QPatch Compact User Manual

Content

1. Introduction to QPatch Compact

1.1 Scope and purpose

QPatch Compact (QPC) performs up to 8 independent, high-fidelity voltage clamp or current clamp experiments at the same time. The system contains a database for data storage and software for setting up, executing, and analyzing patch clamp experiments.

As an integral part of the QPatch Compact system, this manual must be easily accessible to users. This user manual is also accessible from the QPatch Compact screening station software (SSS).

Suggestions for improvements are always welcome; please contact us for your feedback at info@sophion.com.

1.2 Notes and cautions

Throughout the manual, several notes and cautions are mentioned. These are marked in grey, and orange boxes, respectively. The purpose of notes, and cautions is shown in the following.

Note! A note contains information that should be paid special attention to. Notes are typically information which is important for correct assay setup. Failure to conform to notes may negatively affect performance and data quality.

Caution! A caution contains information that should be followed. Cautions are typically information that is important for correct system setup and use. Failure to conform to cautions may lead to permanent loss of data, cells, reagents, and consumables.

1.3 System description

Caution! We recommend that staff familiarize themselves with risks of electrical measurements, hazardous and toxic liquids, and related biohazards. Users should read this manual and especially note the "Safety Guide" which is enclosed with the instrument in the transport case.

QPC is used for measuring ion channel currents or voltages in living cells employing the planar patch clamp technique. The experiments are performed on silicon chips with either a single or ten-patch hole. Eight silicon chips are integrated into a QPlate 8/8X.

The QPlate is a ready-to-use consumable (Figure 1). When cells are applied to the QPlate, they will be moved to the patch hole by a microfluidics system and captured at the patch hole by suction. The cells to be patched are randomly selected. Therefore, the cells in the sample applied to the patch clamp chip must be of high quality and uniformly single cell suspended.

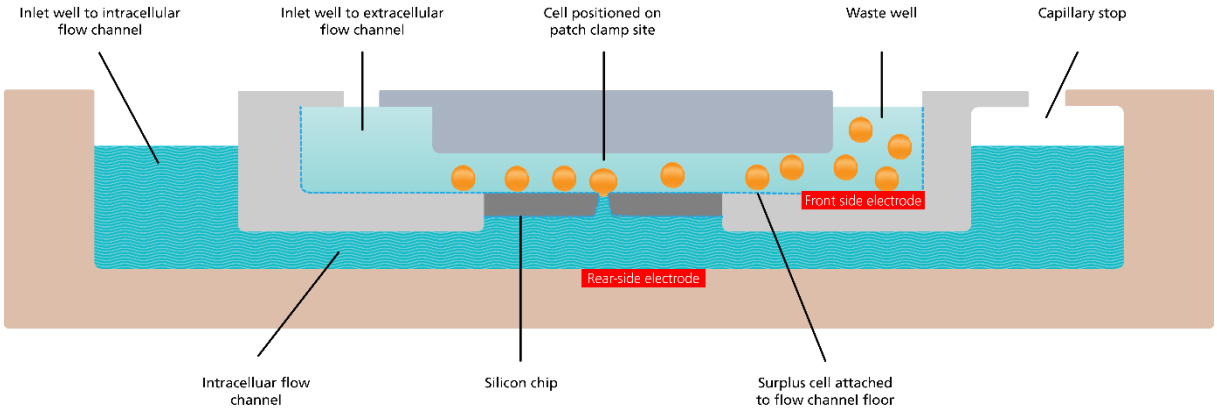


Figure 1 Schematic view of one recording site in a QPlate 8

1.4 QPlate 8/8X

Caution! QPlates must be stored at 4-8°C in the protective bag under vacuum in which they were shipped. QPlates should **not** be placed back at 4-8°C after the bag is opened. This is to avoid condensation on the QPlates, which can disturb the electrical circuit.

Each measurement site contains two microfluidic flow channels, one for the extracellular and one for the intracellular solution (Figure 1) and the liquids are driven by fluid pressure. It is important that both the positive and negative pressure is within the recommended range – see chapter 7.

QPlate 8 are single-hole QPlates and QPlate 8X are the corresponding multi-hole QPlates.

The QPlate 8/8X is a single-use consumable, hence the QPlate recording sites are only once and cannot be reused.

The extracellular solution is collected in the waste reservoir inside the QPlate 8 and has a volume of 250 µL. It is important to comply with the volume guidance from the system for it to keep track of the liquid level in the waste reservoir. It is the only container for biological and potentially hazardous waste and must be disposed of accordingly. Please see our "Safety Guide" which is enclosed with the instrument in the transport case for more information.

A pair of measurement electrodes are placed at each of the 8 sites and connected to individual amplifiers.

1.4.1 Shelf life of partially used QPlate 8

Once you start using a QPlate 8, it can be used for one week. When not actually in use, partially used QPlates 8 should be kept in a desiccator.

1.5 System architecture

QPatch Compact consists of:

- The **instrument** which handles the QPlate, cells, compounds, and performs the actual experiments. This includes the electrothermic circulator which ensures temperature control.
- The internal **Oracle database,** used for storing experimental parameters and measured data.
- The **Sophion Analyzer software,** used for planning experiments, executing, and analyzing the data.

The QPC instrument is commanded via the touch screen using the **Screening Station Software (SSS)**.

The Oracle database stores all recorded data and other information in the system. The database is the software device used for storage of assay definitions, experiment data and user settings. The database ensures that the measured data cannot be deleted accidentally. This also applies to all information on experiment settings and execution. Users must login, and the system records which users performed which actions in the system. QPatch Compact is delivered with a pre-configured and pre-installed database which is ready to operate with the instrument.

Figure 2 QPatch Compact

1.6 Pipetting light guidance

The pipetting light and audio guidance is an assistive feature to the cell and liquid addition steps. It was incorporated to help guide the user during liquid addition for more accurate timing and a better user experience.

The light guidance features several functions depending on the particular step in the patch clamp setup process.

1.6.1 Instrument initialization

During instrument initialization the light guidance will always show an downward-upward flash sequence. This indicates that the light guidance works as expected.

1.6.2 QPlate insertion/removal

The pipetting light guidance indicates when to insert and remove the QPlates and in which direction to move the QPlate.

1.6.3 Active sites on QPlate

The active sites which are indicated on the touch screen as the user selects the sites on which to record are also highlighted with white light next to the manifold.

1.6.4 Intracellular (IC) and extracellular (EC) solution addition

During IC and EC addition, the light guidance shows which sites to pipette into indicated by blue light.

1.6.5 Cell addition

During cell addition, the light guidance will indicate the next site in which to pipette by a blue light. The user must wait without inserting the pipette tip into the manifold until the blue light turns orange while preparing to insert the pipette tip and dispense the liquid. As soon as the blue light turns orange the user inserts the pipette tip and dispenses the liquid in one clean motion. The next site in which to pipette will then turn blue and the process repeats with site.

1.6.6 Compound addition

During compound addition, the light guidance will point to the next site in which to pipette indicated by a blue light like the cell addition step. The user must wait without inserting the tip until the blue light turns orange. Once it has turned orange the user must insert the tip into the manifold as far as

it will go making sure the tip collar rests on the manifold shoulder and dispense the liquid in one clean motion and then remove the tip without aspirating. Please consult our video tutorials "How to prepare cells for QPatch Compact" and "How to start your experiment on QPatch Compact" available on our self-learning QPC support site.

1.6.7 Compound addition for ligand-gated experiments

During compound addition, the light guidance will point to the next site in which to pipette indicated by a blue light similar to cell addition. The user must wait without inserting the tip until the blue light turns orange.

The washout of the compound is also indicated by a blue light and the moment the blue light turns orange, the user must insert the tip into the manifold as far as it will go making sure the tip collar rests on the manifold shoulder and dispense the liquid in one clean motion and then remove the tip without aspirating.

1.6.8 Cells and compound additions scheme

Color	Instruction
Blue	Await orange light without inserting pipette tip
Orange	Dock & dispense, then remove the tip without aspirating

1.7 Temperature control

The temperature control ensures temperature stabilization at the recording site throughout the experiment with a temperature accuracy of ±0.5°C.

The temperature stabilization interval ranges from 18°C/64°F to 40°C/104°F.

The temperature control is enabled by the thermoelectric circulator Loop100 (Lauda), connected to QPC through insulated tubing and a data cable. An ambient temperature sensor on QPC enables temperature stabilization independent of the ambient temperature.

The thermoelectric circulator heats and cools decalcified water and pumps it through the bed of nails (BON) inside QPC and thereby stabilizes the recording temperature. The circulator is filled with decalcified water including an anti-fungal and antibacterial agent through an opening on the top of the circulator. Instructions on how to fill/empty the thermoelectric circulator is described in section 5.3.

The thermoelectric circulator may display a different temperature on its display compared to the target temperature indicated in the SSS depending on the ambient temperature and the absolute temperature indicated. This is expected as the temperature control also takes the ambient temperature into consideration.

The circulator has an independent power inlet and must be activated in the SSS on the QPC touch screen to actively stabilize temperature at the recording site. This is explained in a subsequent section.

Before starting an experiment, the QPC must be activated, and the temperature control dial set to the desired temperature for 1 hour prior to starting any experiments.

1.8 Sophion Analyzer software

The Sophion Analyzer software is used for designing and planning experiments and for analyzing recorded data. It is used to design voltage protocols and whole cell protocols (pressure protocols) as well as documenting the cell type and ion channel studied. These protocols cannot be modified during the recording experiment.

It comes pre-installed on the QPC instrument PC or it is downloaded and installed on one or more office PCs simultaneously, connected to the same network as the instrument in order to access the Oracle database in the instrument PC.

Both raw data and analyzed data can be displayed. The analysis comprises all elements relevant for patch clamp data like IV relation, mono- and bi-exponential fit to kinetic parameters as well as pharmacological quantification.

2. Startup and shutdown procedures

2.1 Startup

Please see the installation guide (available on: QPatch Compact self-support - Sophion, scan QR upper right hand corner for access) for details on setting up the instrument.

Before the system is powered up, ensure that the pressure and vacuum inlets are connected and that the pressure and vacuum levels are within the specified range (see chapter 6 for installation tests and chapter 7 for instrument specifications).

Make sure the thermoelectric circulator is filled with decalcified water incl. an anti-fungal and anti-bacterial agent, and that the water circulator is connected to QPC. Inspect the system and ensure the instrument is clean and dry.

2.1.1 Power up & initialization

Turn on the circulator by pressing the power button on the back of the device. The circulator will automatically enter standby mode (visible on circulator display).

Then turn on QPatch Compact by pressing the power button on the left side of the instrument, a white ring will illuminate as long as it is turned on. The touch screen will activate and QPC will start initializing.

During initialization, the QPC manifold mechanism will move and automatically release the red transport plate which sits in the QPlate slot during transport. This may take a couple of minutes.

Caution! As the insulated tubing fills with water the low volume circulator container will drain slightly. Make sure that the container is refilled with decalcified water as this ensures optimal heating/cooling properties of the temperature control.

2.1.2 Logon

The screening station login screen will appear, and the user must log in with their credentials and password. New user accounts are set up in the Sophion Analyzer software, using the administrator logon - consult our Sophion Analyzer user manual for more information.

Once logged in, the Pre-flight screen will appear and the QPlate icon appears indicating to insert the QPlate. The light guidance next to the manifold will indicate the direction in which to insert the QPlate.

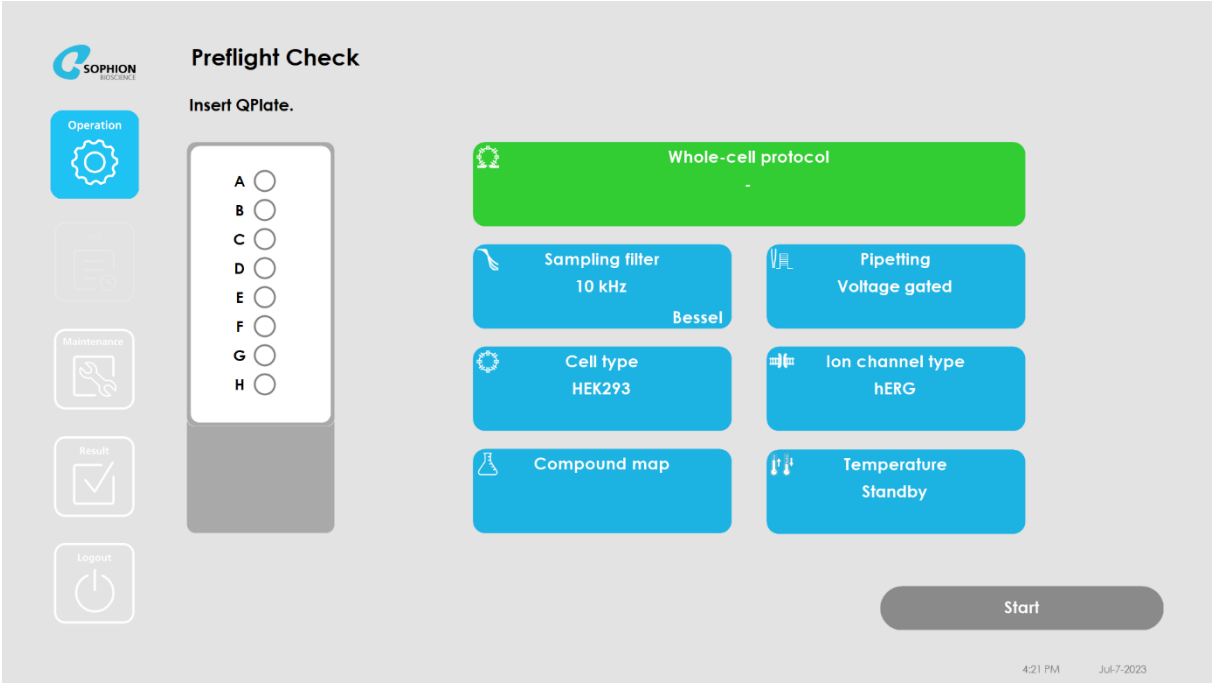


Figure 3 QPatch Compact preflight screen

2.1.3 Temperature control

Press the temperature control icon in the lower right corner to enter the temperature control settings. Activate the temperature control by toggling the button and set the desired target temperature for your next experiment, see Figure 4. Exit the temperature control settings.

We recommend powering up the system 1 hour with the temperature activated and the target temperature set before conducting any experiments. This ensures that the instrument has reached a steady temperature level before conducting any experiments and will ensure optimal temperature recording conditions.

Once the QPlate is inserted, the QPlate color and barcode is shown on the touch screen and the instrument is ready to set up the experiments.

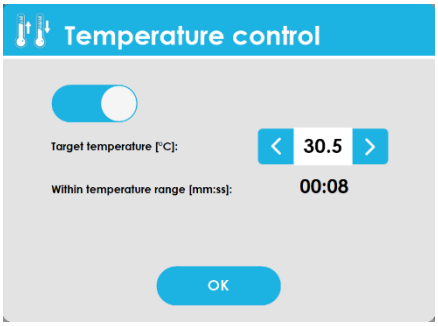


Figure 4 Temperature control dial

2.2 Shutdown procedure

On the touch screen monitor click on "Logout" to return to the login screen. Click on "X" in the upper right corner to shut down the application. It takes a couple of seconds for the touch screen to respond. You can now turn off the power to the system by clicking the power button on the left-hand side of the instrument.

Note! To access the database from another laptop through a network connection, you must leave the instrument turned on.

3. Conducting an experiment

Each step below is described in general terms. We presume the instrument was properly cleaned after previous use.

1. Set up the protocols

   Define a whole-cell protocol and the relevant voltage protocols using Sophion Analyzer software.

   Please refer to the QPatch Compact Assay Setup Guide to learn how to set up protocols.

