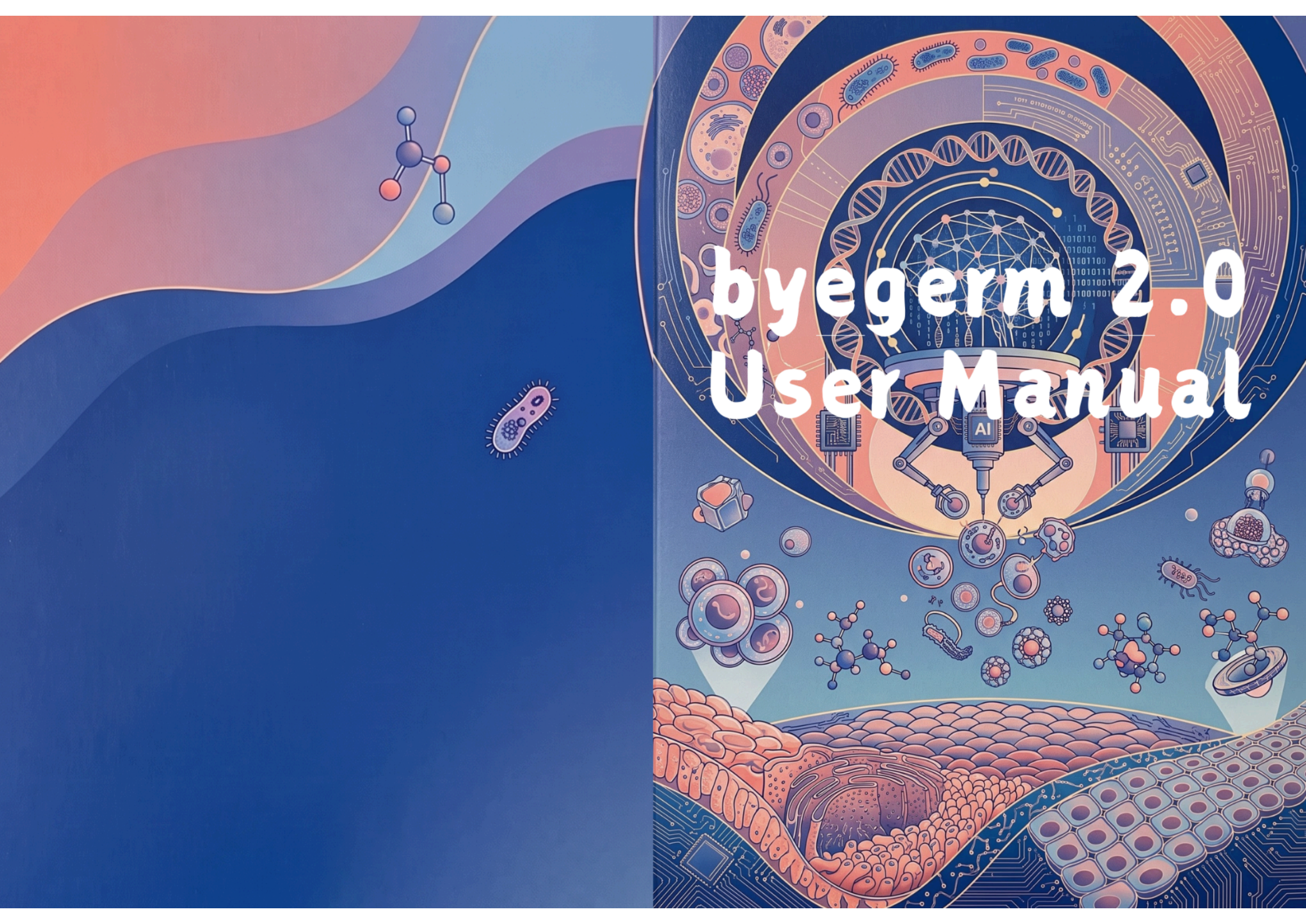




byegerm 2.0

User Manual

Complete workflow from sampling preparation to saving results

This manual explains how to use byegerm 2.0 in the order of a complete test. First prepare and connect the instrument and phone, then collect and process samples. After loading the tubes, use the app to set up and start the run, monitor it, record results, remove the tubes, and clean the instrument. Read the entire manual before first use.



