "plateStartTime": 0, "status": "AVAILABLE", "timeRemainingPlateToFinish": 0, "timestamp": 0, "totalInjection": 0 }, { "arrayCount": 0, "calibrationPlate": false, "cloudEnabled": false, "injectionStat": 0, "plateEndTime": 0, "plateNotificationStatus": false, "platePosition": "D", "plateStartTime": 0, "status": "AVAILABLE", "timeRemainingPlateToFinish": 0, "timestamp": 0, "totalInjection": 0 }], "timestamp": 0

Example response (failure)	**400**—Bad request
	{
	"Message": "Missing Authorization details. Please use proper credentials"
	}
	401—Unauthorized
	{
	"Message": "Username or Password incorrect. Please use proper credentials"
	}

GET/ instrumentErrors

Table 4 GET /instrumentStatus

Attribute	
Description	Use this API method to obtain a list of the current instrument errors.
Request type	GET
URL (API REST endpoint)	REST: `https://<Instrument IP>/SeqStudioFlex/v1/instrumentErrors` OData: `https://<Instrument IP>/SeqStudioFlex.svc/instrumentErrors`
Request parameters	None
Basic authentication required in header	Yes
Response status (possible responses)	• **200**—Success • **400**—Bad request • **401**—Unauthorized • **500**—Internal server error
Example request	`$curl -X GET -H "Authorization: Basic [QWRtaW46MTExMQ==]" -H "Accept: application/json" "https://172.19.21.136/SeqStudioFlex/v1/instrumentErrors"`

Table 4 GET /instrumentStatus *(continued)*

Attribute	
Example response (success)	If no instrument errors are reported: `"request": "getInstrumentErrors",` `"InstrumentErrors": "No instrument errors found"` `}` If instrument errors are reported `"request": "getInstrumentErrors",` `"InstrumentErrors": "[\"[01:01:51.804] 2 999 1 1 1581832911 <alpha_symbolic> % % Data manager internal error occurred.\", \"[01:02:02.896] 2 101 1 1 1581832922 % % START COLLECTION command received before sampling rate set.\", \"[01:02:10.566] 3 102 1 1 1581832930 % % Can't detect Z-Axis home sensor during initialization.\", \"[01:02:15.696] 3 161 1 1 1581832935 % % Can't move Y-Axis of autosampler, destination position is not within the movable range.\"]"` `}`

Example response (failure)	**400**—Bad request
	`"Message": "Missing Authorization details. Please use proper credentials"`
	`}`
	401—Unauthorized
	`"Message": "Username or Password incorrect. Please use proper credentials"`
	`}`

6 Plate—API methods

POST/ pushPlate

Table 5 POST /push/plate

Attribute	Description
API function (description)	Use this API method to send the plate file to instrument software Inbox (input the CSV or PSM file).
Request type	POST
URL (API REST endpoint)	`REST: https://<Instrument IP>/SeqStudioFlex/v1/push/plate?` `OData: https://<Instrument IP>/SeqStudioFlex.svc/push/plate?`
Request parameters	value (required)—Name of CSV or PSM plate file with full path
Basic authentication required in header	Yes
Response Status (possible responses)	• **201**—Success and created resource • **400**—Bad request • **401**—Unauthorized • **500**—Internal Server error
Example request	`$curl -X POST -H "Authorization: Basic [QWRtaW46MTExMQ==]" -H "Accept: application/json" -H "Content-Type: multipart/form-data" -F 'value=@/Desktop/test/APIPlate.csv'` **Note:** See the example **APIPlate.csv** file in **APIDocAttachments.zip**, in the **/pushplate** folder.

Table 5 POST /push/plate *(continued)*

Attribute	Description
Example response (successful)	**201**—Success `{"request":"importPlate","ImportPlate":"Plate pushed to RunQueue successfully."}`

Example response (failure)	**400**—Bad Request
	`{"Message": "Missing Authorization details. Please use proper credentials"`
	401—Unauthorized
	412—Precondition failed
	`{`
	`"Message": "ErrorCode=125, Messages=[Duplicate plate name]"`
	`}`
	412—Precondition failed
	`{`
	`"Message": "ErrorCode=132, Messages=[Plate is not compatible with current instrument configuration.`
	`The current instrument configuration uses 0 capillaries.]"`
	`}`
	412—Precondition failed
	`{ "request": "importPlate",`
	`"ImportPlate": "ErrorCode=121, Messages=[filename convention customFile]"`
	`}`
	412—Precondition failed
	`{ "request": "importPlate",`
	`"ImportPlate": "ErrorCode=122, Messages=[filename convention customFile]"`
	`}`