2. Prepare the QPlate

   Acclimatize the QPlate (while it is still in the vacuum-packed plastic pocket) at room temperature for at least 1 hour before use.

3. Start up the QPC

   Turn on the instrument (on the left-hand side) and the thermoelectric water circulator. Log on via the touch screen monitor.

   Notice: Username and password are valid also for the QPatch Compact database.

4. Prepare the cells

   Harvest the cells and pour the cell suspensions into vials.
   Please refer to the QPC video tutorial "How to harvest cells for QPatch Compact", "How to prepare cells for QPatch Compact" and the QPatch Compact Guide for Preparation of Cells and Solutions to learn how to handle cells for this instrument. Scan the QR code to access our online self-service support material.

5. Preflight the QPC

   Activate the temperature control (if not activated) and set the target temperature at the recording sites for your experiment. We recommend allowing 1 hour to stabilize the recording temperature at the recording site.

   Cut the vacuum-packed plastic pocket and remove the QPlate. Insert the QPlate into the QPC. QPlate test sites now appear on the screen including the barcode.

   Select how many recording sites you want to execute.

   Select the "Whole-cell protocol" you want to use. Define settings for "Sampling filter", "Pipetting", "Cell type", "Ion channel type", and "Compound map".

   Please refer to the QPC video tutorial "How to start an experiment on QPatch Compact" for further information available on our online self-service support site.

6. Start experiments

   Click on "Start" to begin your experiments. The touch screen monitor will now give you instructions for the next steps described in more detail below.

   Notice: we recommend always use reverse pipetting for all pipetting steps.

   How to reverse the pipette:

   - Set up the pipette to the applicable volume

- Depress the plunger completely – go past the first stop to the second stop
- Immerse the tip in the liquid. Slowly release the plunger to full extension
- Dispense by pressing to the first stop
- When using the included motorized pipettes, make sure the pipette is set to "reverse pipetting" mode

Please refer to our QPC video tutorial "How to reverse pipette with QPatch Compact".

If you would like to make additional changes to a protocol or set up a new protocol, go to the Analyzer software.

7. Protocol finished — The "GO" button changes color to green once your experiments are completed.

8. Analyze data — To analyze your data, open the Sophion Analyzer software. Consult the Sophion Analyzer user manual for more information.

3.1 Terminating a running protocol

If you want to terminate or abort a running experiment, click on "End all Experiments". A dialog box will appear. Confirm that you wish to stop the experiment.

All data acquired until aborting the run is stored and is accessed from the Sophion Analyzer software.

4. Operating the system

4.1 Cells

The success rate for experiments on QPatch Compact highly depends on the cell quality. QPatch Compact is optimized for using immortalized cell lines sub-cultured as adherent cell lines. The optimal harvesting procedure for obtaining viable and single cells in suspension should be determined for each cell line.

Note! Please refer to the QPatch Compact Cells & Solutions Guide to learn how to handle cells for QPatch Compact. Also consult our QPC video tutorials "How to harvest cells for QPatch Compact" and "How to prepare cells for QPatch Compact"

4.2 Saline solution requirements

The saline solutions (also known as Ringer's solutions and buffer solutions) used for extra- and intracellular liquids must include at least 10 mM chloride.

Furthermore, it must have conductivity in the range of 0.5–2.0 S/m measured at the same ambient temperature as that used for the experiments. This is a requirement for the QPlates to operate properly. The required conductivity corresponds to the common physiological saline solution.

In addition, the solutions should be filtered using a microparticle filter. Microparticles may block the patch clamp orifice and thus reduce the experimental success rate.

4.3 QPlate barcodes

The onboard barcode reader decodes the QPlate barcode, which is specific for each QPlate. The instrument will reject the QPlate, if the barcode is missing, the QPlate is completely used up or if the barcode is unreadable.

Caution! QPlates are always shipped with a barcode that contains important production information. Do not replace this barcode with your own.

4.4 Touch screen monitor user interface

QPatch Compact is operated from an external touch screen monitor, which responds to directly touching the buttons on the screen. When you need to enter numbers or letters, an on-screen keyboard appears.

4.5 Screening station software (SSS)

4.5.1 Sophion logo – easy access to manuals and guides in SSS

User manuals and guides are easily available by always clicking the Sophion logo in the upper left-hand corner.

4.5.2 Login screen

The database field provides information on which database is used. If there is more than one database available, a drop-down list will appear upon clicking the blue arrow on the right side of the database field (Figure 5).

Figure 5 QPatch Compact logon screen

Touch the username field and an on-screen keyboard will pop up in which you can enter your username. Click "Enter". Do the same steps for the password field.

Click on "Login" when you are done. The username and password entered are checked in the database. If no match is found, a "Login failed" message will appear.

Shutdown by clicking the "x".

Note! The on-screen keyboard does not have special characters (such as #, @ or $). Therefore, when you choose a username and password, please ensure it can be entered using the on-screen keyboard. The username and password validation are not case-sensitive.

4.5.3 Left-side menu bar

In the instrument software a left-side menu is always visible when logged in. The menu allows easy navigation between the functions.

Table 1 Software button explanations

	**Click the button to enter preflight mode.** In this window you can initiate and set up your experiments.
	Not applicable
	**Click the button to open maintenance mode.** In this window you can perform maintenance tasks such as setting the temperature control settings etc.
	Click the button to view completed results.
	Click the button to get system information and to log out of the instrument.

4.1 Operation

By pressing the "Operation icon" the Preflight Check window will appear. This is where each patch clamp run is set up.

4.1.1 Preflight Check screen

The Preflight Check screen opens after login or when selecting the 'operation' button, located at the top of the left-side menu bar.

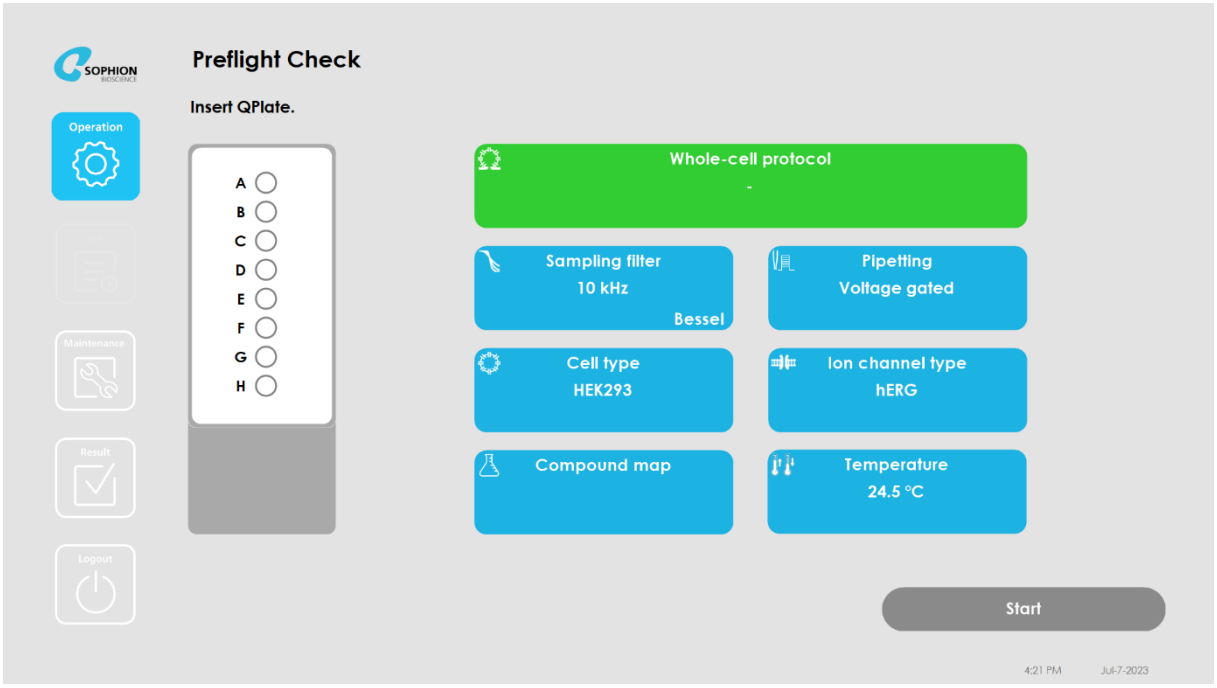


Figure 6 Preflight Check screen

4.1.2 Maintenance menu

While in Preflight Check and before setting up a run, the user can enter the maintenance menu by clicking the Maintenance icon on the left-hand side of the menu bar (Figure 7).

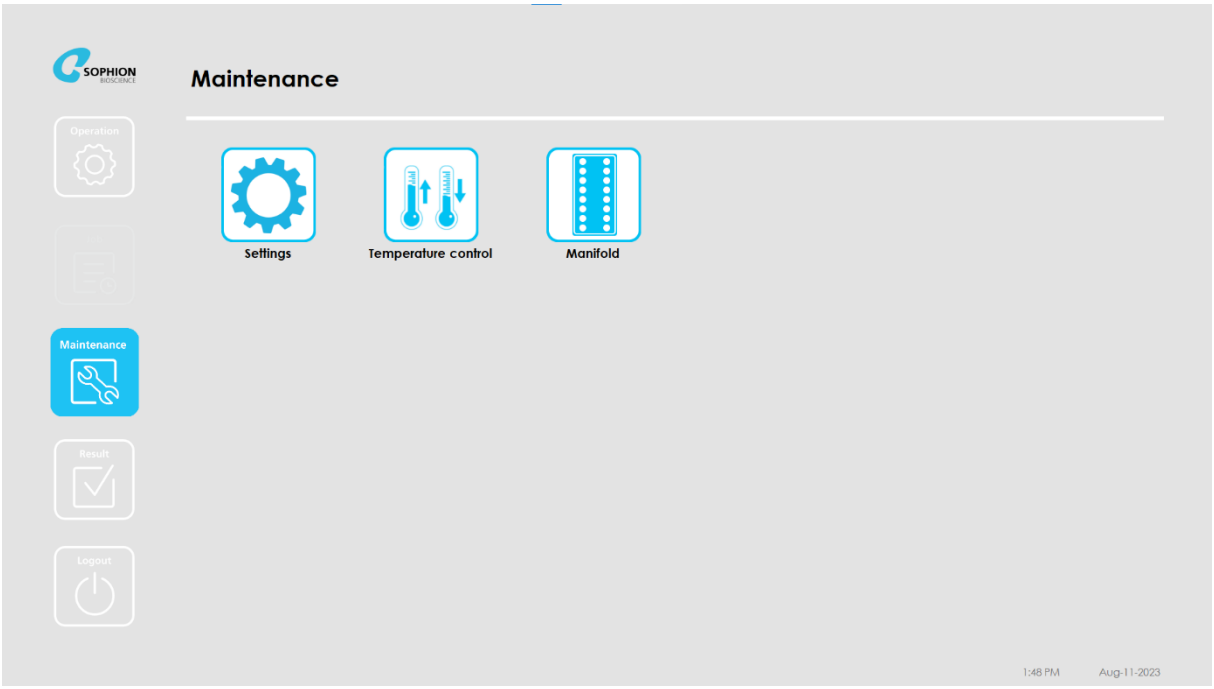


Figure 7 Maintenance menu

Here's access to the Settings menu, the Temperature control and the Manifold menu. IN the setting menu, user can preset default settings before a run and the Temperature control menu and Manifold menu are mainly for performance tests and troubleshooting purposes. The 2 latter menus are described in the Troubleshooting section.

4.1.3 Settings menu

The settings menu allows the user to preset 3 user defined settings, see Figure 8. These settings are not accessible during a run and must be preset before the run starts to be applied.

1) The minimum dispense delay for liquid addition
2) Whether the Repeat protocol setting when applying voltage protocols should be on or off by default
3) Activation of the audio cue (single beep) at dock & dispense during liquid addition

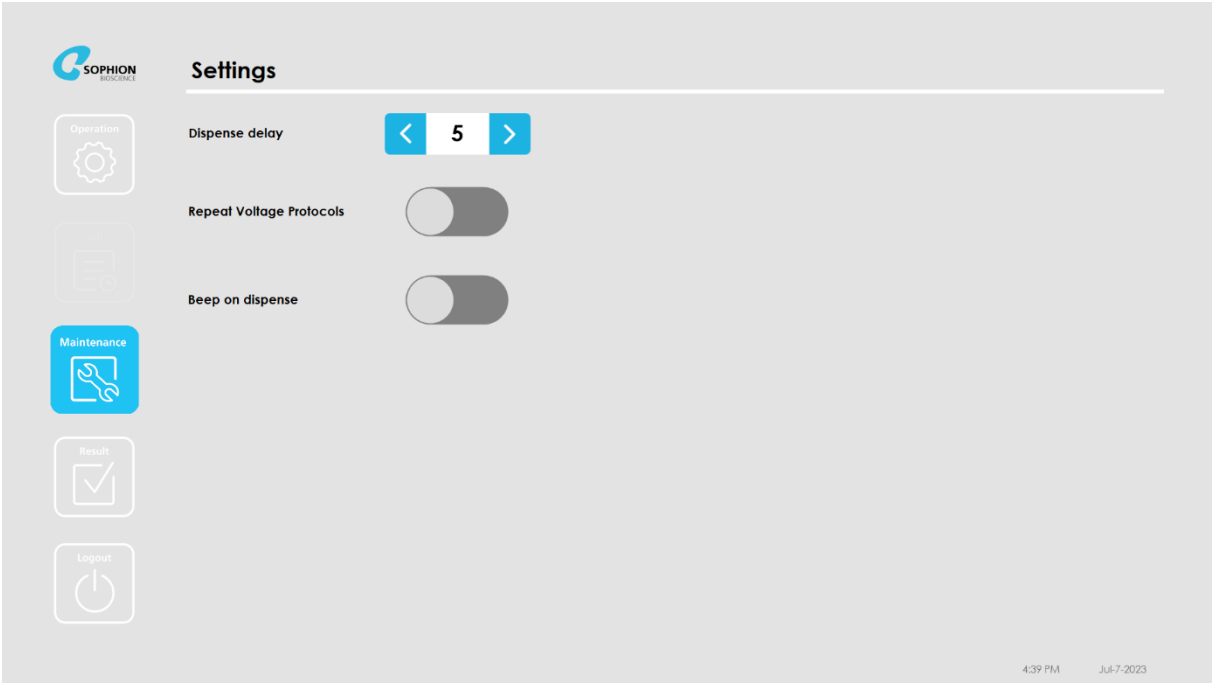


Figure 8 Settings menu

4.1.3.1 Minimum dispense delay

This setting allows the user to adjust the minimum dispense delay, which is the minimum delay from the user clicks OK at a site until that compound is dispensed. This delay is aimed at giving the user sufficient time to prepare for dispensing into sites.

4.1.3.2 Repeat voltage protocols

When the user chooses a voltage protocol in the voltage gated mode the default setting of "repeat protocol" whether it be on or off is set here. After choosing a voltage protocol the user can always revert back to this default setting of the repeat voltage protocol.

4.1.3.3 Beep on dispense

If left on, the instrument will emit a beep when the user must insert the pipette tip and dispense into the well the moment the blue light turns orange.

To return to the Preflight check screen press the Operation button.

Once the QPlate has been inserted the QPlate color and barcode will appear. The user indicates which sites to record from by selecting the sites on the touch screen. The sites are highlighted accordingly by white light on the QPatch Compact next to the manifold (see Figure 9).