Figure 1 byegerm 2.0 with both lids open Design rendering

Identify the two tube-loading areas

This generation is designed for centralized testing in settings such as kindergartens and nursing homes. The independent lysis area is beneath the front lid, and the main reaction chamber is beneath the top lid. The lysis area processes samples, while the main chamber holds sealed reaction tubes. A rotating mechanism brings each viewing face into the camera's field of view; the app provides control and viewing functions.

Prepare the required items

Prepare the instrument, its supplied power source, an Android phone with the matching app version, a sampling kit, identification labels, sample preparation materials, test reagents, compatible reaction tubes, pipetting equipment, required controls, protective equipment, and waste containers. Check material expiry dates, the test to be performed, its protocol, and the result interpretation rules.

This manual is for trained operators of the research prototype. Throat swabs are collected by trained personnel. Design for home or institutional use does not replace validation of suitability for real specimens and diagnostic performance.



01 Prepare the instrument and phone

Position and inspect the instrument

Place the instrument on a stable, dry bench with space for ventilation. Once it has stopped and cooled, check the lids, tube-loading area, and power cable. Remove any remaining tubes and foreign objects. Do not use the instrument if parts are loose, liquid has entered, or cables are damaged. Routine operators must not disassemble or adjust the camera, optical filters, or internal circuitry.

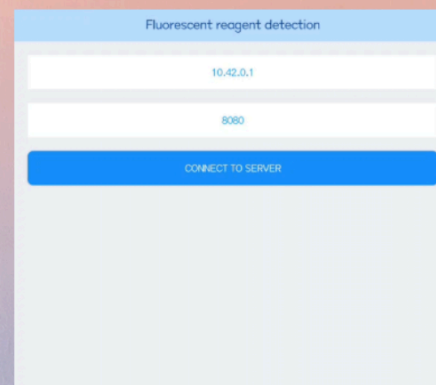
Power on and wait until ready

Use the supplied adapter, or ensure the battery has sufficient charge before powering on.

Wait for the instrument's specified ready indication before using the app. If power ratings or connector functions are unclear, check the configuration card first. Do not connect another power source merely because its plug fits.

Connect the phone to the instrument

Open the phone's Wi-Fi settings, join the instrument's local network, and open the companion app. In the connection area, enter the configured device address and port in Server IP and Port, then tap Connect to Server. After the connection confirmation appears, check that device status and temperature readings update.



If the connection fails, check in order that the instrument is on, the phone is on the correct network, and the IP address and port match. Do not change settings or start a test until the connection is confirmed. The person responsible for the instrument records the Wi-Fi name, IP address, and port on the configuration card on the last page.

Perform an integrated check before first use

Before first use, after repairs, or after replacing key components, the person

responsible for the instrument checks the lysis area, main reaction area, and rotating mechanism separately using non-infectious test materials. Complete initial positioning as required. Close the lids to change viewing faces, wait for motion to stop, and then capture an image. Confirm that each face matches its app label, and check data saving and stopping functions. Finish the check, stop the instrument, allow cooling, and remove the test materials. Before proceeding, confirm that the instrument and app are connected, startup checks have passed, and test materials have been removed. For routine use, retain the verified configuration. Do not change network, optical, or temperature-control settings without authorization.

02 Collect and prepare samples

Assign identifiers before sampling

Confirm the person's identity, the requested test, and the sample ID, and prepare the appropriate swab and collection tube. The collector performs hand hygiene, uses the required protection, and explains the procedure.

Collection tube labels must correspond to the subsequent processing and reaction tubes.

Collect the throat swab and seal the tube

A trained healthcare professional inserts the swab into the posterior pharynx and tonsillar areas, swabs both tonsillar pillars and the posterior oropharynx, and avoids the tongue, teeth, and gums. Place the swab tip in the supplied collection tube.

Retain or break off the swab as directed by the kit instructions, tighten the cap, record the collection time, and check for leakage. Store and transfer the sample under the conditions specified in the applicable protocol.