7 Results—API methods

GET/ resultsLocation

Table 6 GET /getresultslocation

Attribute	Description
Description	Use this API method to obtain the save location (results location) specified in a plate file.
Request type	GET
URL (API REST endpoint)	REST: `https://<Instrument IP>/SeqStudioFlex/v1/resultslocation?platename=` OData: `https://<Instrument IP>/SeqStudioFlex.svc/resultslocation?platename=`
Request parameters	`platename` (required)—Name of the plate file
Basic authentication required in header	Yes
Response status (possible responses)	• **200**—Success • **400**—Bad request • **401**—Unauthorized • **412** —Precondition failed (plate not found) • **500**—Internal server error
Example request	`$curl --insecure -X GET -H "Authorization: Basic [QWRtaW46MTExMQ==]" -H "Accept: application/json" "https://XXX.XX.XX.XXX/SeqStudioFlex/v1/resultslocation?platename=Plate_1`

Table 6 GET /getresultslocation *(continued)*

Attribute	Description

Example response (successful)	**200**—Success
	{
	"request": "getResultsLocation",
	"ResultsLocation": {
	"PlateName": "Plate_1",
	"Instrument": "Instrument",
	"Connect Platform": "Thermo Fisher Connect/Personal Files/ Test2",
	"Network drive": "XXX.XX.XX.XXX/User1/"
	}
	}

Example response (failure)	**400**—Bad Request
	{
	"Message": "Missing Authorization details. Please use proper credentials"
	}
	400—Bad Request
	{
	"request": "getResultsLocation",
	"ResultsLocation": "Missing platename in the request"
	}
	401—"Username or Password incorrect. Please use proper credentials"
	412 Precondition failed—
	{
	"request": "getResultsLocation",
	"ResultsLocation": Could not able to get results locations. (Requested plate not found)"}

GET /getresultfiles

Table 7 GET /getresultfiles

Attribute	Description
Description	Use this API method to obtain the result files for one well (specified by plate name and well ID). Results for re-injections of the well are included. A ZIP file with the appropriate files for the well is saved to the specified location. Sequencing: • AB1—Sequencing results • FASTA—Text file of the sequence • QUAL—Text file of quality scores for a sequence stored in a corresponding FASTA file • PHRED—Text file of quality scores Fragment analysis • FSA—Fragment analysis results • CSV—Peak table for fragment analysis results
Request type	GET
URL (API REST endpoint)	REST: `https://<Instrument IP>/SeqStudioFlex/v1/getresultfiles?platename=<platename>&wellid=<wellid>` OData: `https://<Instrument IP>/SeqStudioFlex.svc/getresultfiles?platename=<platename> &wellid=<wellid>`
Request parameters	• `platename` (required)—Name of the plate `wellid` (required)—Well location (for example A01, B01)
Basic authentication required in header	Yes
Example request	`$curl -X GET -H "Authorization: Basic [QWRtaW46MTExMQ==]" -H "Accept: application/json" "https://XXX.XX.XX.XXX/SeqStudioFlex/v1/getresultfiles?platename=Plate1&wellid=A01" > /Downloads/getresultsSequencing.zip`
Possible responses	• **200**—Success • **400**—Bad request • **401**—Unauthorized • **412** —Precondition failed • **500**—Internal Server error

Table 7 GET /getresultfiles *(continued)*

Attribute	Description
Example response (successful)	Binary stream of ZIP content containing results files. This stream can be saved as a ZIP file. **Note:** See the example files in **APIDocAttachments.zip**, in folders **/getResults/sequencing** and **/getResults/fragment**.

Example response (failure)	**400**—Bad Request
	`{`
	`"Message": "Missing Authorization details. Please use proper credentials"`
	`}`
	401 Unauthorized—
	`"Username or Password incorrect. Please use proper credentials"`
	412 Precondition failed—
	`{`
	`"request": "getResultFiles",}`
	`"ResultFiles": "Missing platename in the request."`
	`}`
	412 Precondition failed—
	`{`
	`"request": "getResultFiles",}`
	`"ResultFiles": "Missing wellid in the request."`
	`}`
	412 Precondition failed—
	`{`
	`"request": "getResultFiles",}`
	`"ResultFiles": "Could not find any result files for plate <Plate_SeqJuly23> and wellId <A01>"}`
	`}`

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  Note: For SDSs for reagents and chemicals from other manufacturers, contact the manufacturer.