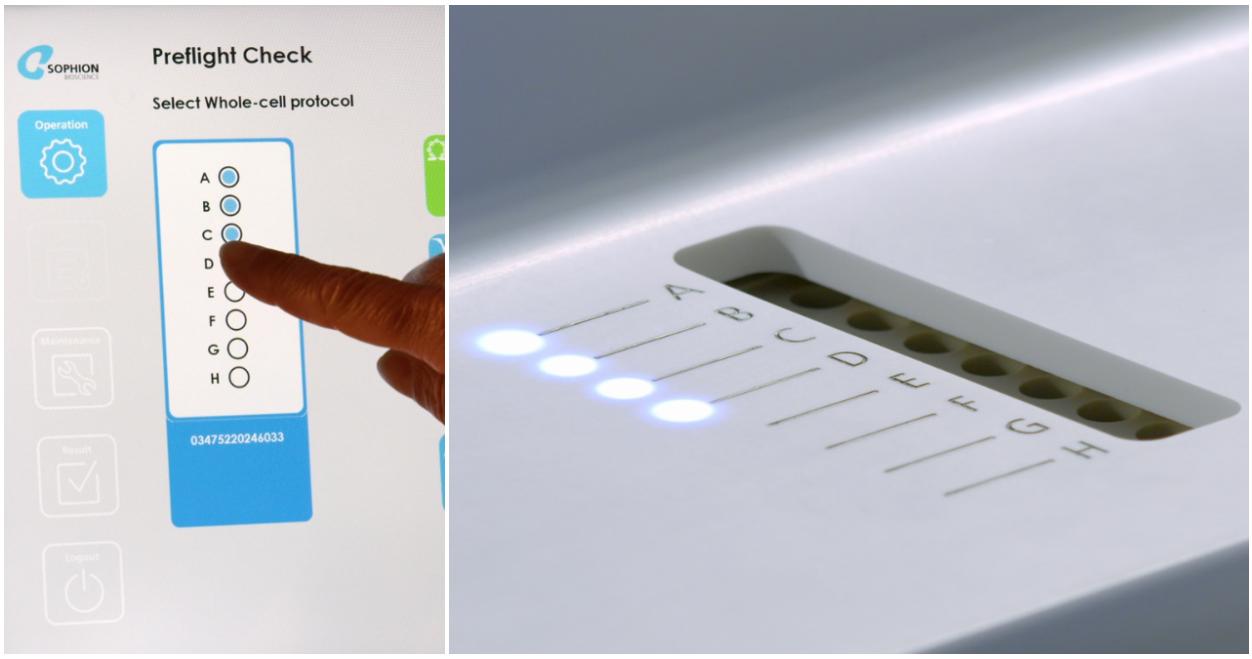


Figure 9 Preflight check – select the recording sites you want to record in your experiment

Table 2 Preflight parameter definitions for touch screen interface

QPlate	Once the QPlate is inserted, the well status is displayed: • Blue wells = selected • White wells = can be selected • Greyed out = inactive/previously used
Whole-cell protocol	Choose the protocol you wish to use for your experiment. The protocols are modifiable using Sophion Analyzer software prior to the run.
Pipetting	Toggle between voltage- or ligand gated ion channels.
Sampling filter	Set up criteria for the digital filtering.
Cell type	Choose the cell type to be used in the experiment.
Ion channel	Choose the ion channel to be used in the experiment.
Compound map	Set up the compound map.
Start	Click this button to start the experiment.

4.1.4 Setting up the compound map

The compound map is set up by entering the compound map overview as seen below:

Figure 10 Compound map

Any serial dilution of the compound is set up by entering the name, the compound stock concentration, the number of dilution steps per compound and the dilution factor between each step. You can assign a particular compound to a specific color (Figure 11).

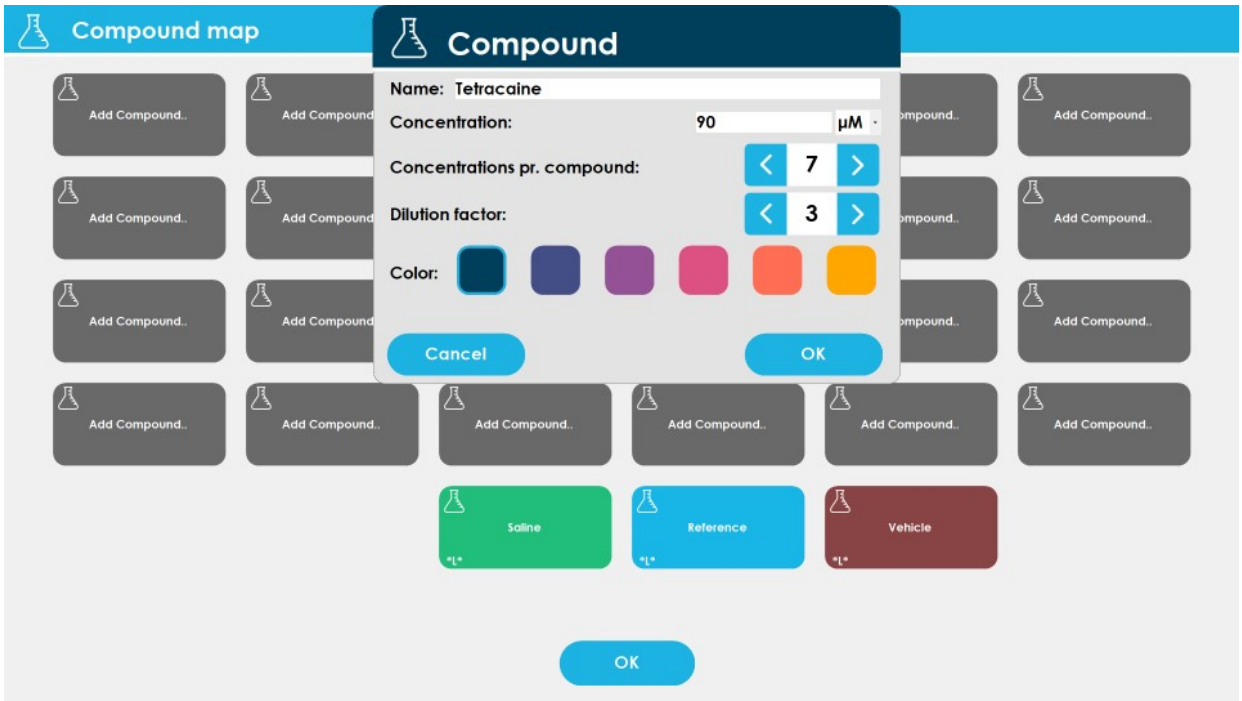


Figure 11 Serial dilutions are generated in the Compound map

The serial dilution is subsequently indicated by a gradient of that color as indicated below. Press OK to return to the Preflight Check screen (Figure 12).

Additional compounds and concentrations are easily added to the compound map while the experiment is running.

Figure 12 Serial dilutions generated in the compound map overview

After pressing "Start" an automatic hardware check appears while different instrument hardware modules and sensors are checked (Figure 13).

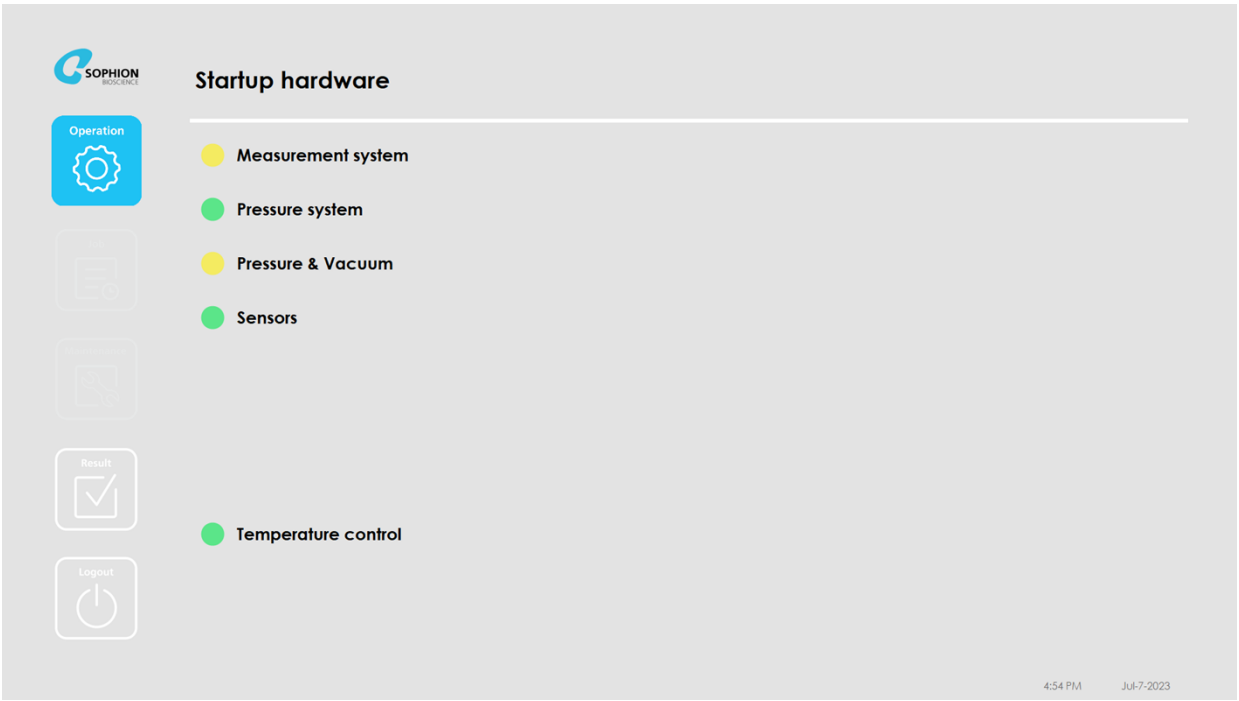


Figure 13 Startup hardware check

Once the hardware check has completed, follow the on-screen instructions.

4.1.5 Priming the QPlate

At this point the instrument will ask the user to dispense intracellular (IC) liquid into the wells chosen. These sites are also highlighted by blue light at the manifold level.

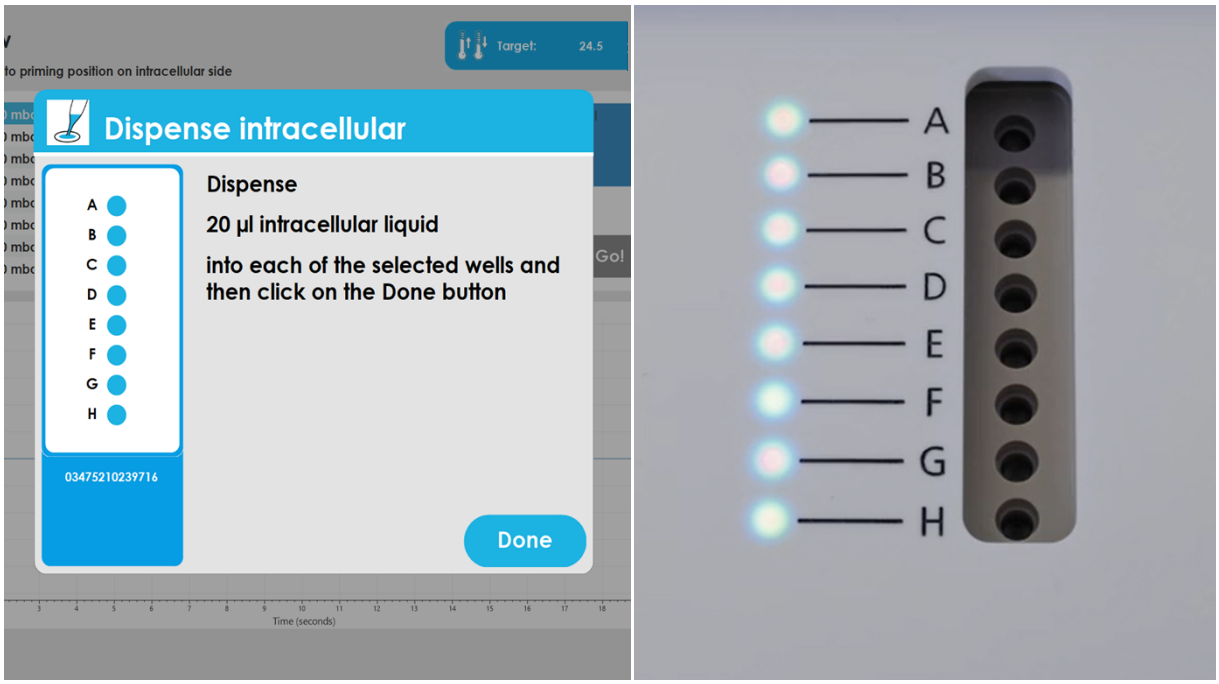


Figure 14 The instrument prompts the user to dispense intracellular (IC) liquid into the well. The corresponding sites next to the manifold are highlighted at the manifold level as well.

Note! Make sure to insert the pipette tip all the way through the manifold until you reach firm resistance. This indicates that the correct height for pipetting is reached.

Once the IC liquid has been added the instrument will start priming the wells as shown below:

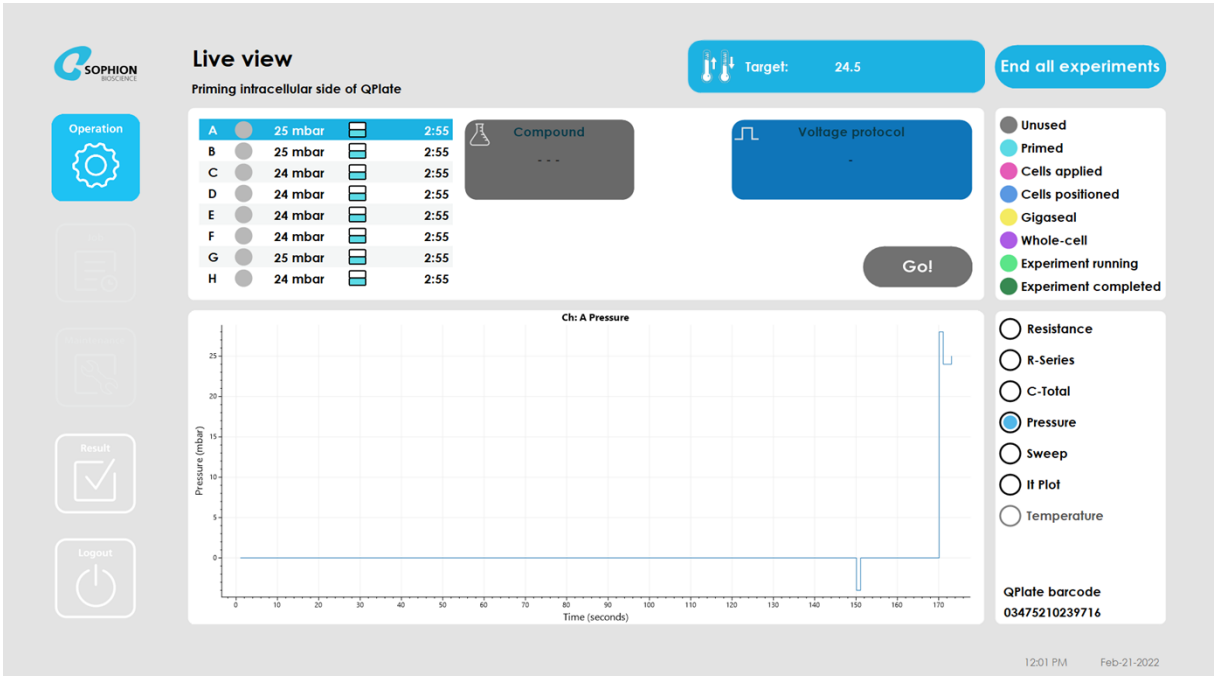


Figure 15 Priming the wells with intracellular liquid

Next, the user will be prompted to dispense the extracellular (EC) liquid into the wells. The corresponding sites are indicated by blue light next to the manifold.

Note! Make sure to insert the pipette tip all the way through the manifold until you reach firm resistance. This indicates that the correct height for pipetting is reached

Once the EC liquid has been added, the instrument will start priming the wells.

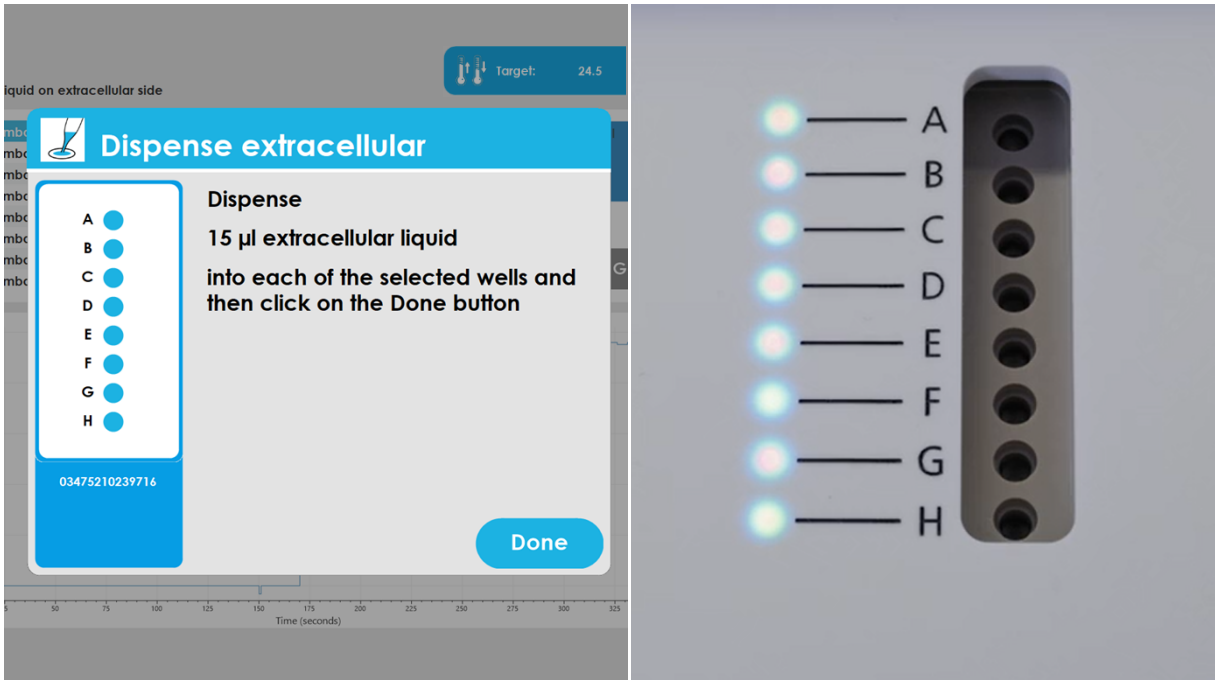


Figure 16 The instrument prompts the user to dispense extracellular (EC) liquid into the wells

Next, the on-screen guide will prompt the user to dispense the cells into the wells. It is possible to modify the delay by which the dispense occurs between each site and whether the countdown should pause for each site (Figure 17).

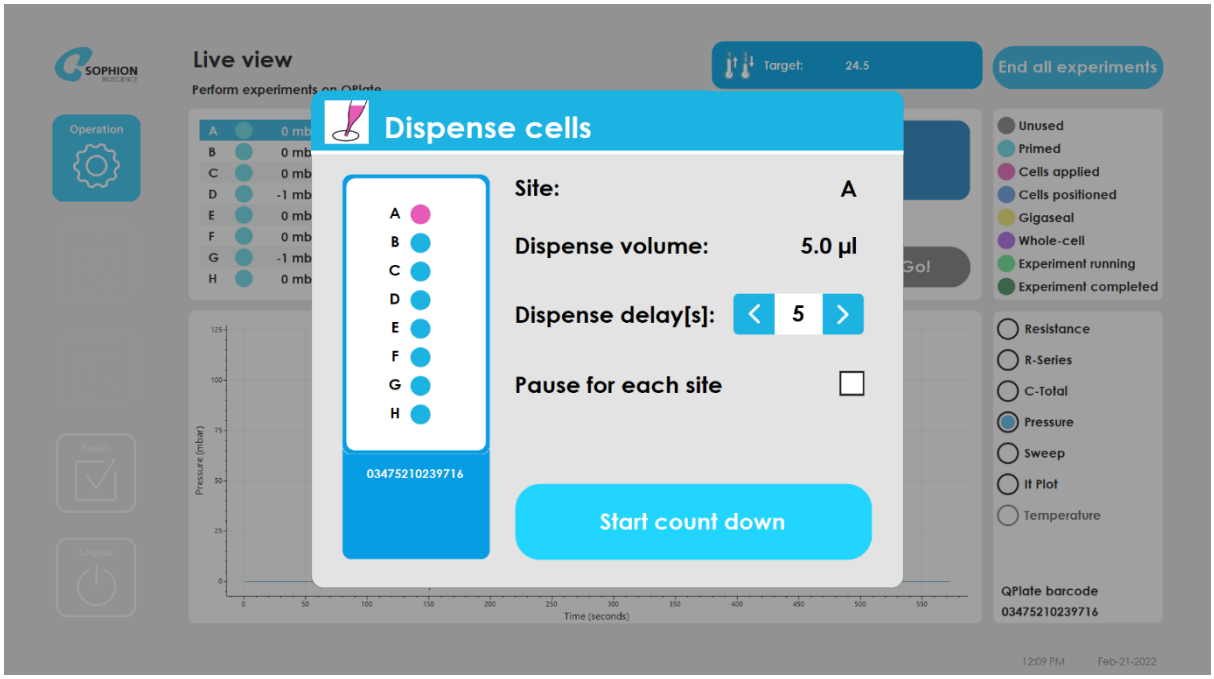


Figure 17 At this stage QPatch Compact will prompt the user to add the cells to the wells

The on-screen countdown will initiate for each of the sites, one by one and count down to 0.

At the manifold level, the next site to pipette into is indicated by blue light. The user must prepare to insert the pipette tip and dispense as soon as the blue light turns orange. This is coordinated with the on-screen countdown. The next site to pipette into will then turn blue and the process is repeated.

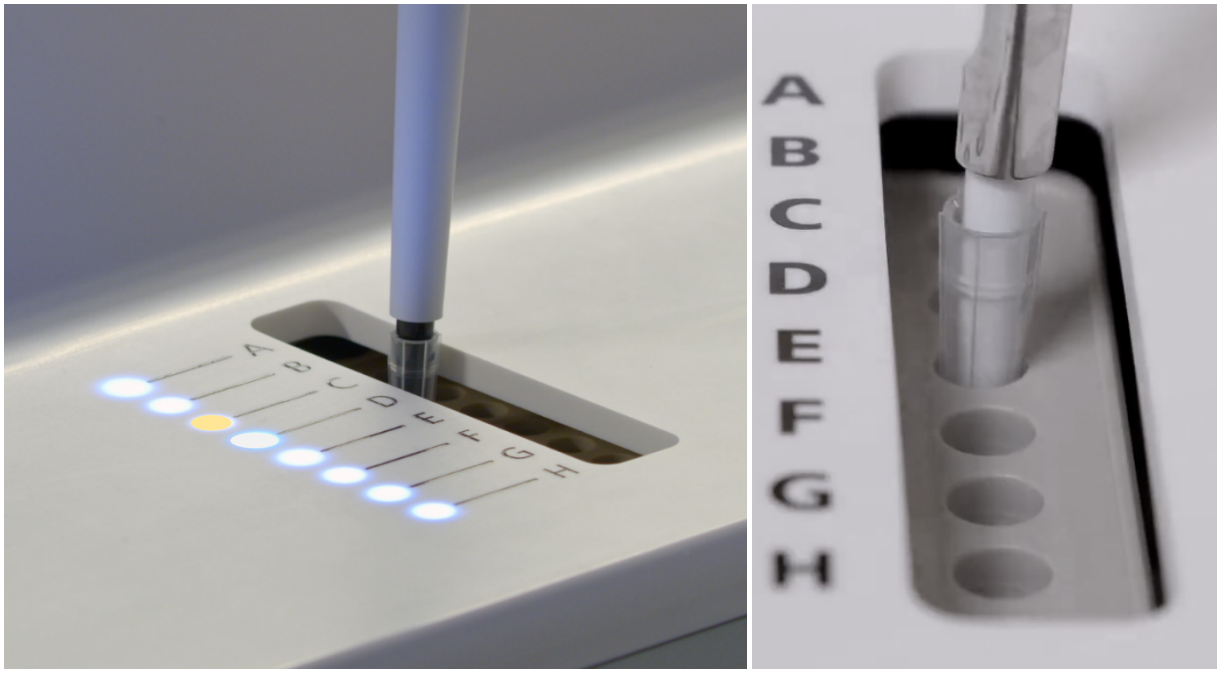


Figure 18 Light guidance indicates where to pipette next and when to dock and dispense. The image on the right side shows how the pipette tip is positioned in the manifold well.

Note! Make sure to insert the pipette tip all the way through the manifold until you reach firm resistance and the collar of the pipette tips rests on the manifold shoulder. This indicates that the correct height for pipetting is reached.

4.1.6 Live view panel

When starting experiments from the preflight screen, a live view panel (Figure 19) will appear. From here the running experiments can be executed, and the output monitored live.

The upper panel displays an overview of the QPlate test sites and their experiment status. A legend on the right side explains the color codes.

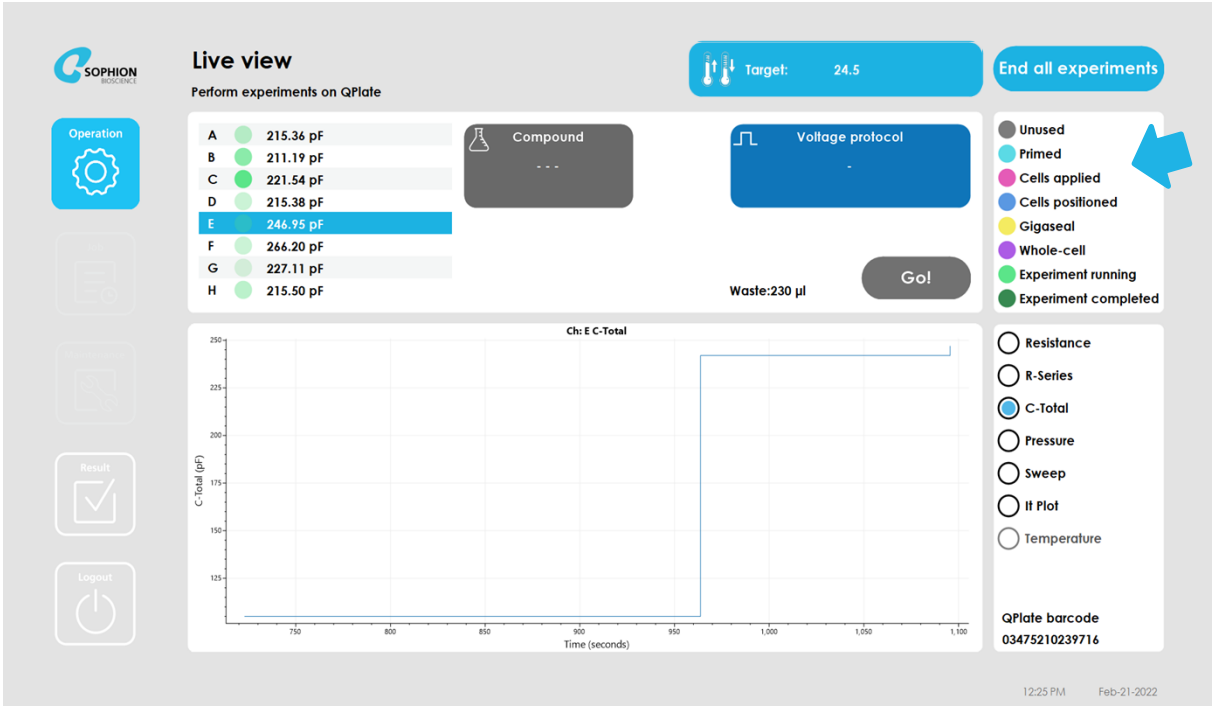


Figure 19 Live view panel

The lower panel displays various plots, which can be chosen from the list on the right-hand side, in accordance with the user's preferences and the progress of the patch clamp process: R-Series; C-Slow or Measurement Sweep e.g. as displayed in Figure 19. The lower panel also indicates the QPlate barcode number.

4.1.7 Choosing the voltage protocol and run parameters

The voltage protocol is chosen from the list of standard pre-installed Sophion protocols or any other protocol which the user has previously generated. Several parameters are modifiable for each protocol besides an option for continuous repeat of the voltage protocol (Figure 20).

Note! Whether the repeat protocol option should be "on" by default or "off" by default is user-specified in the Settings menu in the Maintenance menu – see section 4.1.1.1

Here, the user can either select the indicated protocol for that specific site "Select" or select it for all active sites "Select for All". This will apply the same voltage protocol to all active sites.

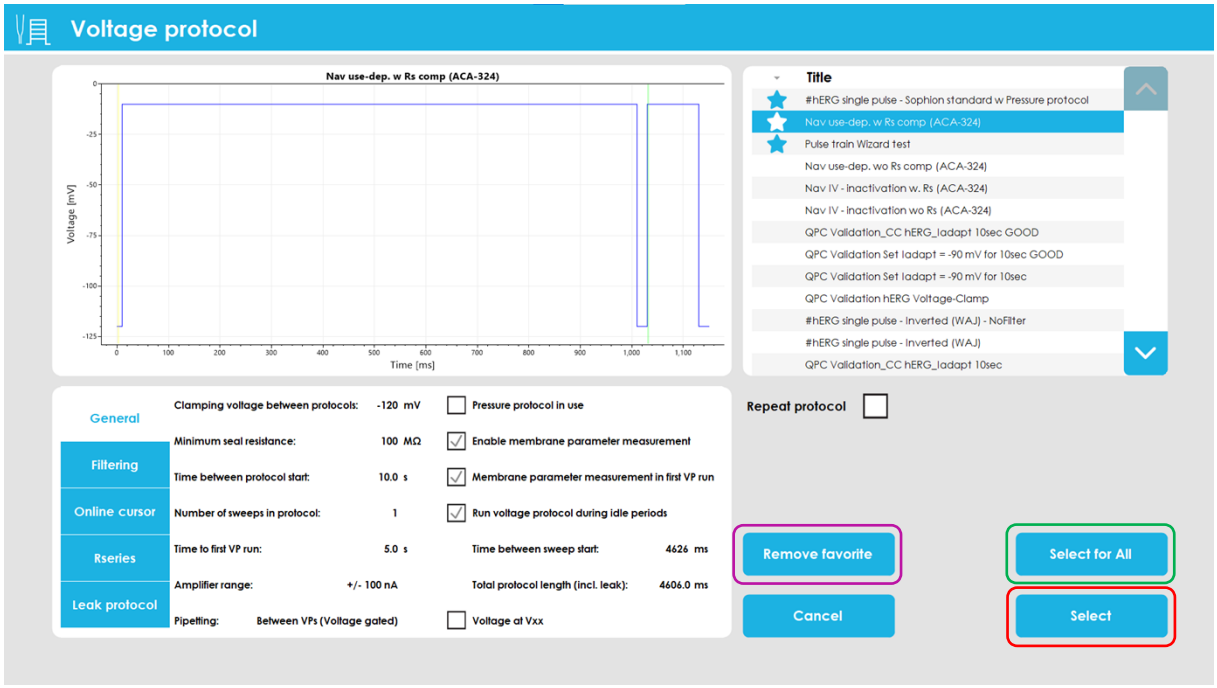


Figure 20 Several parameters are modifiable for pre-defined voltage protocols. The protocol is applicable to either 1 site or all active sites.

4.1.7.1 Voltage protocol favorites

The user can optionally choose specific voltage protocols and highlight these as favorites by highlighting the protocol and clicking the "Add favorite" button (a blue star will indicate that the protocol is featured as a favorite). These protocols will always show up on top of the voltage protocol list (Figure 21). To remove the favorite, highlight the protocol and click the "Remove favorite" button.

Previously used protocols are automatically marked as favorites. The rest of the protocols are either sorted alphabetically or according to when they were last edited.

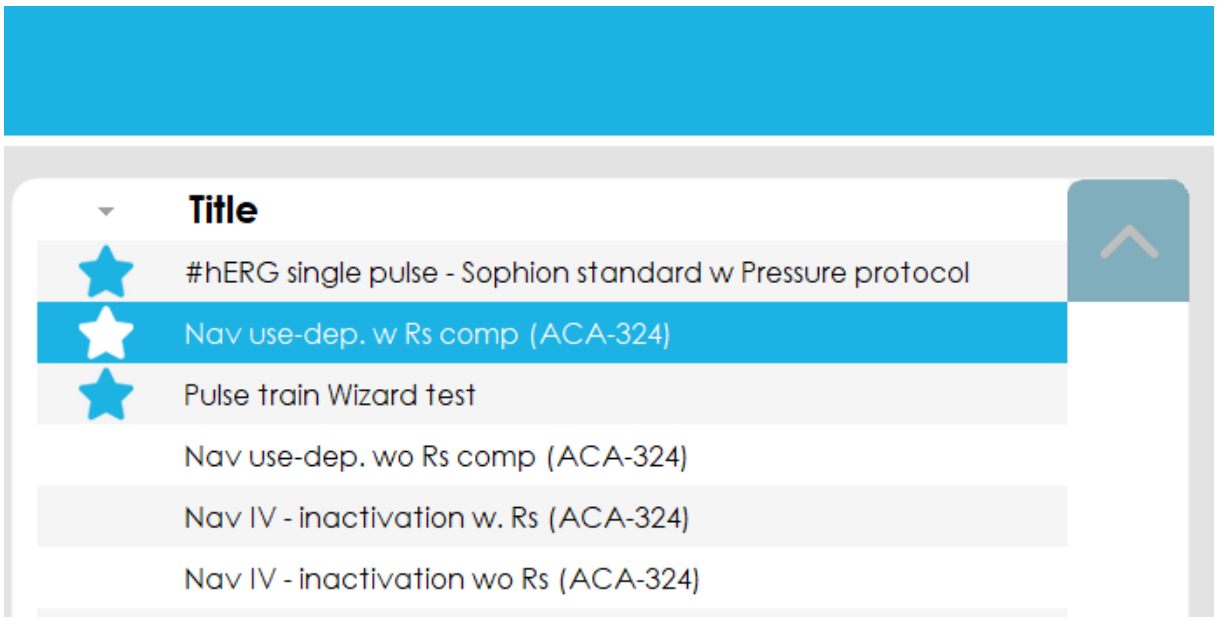


Figure 21 Assign your most frequently used voltage protocols as favorites for easy access

Next the compounds are added by pressing the grey "Compound" icon on the Live View panel.

Choose the desired compound from the previously defined compound map. The compound map includes saline, a reference, and a vehicle.

Upon choosing the compound, the user can either select this compound to that specific site (Site X only) or select it to all active sites (All sites) (Figure 22).

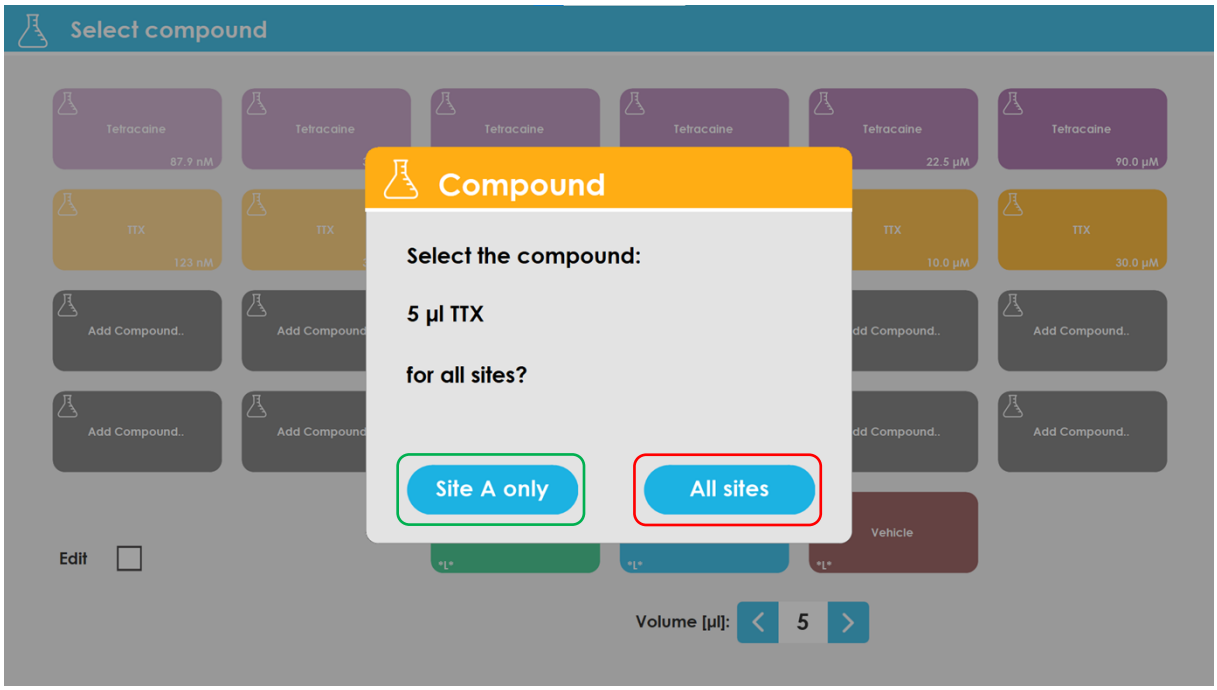


Figure 22 Choose the desired compound from the predefined compound map

Press "OK" to return to the Live View panel.

Up to all 8 sites are therefore pre-programmed with compounds and voltage protocols and after choosing the compounds and voltage protocols, to start the recording press the "Go!" button for each of the sites.

The Live View panel shows the real-time progress of the experiment (Figure 23).

Figure 23 The Live View shows the real-time progress of the experiment

Here the lower panel displays various plots, which can be chosen from the list on the right-hand side, in accordance with the user's preferences: R-Series; C-Slow or Measurement Sweep e.g. as displayed in Figure 23.

4.1.8 Job finished

Once the run has finished, an overview of the run specifying run status, start time, run duration, and run specific performance parameters (Figure 24). Press "Done" to release the data to set up a new run.

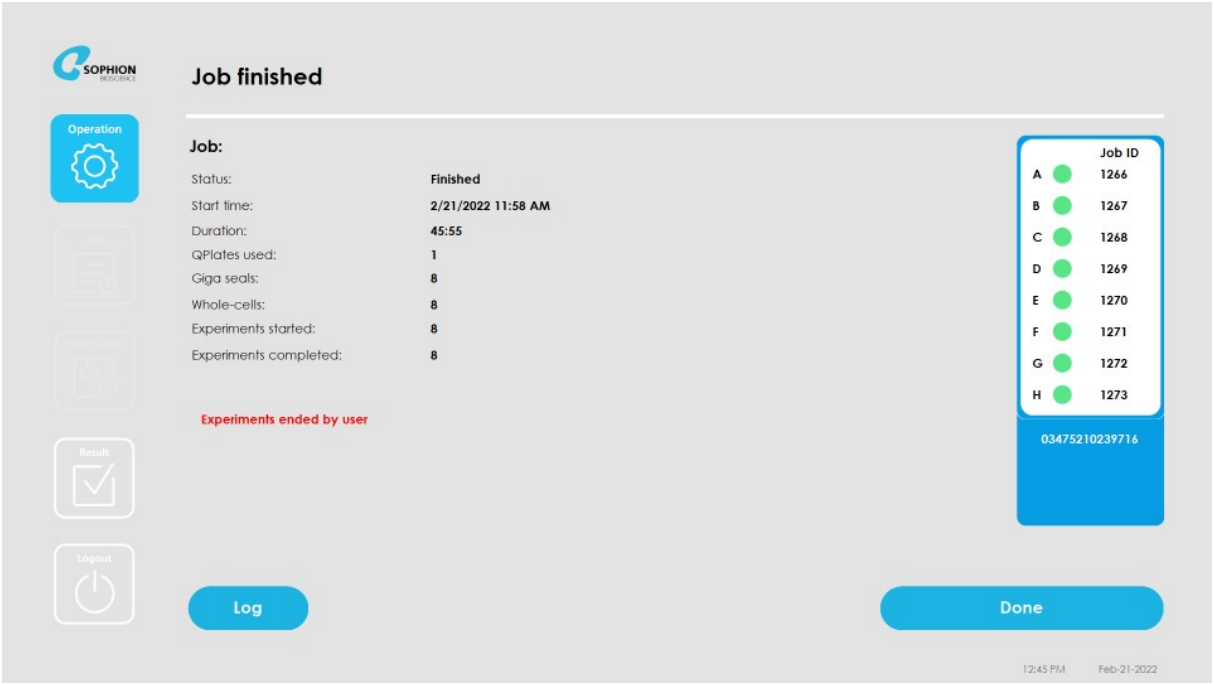
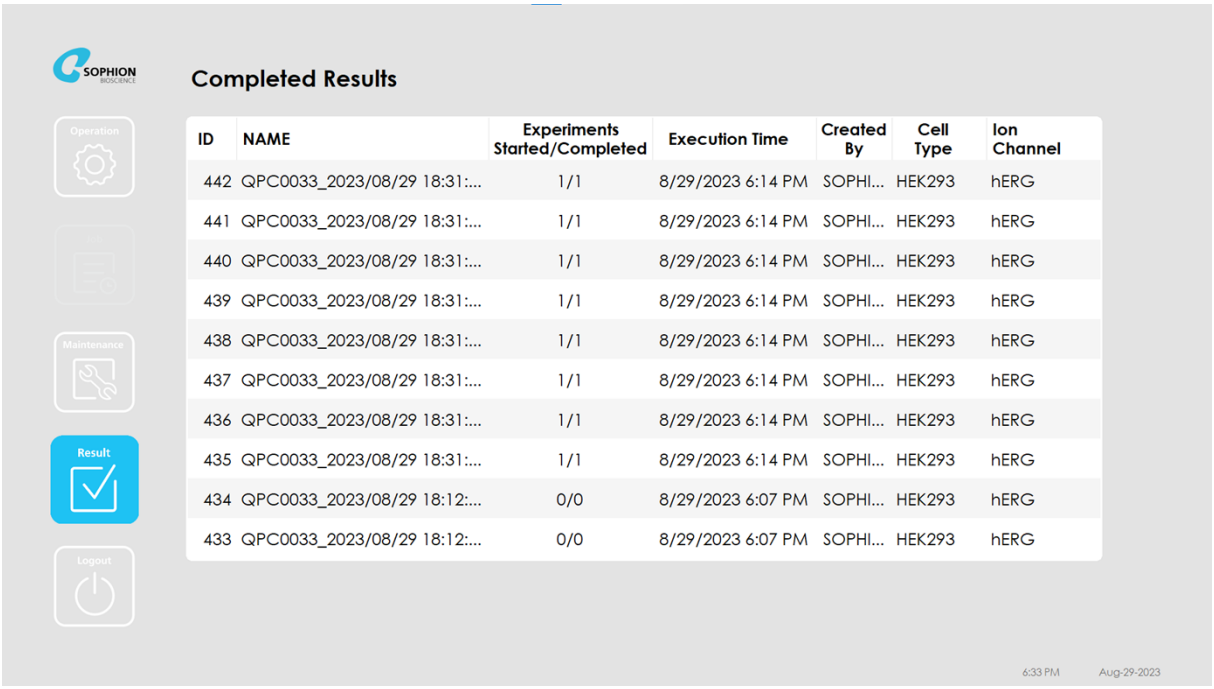


Figure 24 Run-specific information and performance data are shown

4.1.9 Results screen

Once the run has finished, completed run results can be viewed from the Results screen. The following experiment information is displayed: ID; NAME; Experiments started/completed; Execution time; Created by; Cell type; Ion channel (Figure 25).



ID	NAME	Experiments Started/Completed	Execution Time	Created By	Cell Type	Ion Channel
442	QPC0033_2023/08/29 18:31:...	1/1	8/29/2023 6:14 PM	SOPHI...	HEK293	hERG
441	QPC0033_2023/08/29 18:31:...	1/1	8/29/2023 6:14 PM	SOPHI...	HEK293	hERG
440	QPC0033_2023/08/29 18:31:...	1/1	8/29/2023 6:14 PM	SOPHI...	HEK293	hERG
439	QPC0033_2023/08/29 18:31:...	1/1	8/29/2023 6:14 PM	SOPHI...	HEK293	hERG
438	QPC0033_2023/08/29 18:31:...	1/1	8/29/2023 6:14 PM	SOPHI...	HEK293	hERG
437	QPC0033_2023/08/29 18:31:...	1/1	8/29/2023 6:14 PM	SOPHI...	HEK293	hERG
436	QPC0033_2023/08/29 18:31:...	1/1	8/29/2023 6:14 PM	SOPHI...	HEK293	hERG
435	QPC0033_2023/08/29 18:31:...	1/1	8/29/2023 6:14 PM	SOPHI...	HEK293	hERG
434	QPC0033_2023/08/29 18:12:...	0/0	8/29/2023 6:07 PM	SOPHI...	HEK293	hERG
433	QPC0033_2023/08/29 18:12:...	0/0	8/29/2023 6:07 PM	SOPHI...	HEK293	hERG

Figure 25 Completed Results screen

4.1.10 Log out screen

The following information is displayed on the Log out screen: screening station name; software version; username; database name; database server; database version; oracle version; latest PM; installation add-ons; pressure system status; temperature control status (if installed); sensor control board status; barcode reader status (Figure 26).

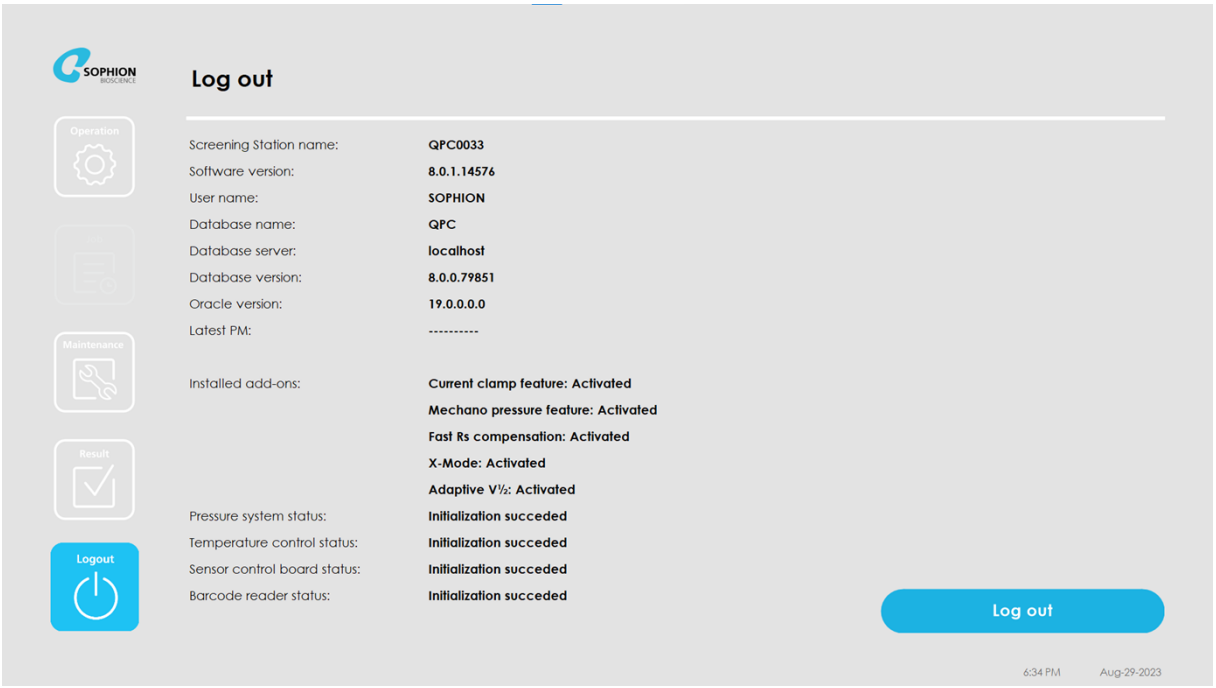


Figure 26 Log out screen

Click “Logout” to change user or to log out from the system.

5. Instrument cleaning and maintenance

5.1 Daily cleaning

The following daily cleaning should be carried out at the end of each day:

1. Remove the used QPlate. If all sites are used, then dispose of the QPlate according to guidelines for disposal of hazardous substances.
2. Wipe off the instrument with a moist lint free cloth. Make sure no fluid enters the manifold holes.
3. Lift the instrument lid and wipe off the manifold with a moist lint free cloth. Make sure no fluid enters the manifold holes.
4. Close the instrument lid.

If spills occur the manifold should be removed and cleaned, see chapter 6.2

5.2 Occasional maintenance

5.2.1 Thermoelectric circulator

Ensure the liquid container in the thermoelectric circulator is continually refilled and an anti-fungal and anti-bacterial growth agent has been added to the water. If any organic growth is observed in the container or the insulated tubing, please drain the circulator, see section 5.3, and refill with a new batch of water.

The instrument has been designed to sustain daily use for a very long period without the need of maintenance. However, if performance deteriorates, there could be a need for replacement of certain components. Contact us at qpcsupport@sophion.com in these cases, be prepared to share a debug file and Sophion will evaluate whether a component must be replaced.

5.3 How to drain the thermoelectric circulator for water

Before shipping the thermoelectric circulator it is important to drain it for water as shipping it containing water may destroy the electric circuits.

Caution! Note that the circulator must not be drained by turning it upside down as this may destroy it. It is imperative that both chambers (upper liquid return and lower liquid feed) are drained according to the below guide to ensure full functionality.

Before draining the circulator it must be disconnected from any power cables, data cables and insulated tubing.

A draining kit is included with the circulator and must be used for this procedure.

The main goal for this procedure is to drain both chambers, upper and lower chamber.

Locate the short connector tubing from the kit, see Figure 27.

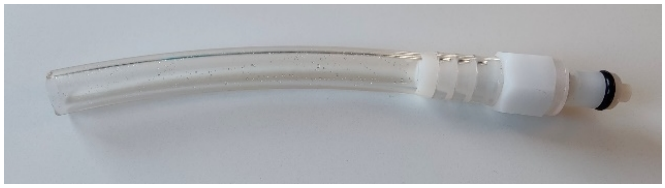


Figure 27 Connector tubing for draining circulator

Connect this piece to the lower inlet (feed inlet) on the thermoelectric circulator close to an open reservoir or the open glass bottle included in the draining kit. Ensure it is snapped firmly into place.

The lower chamber will now drain water into the open glass bottle, see Figure 28.

Figure 28 Draining the lower circulator chamber

To drain the upper chamber, connect the drain tubing to the upper connector (return) close to a reservoir or the open glass bottle included. Note that some water will already start draining now.

Loosen the circulator container screw cap allowing the upper chamber to drain the water completely, see Figure 29.

Figure 29 Draining the upper circulator chamber

5.4 How to drain the QPatch Compact for water before shipping

In order to ship the QPatch Compact safely, the instrument must be drained for water following the below procedure:

Locate the short connector tubing from the draining kit and connect it to the upper inlet (feed) on QPatch Compact, see Figure 30.

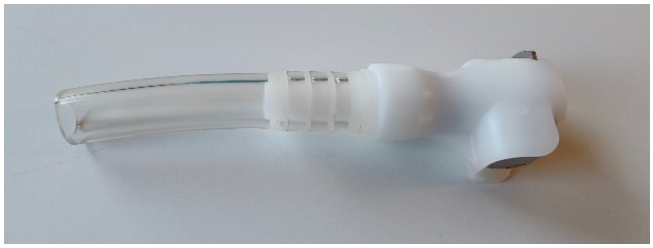


Figure 30 Connector tubing for draining QPC

Assemble the draining bottle by assembling the bottle and cap with the attached vacuum inlet, see Figure 31

Figure 31 Assembled draining bottle

Figure 32 Draining QPatch Compact for water

Now connect the compatible connector attached to the glass bottle to the QPatch Compact return outlet (lower outlet) and the other end of the vacuum inlet on the bottle to a vacuum pump using the tubing included in the transport case. Turn on the vacuum pump and observe as the water is drained from the QPC into the bottle, see Figure 32.

Turn off the vacuum and disconnect the draining bottle. The QPatch Compact is now drained for water.

5.5 Decontamination before shipping to Sophion Bioscience

Use a microfiber cloth for wiping all surfaces accordingly.

1. Turn off the QPatch Compact if not turned off.
2. Remove the manifold as described in section 6.2 and rinse it with MilliQ water and 70% EtOH.
3. Wipe off all other surfaces and below the instrument lid with Milli Q water and 70% EtOH.
4. Wipe off the screen with a gentle window cleaner agent.

6. Troubleshooting

Before contacting support, please perform on-site troubleshooting. Below you find typical issues with solutions to how to solve these.

If the below troubleshooting guide doesn't resolve the issue at hand, please send an email to qpcsupport@sophion.com describing the issue in question.

If you do need assistance from Sophion Bioscience support, please be prepared to share log and debug messages since forwarding these will speed up our troubleshooting process.

6.1 Issues during instrument startup

Problem: QPC does not power up and the touch screen monitor remains black?

- Check if the cooling fans start turning on the back of the instrument.
- If they do not, check the power connection.
- If the instrument appears to power up, but the touch screen monitor remains black, then check the power connection to the touch screen monitor. The HDMI cable must be correctly connected.

Problem: The login screen does not appear after the instrument is turned on?

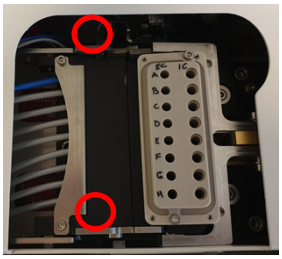
- Check if the Oracle database software is running. You can check this by attempting to login using the Analyzer software on the instrument or from a PC that is connected to the same network as the instrument.
- If you cannot connect to the database using the Analyzer software, restart the instrument.

Problem: I cannot log into the instrument?

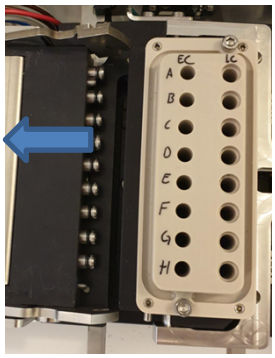
- After a power cycle of the instrument, the Oracle database can take up to a few minutes to start up. Wait for 5 min. and try again.
- Check if you are registered as a user and can log into the Analyzer software.
- Get help from your local QPatch Compact database administrator. Your password or user account might need to be reset. *Please refer to "User administration" in the Analyzer software user manual.*

6.2 Issues during instrument use

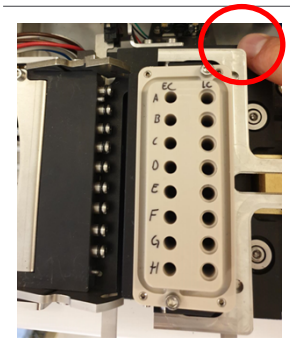
Problem: Liquid accumulates inside the manifold – removal of manifold



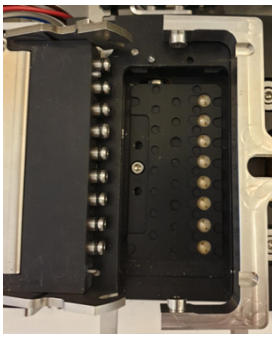
1. Ensure the manifold is in home position – consult section 6.4.3. Turn off the QPC. Press down the two metal bars (marked red) to loosen the two guiding pins.



2. Move the left part of the manifold (arrow) to the left side to disconnect the manifold.



3. Lift the manifold and press down on the frame (as indicated on the image) and loosen the two guiding pins on the manifold sides. Now the manifold can be removed.



4. Clean the manifold with a moist lint free cloth.
5. Dry the manifold with a lint free cloth.
6. Place the manifold back again in the instrument by following the instructions in the reverse order.

6.3 Issues when running an experiment on the instrument.

Problem: The instrument rejects the QPlate after attempting to read the barcode

- Check if the QPlate barcode is damaged, scratched, or difficult to read in some other way.
- Clean the barcode with a dry lint free cloth and try again.
- Make sure the QPlate has not been completely used before.

Problem: The priming of the QPlate fails

All or almost all the QPlate sites turn light blue and are crossed over immediately after priming. Cells were not added to these sites.

- Check pressure and vacuum are adequately connected to the ports on the back of the instrument. Check they are plugged into the correct ports.
- Reconnect the supplies and turn it on. Start a new experiment.
- Inspect the QPlate where the priming has failed. Check if liquid droplets are present in other locations than in the pipetting wells and waste reservoir.
- If droplets are misplaced, please contact Sophion Bioscience A/S to get support.
- Chip resistance should normally be within 1–3 MOhm on single hole plates and within 100kOhm -> 300kOhm on multi-hole plates. If you are using saline solutions with conductance differing significantly from normal physiological saline solution, the chip resistance might have different values. This should be changed accordingly in the whole-cell protocol.

Note! The QPlate chip resistance values are measured during initialization. These values are shown on the touch screen monitor during the experiment or via the Sophion Analyzer software afterwards. Compare the values against the settings in the whole-cell protocol.

Problem: The priming of some QPlate sites fails

These sites turn light blue and are crossed over on the touch screen monitor immediately after priming. Cells were not added to these sites.

- This could be caused by not inserting the pipette tip sufficiently especially during IC addition. Make sure the pipette tip is inserted as far as it goes until the pipette tip collar rests on the shoulder in the manifold well (see Figure 18 for more information).
- If the problem persists, check if it occurs at the same sites every time
- Restart the instrument. Start a new experiment to see if the problem persists.
- Check the saline solutions used.
- We do not generally recommend using saline solutions that have been frozen. They may form microcrystals during freezing, which can interfere the priming and/or sealing success rates. Experience has shown that some types of saline solutions, such as those containing glutamate and aspartate or other large molecules in great quantities, can be problematic and should not be stored for long periods of time and never below room temperature.
- If your saline solutions have been frozen or contain large molecules (such as glutamate or aspartate), we recommend you make a fresh portion and run the experiment again.
- If none of the above works, some of the amplifiers may be damaged.
- Please refer to the *QPatch Compact Utility protocols Guide* to learn how to execute standard tests to troubleshoot the system

Problem: The positioning of cells fails too often

Cells are added to the QPlate sites, but the cell positioning times out. The log message: "Cell positioning timeout" appears.

- Take a sample of the cell suspension from the cell vial. Count the cell density and check if they are as recommended.
- If the cell density is incorrect, adjust the density and try again.
- Alternatively, the cell positioning timeout may be too short in the whole-cell protocol.
- Adjust the positioning timeout in the whole-cell protocol and try again.

Problem: The success rate is consistently lower than expected

Check the cell quality and viability. The cells should appear round and individual and not observed in clusters. Take a sample from the cell vial. Ensure that the standard operating procedures (SOPs) for cell culturing and harvesting have been followed. See our "Guide for preparation of cells and solutions" available on our QPatch Compact techsupport site.

For further technical support please contact us at qpcsupport@sophion.com.

6.4 Maintenance menu

6.4.1 Temperature control menu

To test the temperature control, the "Temperature Control" menu in the "Maintenance" menu is available, see Figure 33. Here the user can activate the temperature control, set the target temperature, and specify whether the circulator should start up in active mode or standby mode when the QPatch Compact is turned on.

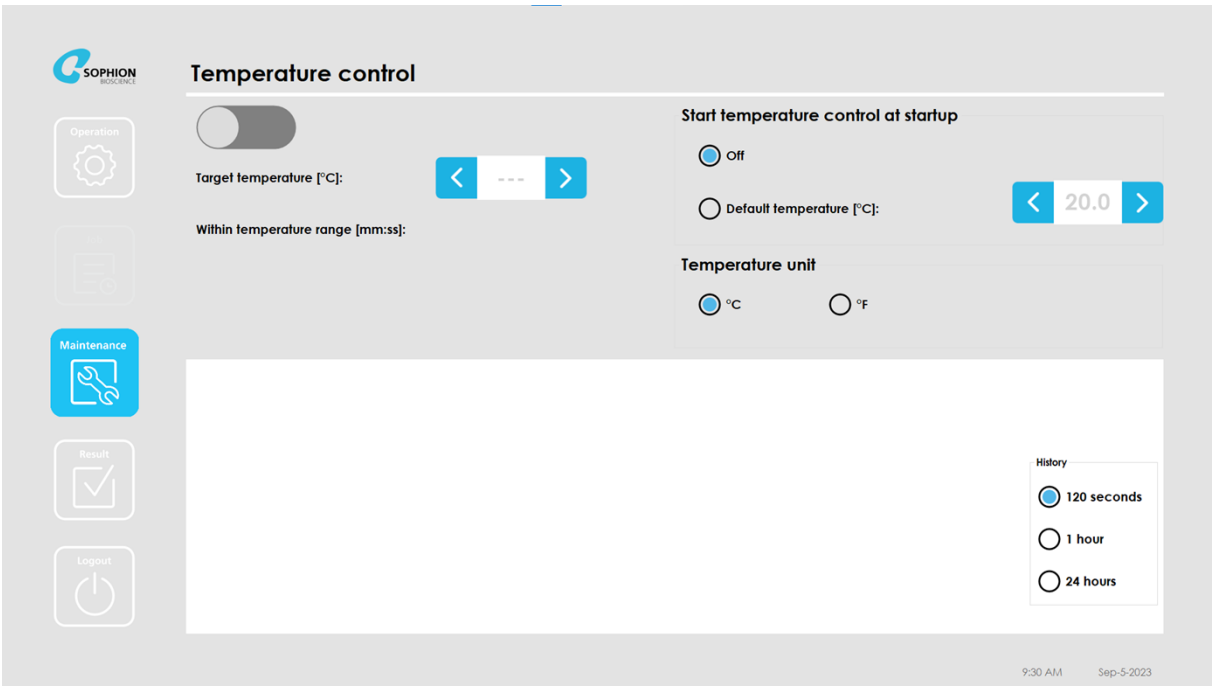


Figure 33 Temperature control menu (maintenance tab)

The menu allows the user to set a specified target temperature and to monitor the estimated QPlate recording temperature over a specific timespan to test the temperature control stability.

6.4.2 Manifold menu

The manifold menu allows the user to fix the manifold in a safe transport position, unjam the manifold and move the manifold into different positions.

In the manifold menu the following options are available (Figure 34):

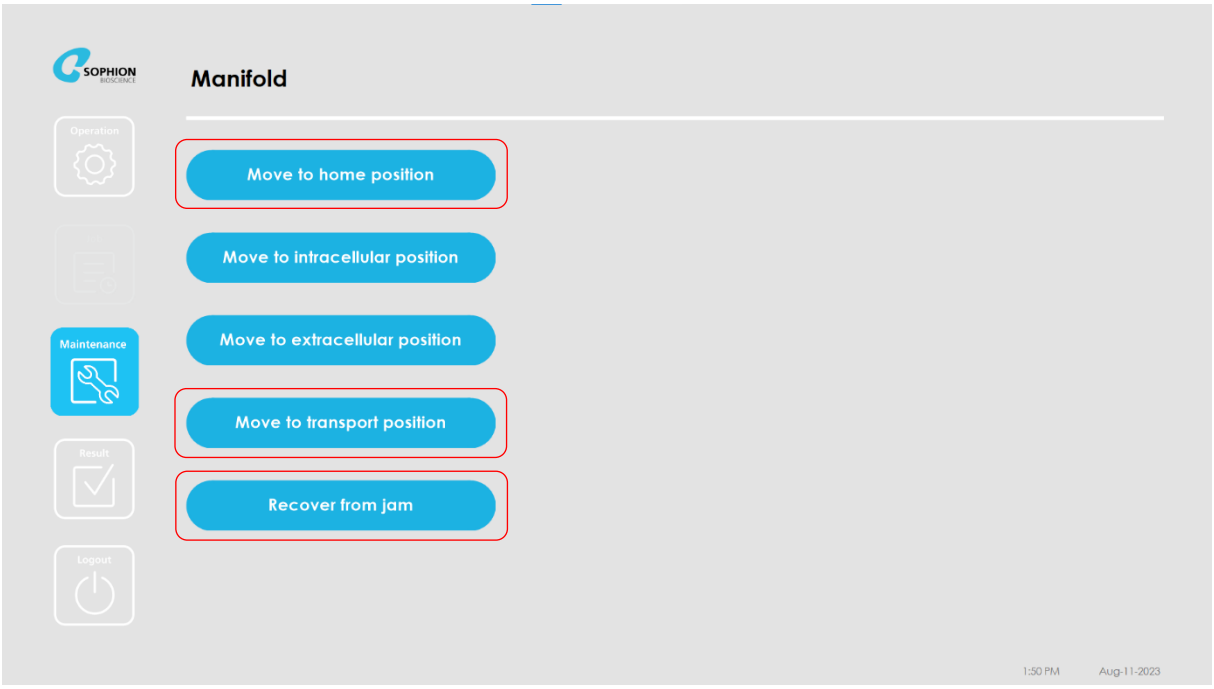


Figure 34 Manifold menu

It is only the first function: "Move to home position" and the last 2 functions: "Move to transport position" and the "Recover from manifold jam" which the user needs during intended use and troubleshooting. In certain cases, the user may be asked to perform other movements of the manifold to diagnose an issue in relation to troubleshooting an issue.

6.4.3 Move to home position

To move the manifold to home position, activate this function. Once moved to home position, the user can start replacing the manifold eg.

6.4.4 Move to transport position

To prepare the QPatch Compact for safe transport follow these steps:

- Insert the red transport QPlate (the red plastic plate without wells or printed circuit board on the back) into the QPlate slot, see Figure 35.
- Click "move to transport position"
- The manifold mechanism will move to fixate the transport plate into a safe position. Once the manifold mechanism has stopped, verify that the transport plate is fixed firmly in the QPlate slotAlso see the QPatch Compact – installation guide available on our self-service support site.

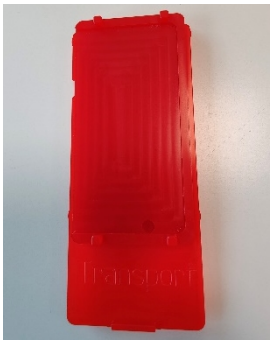


Figure 35 Transport plate

6.4.5 Recover from a jammed/stuck manifold

In case of unforeseen mechanical events, the manifold may be jammed into a position where it will not release itself during normal operation. Follow this guide to recover the manifold via the built-in recovery function.

6.4.5.1 Start up and attempt homing

1. **Read through procedure**

   Please read the entire procedure before starting the recovery process. Some steps need to be monitored manually. Ensure the instrument is turned off before proceeding.

2. **Close latches**

   Open the instrument lid and ensure that both latches are fully engaged.

   If the manifold has been dislodged from the interface module so latches cannot fully close, make sure to push the manifold and the interface module together as much as possible without closing the latches.

Caution! Never use excessive force to attempt closing the latches.

3. **Start up the QPC**

   Turn on the instrument (on the left-hand side). Log in via the touchscreen using your normal login credentials for the QPC database.

4. **Wait for homing**

   If the manifold releases itself during homing, remove the QPlate after homing is done and proceed to checking manifold latches and verifying functionality.

   If the manifold is stuck, the instrument will make a low-pitched humming during homing and the "Preflight Check" status will stay in "Initializing QPlate slot". In that event proceed to the next step.

6.4.5.2 Run manifold recovery function

1. Enter Maintenance menu

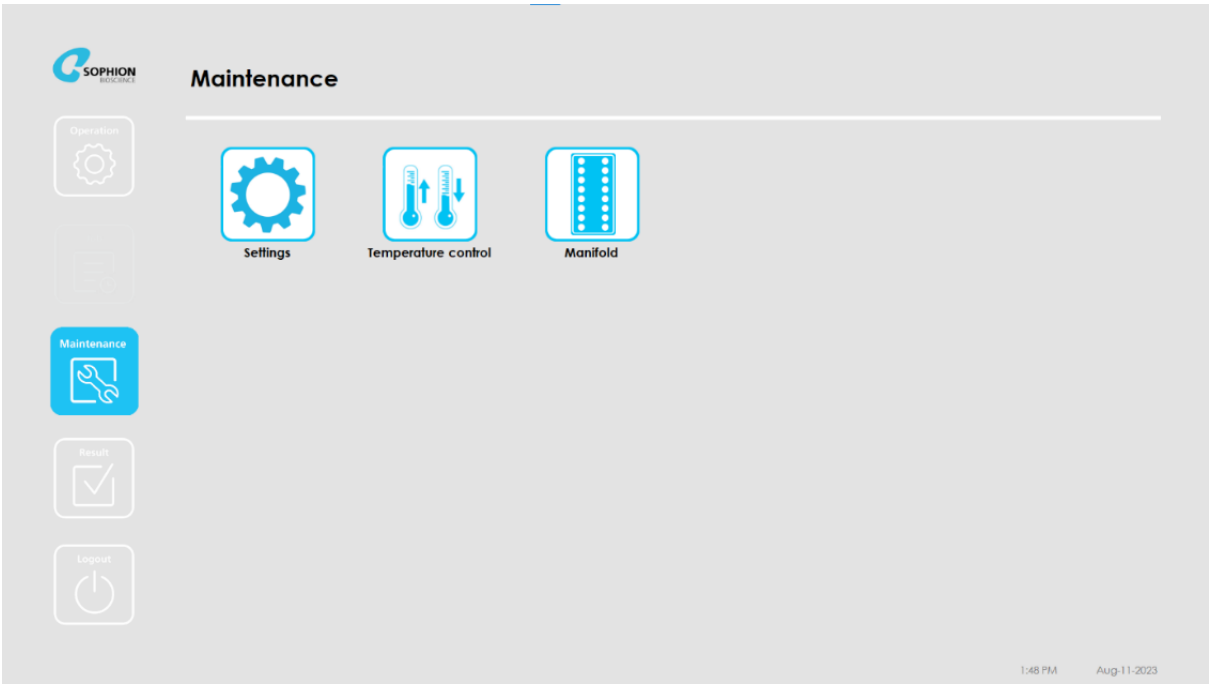


Figure 36 Manifold menu

2. Enter the Manifold menu

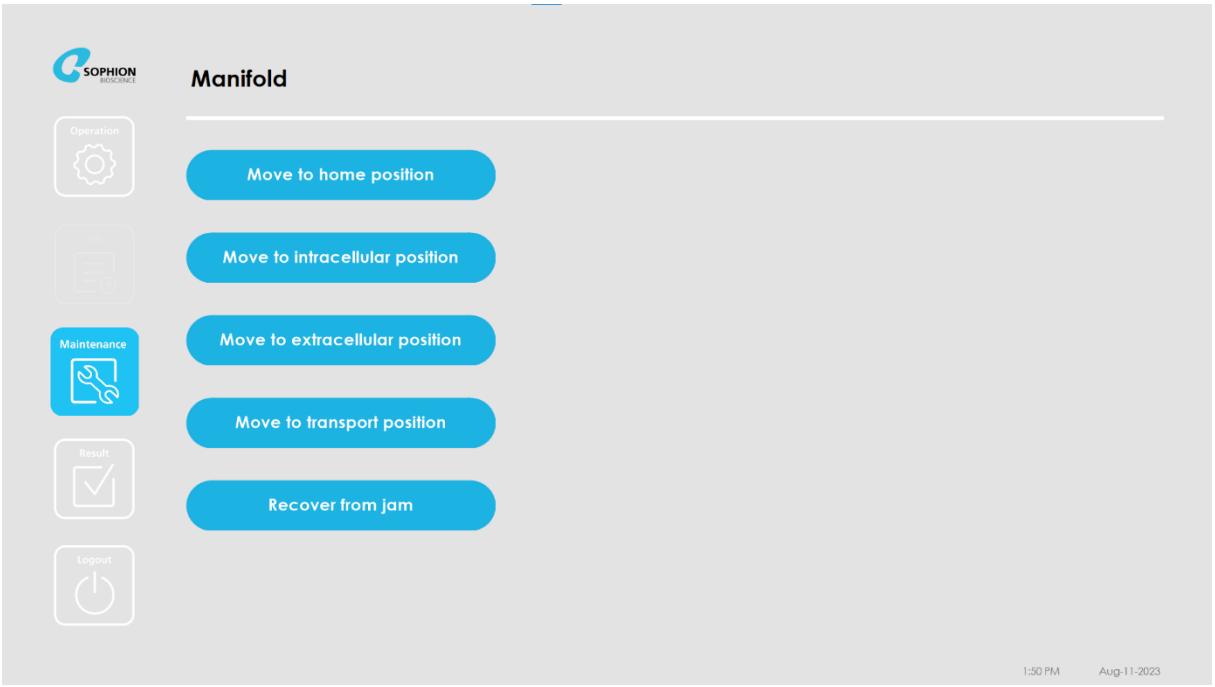


Figure 37 Manifold menu

3. Click "recover from jam" button

Press the "Recover from jam" button in the "Manifold" menu to start the recovery process. A countdown timer next to the button will show the remaining time for the process.

The recovery function will attempt moving the manifold back and forth between the intra- and extracellular positions via a forced move. The instrument may make a low-pitched humming during the process. This is normal.

The humming should stop during the process or at the latest a few seconds after the countdown has ended.

Caution! If the humming does not stop shortly after the countdown, open the instrument lid to stop the motor.

4. Start recovery function

Press the "Recover from jam" button in the "Manifold" menu to start the recovery process. A countdown timer next to the button will show the remaining time for the process.

5. Monitor the manual move

Monitor the manifold through the pipetting access cut-out during the process. When the manifold starts lifting, it is recommended to very gently pushing down on the protruding QPlate handle a couple of times to aid the release process.

Caution! Do **NOT** attempt to remove the QPlate during the recovery process.

Caution! Do **NOT** touch the manifold during the recovery process.

6. Wait for countdown

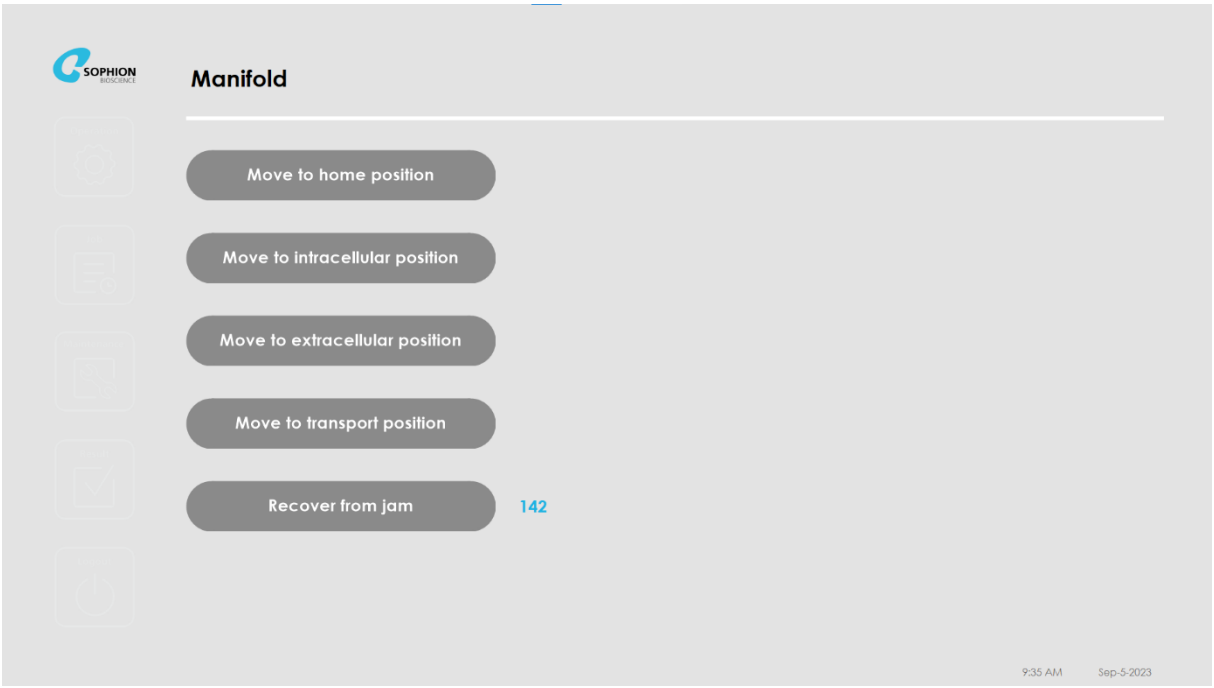


Figure 38 Recover from manifold jam

When the countdown has stopped, remove the QPlate if possible, see Figure 38.

7. Close latches

Open the instrument lid to check and close the manifold latches if they are loose, see also section 6.4.5.1 in this manual or the installation guide on how to check the manifold latches.

If the manifold is still jammed, then contact our techsupport at qpcsupport@sophion.com for follow-up on this issue. Please note down any error messages and relay these to our technical support staff.

6.4.5.3 Verify mechanical functionality and close software

1. Insert QPlate	Insert a QPlate. Ensure that the plate is fully inserted since the next steps are not dependent on the plate sensor.
2. Move to home	Click the "Move to home position" button and verify that the manifold moves to the home position.
3. Move to intracellular	Click the "Move to intracellular position" button and verify that the manifold moves to the intracellular priming position.
4. Move to extracellular	Click the "Move to extracellular position" button and verify that the manifold moves to the extracellular priming position.
5. Move to home	Click the "Move to home position" button and verify that the manifold moves to the home position.
6. Remove QPlate	Remove the QPlate.
7. Close software	Click the "Logout" menu button and click "Log out" Click the "X" in upper right corner to close the software. The software can now be restarted, and the instrument used for normal operation.

Caution! It is important to close the software to power off the motor after the recovery process.

6.5 Conducting a pressure test

In order to make sure the QPatch Compact instrument is working as expected, e.g. after shipping or service, it is possible to execute a pressure test to ensure that pressure connections to the QPlate are leak tight within specifications.

Locate the pressure ARQ plate

The QPatch Compact is delivered with a special Artificial Reference QPlate (ARQ) pressure plate. It has a red frame and a label which states "Pressure ARQ", see Figure 39.

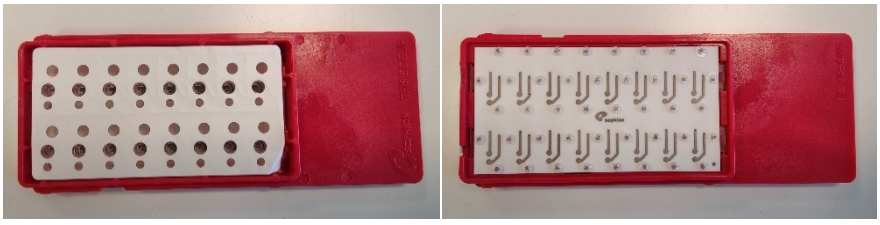


Figure 39 ARQ pressure plate (front and rear)

Start up the QPC	Turn on the instrument (on the left-hand side).
Close main application	At the login screen of the main application, close it by pressing the "X" in the corner. It may take a while before the button is clickable due to initializing of the instrument.
Open test application	Locate and start the application "VtepTest.exe" found in the C:\QPatchII\tools folder.

6.6 Conducting an artificial reference QPlate (ARQ) experiment

In order to make sure the QPatch Compact instrument is working as expected, e.g. after shipping, service, or for general troubleshooting of instrument functionality, it is possible to execute standard non-biological assays such as the one below.

1. **Locate the ARQ plate**

   The QPatch Compact is delivered with a special Artificial Reference QPlate (ARQ) plate. It is red, features a green plate on its back and has a barcode starting with "032", see Figure 40.

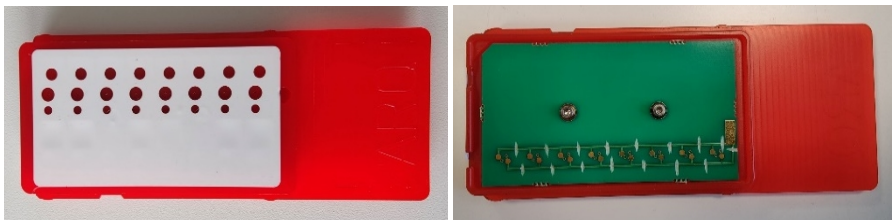


Figure 40 An ARQ plate (front and rear)

2. **Start up the QPC**

   Turn on the instrument (on the left-hand side). Login via the touchscreen using your normal login credentials for the QPC database.

3. **Preflight the QPC**

   Insert the red ARQ plate into the QPC. QPlate test sites now appear on the screen. Select all 8 sites for execution:

   Press the green "Whole-cell protocol" button and select the specific protocol called "#ARQ – Sophion standard".

   Leave settings for "Sampling filter" and "Pipetting" as default (10kHz, 3333Hz cutoff, 8th order Bessel, Voltage-gated pipetting).

   Settings for "Cell type", "Ion channel type", and "Compound map" are not applicable.

4. **Start experiments**

   Click the "Start" button to begin your experiment. The touchscreen will give you instructions for the next steps. *Notice: You will not use any liquids for this experiment.*

   - "Dispense intracellular" – Press "Done" without adding liquid.

- ”Dispense extracellular” – Press ”Done” without adding liquid.
- ”Dispense cells” - Set the ”Dispense Delay” parameter to 5 s and uncheck ”Pause for each site”. Click the ”Start countdown” button within 20 seconds without adding any liquid

Wait until the instrument shows all sites in the state of ”Experiment running” visible by a pulsing light green indicator.

Now up to 8 sites are ready for experiments. Choose a site, select ”saline” for compound and choose the voltage protocol called ” #Nav double pulse - Sophion standard”. Press the ”Go” button and repeat this step for all sites.

Select ”Resistance” in the live view plot. Toggle through all sites and verify a value of 500 MΩ -100 MΩ/ +200 MΩ.

If the value is not within the specified range, then please contact qpcsupport@sophion.com for technical support.

Press ”End all experiments”.

6.7 Priming a QPlate 8/8X

In order to make sure the QPatch Compact instrument is working as expected, e.g. after shipping, service, or for general troubleshooting of instrument functionality, it is possible to execute standard non-biological assays such as the one below.

8. Prepare a QPlate 8

Acclimatize the QPlate at room temperature for at least 1 hour before use.

9. Start up the QPC

Turn on the instrument (on the left-hand side). Login via the touchscreen using your normal login credentials for the QPC database.

10. Prepare the solutions

For a simple priming experiment, we recommend using a standard Phosphate Buffered Saline (PBS) solution for both intra- and extracellular side.

11. Preflight the QPC

Insert the QPlate into the instrument. QPlate test sites now appear on the screen. Select all 8 sites for execution. Press the green ”Whole-cell protocol” button and select the specific protocol called “#Priming – Sophion standard”.

Leave settings for “Sampling filter” and “Pipetting” as default (10kHz, 3333 Hz cutoff, 8th order Bessel, Voltage-gated pipetting)

Settings for “Cell type”, “Ion channel type”, and “Compound map” are not applicable

12. Start experiments

Click on “Start” to begin your experiment. The touchscreen will now give you instructions for next steps. *Notice: We recommend always using reverse pipetting.*

How to do reverse pipetting:

- Setup the pipette to the applicable volume

- Depress the plunger completely – go past the first stop to the second stop
- Immerse the tip in the liquid. Slowly release the plunger to full extension
- Dispense by pressing to the first stop
- If you use a motorized pipette, select "reverse pipetting"

The instructions will take you through priming of a QPlate.

- "Dispense intracellular" – Press "Done" after adding PBS solution
- "Dispense Extracellular" – Press "Done" after adding PBS solution
- "Dispense cells" – Use PBS solution without cells and add to each site according to the on-screen instructions

Now up to 8 sites have been primed. Select "Resistance" as parameter in the plot and verify in the site overview if all sites have primed to a value in range of 1.5 MΩ - 2.3 MΩ.

If the value is not within the specified range, then please contact qpcsupport@sophion.com for technical support.

Press "End all experiments".

7. System requirements & specifications

7.1 Instrument

- **Mains supply:** 100–240 V AC, 50–60 Hz and max 2A
- **Vacuum:** min. –700 mbar (~ –10.0 psi) at a peak consumption of 3L/min
- **Pressure range:** 4–8 bar (72.5–116.0 psi)
- Compressed air quality: ISO 8573-1:2010 [1:4:1]
- **Network connection:** 100BASE-T Fast Ethernet (1 Gbit/s) connection
- IP classification: IP20
- **Dimensions:** width: 608 mm (23.9 inches); depth: 332 mm (13.1 inches); height: 173 mm (6.8 inches)
- **Weight:** Total: 33.8 kg (75 lb): Instrument 22 kg (49 lb), monitor incl. stand 4.8 kg (11 lbs) and thermoelectric circulator (15 lb)
- **Screen:** 15.6” Full HD 10 touch screen
- Parallel recordings: up to 8
- Certifications: CE

7.2 Handling the instrument and precautions

Note that when lifting the instrument, you must make a firm grip underneath the body of the instrument and make sure to find the correct balance of the instrument before moving it. Also note that due to its weight we recommend that two people carry it.

Please ensure that the QPC does not rest on its back as this may break the delicate temperature control couplings.

The instruments must be placed in a way so that the mains plug is reached without any unnecessary obstructions. This is to ensure that a disconnection can be made in case of emergency.

7.3 Environmental conditions

QPatch Compact is designed for indoor use, primarily for operation in commercial and university laboratories. The hardware of the instrument will operate safely in the ambient temperature range +15°C to +30°C. Temperatures deviating from the ambient temperature range are expected to seriously affect the lifetime of the instrument and reduce its performance. The system has only been tested at room temperature.

The maximum safe altitude is 2000 m. The safe relative humidity range is 40–80% for temperatures between +18°C and +28°C. QPatch Compact should only operate under non-condensing conditions.

If condensed water is present in the instrument, it must be acclimatized before being switched on. In some cases, for example conditions of extreme cold (below 0°C), 24-hour elapse time should be enforced before operating the QPatch Compact instrument. We do not recommend placing the instrument in an environment with large temperature deviations. Condensed water repeatedly appearing on the instrument should be avoided. The instrument should be kept in a clean and dry room. The instrument must not be operated in explosive, corrosive, dusty or moist environments.

7.4 Database

- **Database:** Oracle database 19c Standard Edition 2

The performance of the system is only guaranteed when the database is running on server hardware supplied by Sophion Bioscience A/S and when no other applications are running on the server.

7.5 Sophion Analyzer software

The Analyzer software is installed on the instrument and can access the database in a standalone setup without external connection. The QPatch Compact can be connected to a network enabling the Sophion Analyzer software to run on other computers and access the database on the instrument.

The Analyzer software is tested on a standard PC running Microsoft 10, which is the recommended platform. The hardware requirements for the computer running the Analyzer software are:

- **Graphics resolution:** 1920 x 1080 pixels or higher
- **RAM:** 1 GB minimum, 4 GB or more recommended for optimal performance
- **Data cache:** minimum 1 GB recommended, 10 GB free space

7.6 QPlate 8

- Waste reservoir capacity: 250 µl
- **Typical seal resistance:** >1 GΩ (but lower seal resistance may still provide satisfactory data quality)
- **Electrodes:** Ag/AgCl

7.7 PolyAmp 4 – Patch Clamp Amplifier

- **Sampling rate:** 50 kHz, 16 bit
- RMS noise <12 pA in full bandwidth
- Digital C_{fast}, C_{slow} and R_{series} compensation in single hole
- C_{total} in multi-hole
- **Bandwidth:** 20 kHz
- **Input current range:** ±25 nA, ±50 nA and ±100 nA
- **Control output voltage range:** –400 mV to +600 mV

The raw data sampled at 50 kHz may optionally be digitally filtered and down sampled to save database storage and improve the performance of the data analysis software.

The PolyAmp 4 – Patch Clamp Amplifier can be used for multicell patch clamping on the QPlate 8X. When measuring on multiple cells, the cell capacitance (C_{slow}) is larger than when measuring on one cell only. The PolyAmp 4 – Patch Clamp Amplifier can compensate for a large C_{total} (C_{fast} + C_{slow}), but within some limits. These limits depend on two parameters:

- the total size of C_{total} (C_{fast} + C_{slow}); and
- the voltage change, or step, defined in the voltage protocol

The capacitance compensation is good if the voltage step (V_{cmd} max – V_{cmd} min) and total capacitance (C_{total}) are located below the curve depicted in Figure 41.

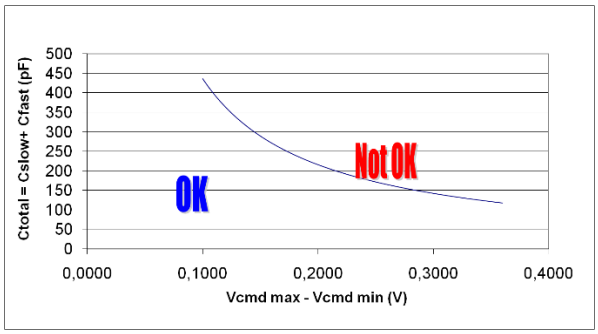


Figure 41 Relationship between C_{total} and $V_{cmd\ max}$ – $V_{cmd\ min}$

Digital filters are

- Bessel filter of 8th order
- Butterworth filter of 8th order

8. Legal statement

8.1 Copyright

This manual covers the Sophion product named QPatch Compact.

8.2 Trademarks

8.3 Compliance

The QPatch Compact instrument complies with the directive and standards as described in the QPatch Compact Safety Guide.

8.4 Disclaimer

Sophion Bioscience A/S, Sophion Bioscience KK, Sophion Bioscience Inc. and Sophion Bioscience (Shanghai) Co., Ltd. cannot be held responsible for any damage caused by using the QPatch system or related software.

Sophion Bioscience A/S, Sophion Bioscience KK, Sophion Bioscience Inc. and Sophion Bioscience (Shanghai) Co., Ltd. do not guarantee the correctness, accuracy, reliability, performance or otherwise of QPatch Compact. The user assumes the risk as to the results and the performance of QPatch Compact.

The information provided in this manual may not be up to date. The disclaimer written above may be incomplete and should be considered together with all other agreements made between Sophion Bioscience A/S, Sophion Bioscience KK, Sophion Bioscience Inc. and Sophion Bioscience (Shanghai) Co., Ltd. and the users of the system.

9. Terms and abbreviations (appendix I)

Table 3 explains the terms and abbreviations used in this manual. Terms in **bold** are defined elsewhere in the table.

Table 3 Terms and abbreviations

Term or abbreviation	Explanation
Assay	In QPatch Compact the experimental set-up is called an assay. It defines the set of parameters used. For example, the set-up includes parameters for voltage control, sampling, resistance and capacitance and information on the types of cells and ion channels.
C_{chip} (C_{fast})	Capacitance of the chip between the reference and measurement electrodes in the cell-attached configuration.
$C_{membrane}$ (C_{slow})	Capacitance across the cell membrane in the whole-cell configuration.
C_{total}	Capacitance contribution from both $\boldsymbol{C_{chip}}$ and $\boldsymbol{C_{membrane}}$.
Compound list	List of compounds defined in **Sophion Analyzer software**.
Concentration–response study	A study of the relationship between the concentrations of a compound applied and the recorded current responses from cells.
Digital signal processor	A microprocessor designed specifically for high-speed digital signal processing (DSP).
Flow channels	Liquid flow channels on the QPlate used to apply the compounds to the cells.
Gigaseal	A high-electrical-resistance seal between the chip orifice and the cell membrane of around or above 1 GΩ.
Hit	A compound has the desired effect or any other effect on the ion channels in the **experiment**.
Measurement site	An individual, physical measurement position on a **QPlate**. This comprises the chip, the electrodes, the flow channels, and the waste reservoir. A **QPlate** consists of 8 measurement sites.
MilliQ	Millipore filtered water.
Priming	The process by which intra- and extracellular saline solutions are filled into the flow channels of a **QPlate** using air pressure. Electrical contact is established when the two solutions meet in the patch hole.
QPlate	Consumable part of the QPatch Compact. Contains 8 measurement sites, allowing single cells measurements on to be made in parallel.
R_{access}	The sum of the patch resistance and the resistance of the cell interior.
R_{chip}	Electrical resistance of a single chip orifice measured before cell application.
$R_{membrane}$	Electrical resistance of a cell membrane measured in the whole-cell configuration, when voltage-clamped at a potential where the ion channels are closed.
R_{series}	$\boldsymbol{R_{chip}}$ + $\boldsymbol{R_{access}}$. It also contains other parasitic resistances, which are small and therefore usually neglected.

Screening	Electrophysiological experiments performed to determine whether compounds affect the current from ion channels expressed in the cells.
Screening station	The QPatch Compact instrument.
Sophion Analyzer software	The administration, planning and analysis software package for QPatch Compact.
Whole-cell configuration	A measurement configuration in which it is possible to measure the response from ion channels expressed in the entire cell membrane in the open configuration.

10. Declaration of conformity (appendix II)

CE

Declaration of Conformity

Manufacturer:	Sophion Bioscience a-s
Address:	Baltorpvej 154 2750 Ballerup Denmark
Product description:	Laboratory instrument
Product name/Type no:	**QPatch Compact**

We declare under our sole responsibility that the products, to which this declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EEC Member States relating to the following:

Directives

Electromagnetic compatibility 2014/30/EU
Machinery Directive 2006/42/EU
RoHS Directive 2011/65/EU

and

Standards

EN 61326: 2013 Product family standard, Measurement, control and laboratory equipment
EN 61010-1: 2010 Safety requirements for electrical equipment for measurement, control, and laboratory use
EN 61010-2-081:2015 Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes
EN 12100: 2010 Risk assessment and risk reduction
EN 13849-1: 2015 Safety-related parts of control systems
EN 63000: 2018 Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Year of applying CE marking: 2022

Date January 27th 2022 Location: Ballerup

Name : Thais Johansen, CEO, Sophion Bioscience

Signature