Load samples into the lysis area in batches

On receipt, verify identifiers and tube integrity, and complete pre-lysis preparation according to the protocol. For each batch, record the sample ID, processing tube, and lysis position. Once the lysis area has stopped and loading is permitted, open the front lid, seat compatible processing tubes securely in the assigned positions, and close the lid.

Batch samples according to the actual available positions, not the main reaction chamber's capacity.

Start lysis for the batch in the app

Open the control for this instrument's lysis area and confirm that it controls the front lysis area. Set the temperature and time according to the protocol and start. Check that feedback from this area updates, and record the batch and start time. When complete, stop heating in this area and wait until tube removal is permitted before opening the front lid. Complete post-lysis processing according to the protocol, retaining the sample-to-batch mapping.

Prepare sealed reaction tubes

Use the processed samples to prepare reactions according to the reagent protocol for this run, including the required controls. Verify identifiers, mix and collect the liquid as instructed, and close the caps. If using an external sample preparation method, resume at this step after completing that method. Distinguish processing tubes from reaction tubes; do not place collection tubes directly in the main reaction chamber. Before loading, check each tube's ID, type, and closed cap, and confirm that all samples and controls for the run are present.

03 Load reaction tubes and start the test

Map viewing faces and tube positions

Assign a run ID and map each sample ID, lysis batch, reaction tube ID, target, viewing face, and tube position. Reserve positions for controls. Allocate samples according to the actual usable positions. Multiple targets from one sample and controls occupy multiple positions, so total tube capacity is not the number of people tested.

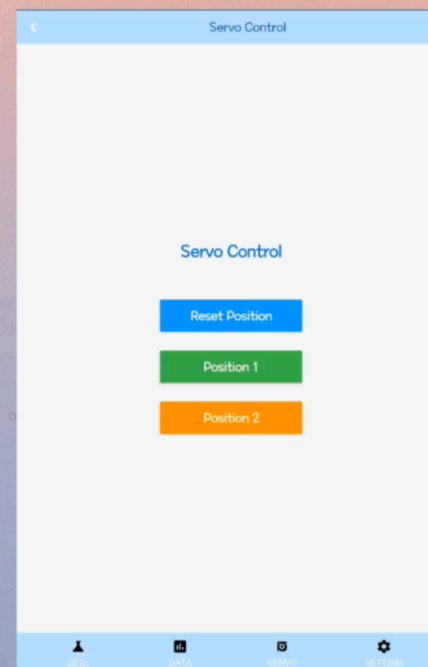
Load tubes in sequence and close the top lid

Once the main reaction area has stopped and loading is permitted, open the top lid and load currently accessible positions according to the map. To change faces, follow the loading procedure: close the lid, activate the drive,

wait for motion to stop, and reopen to continue loading. Do not rotate the mechanism by hand. Caps and labels must not enter its travel path. Check the record after loading all tubes and close the top lid.

Set reaction parameters in the app

Keep the phone connected. Open Settings, set the target temperature required by the protocol in Temperature Setting, and enter or adjust the run time in the time area. Confirm that the main reaction area is selected; do not reuse the front lysis area's parameters. Check entries against the reagent protocol for this run. Default values and temperature shortcut buttons are interface aids; they do not replace verification of the run parameters.

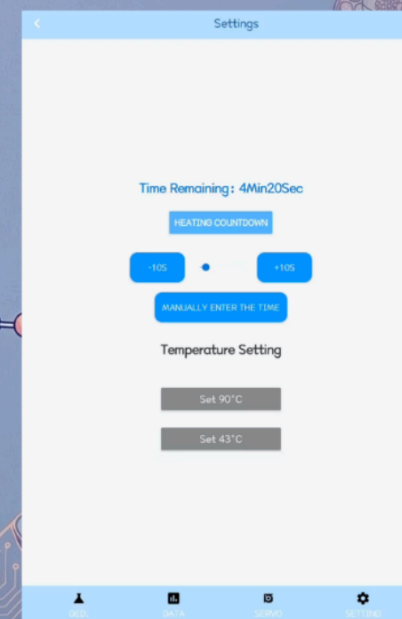


Complete the final checks before starting

Confirm that tubes are seated, position records are correct, controls are complete, lids are closed, the connection is working, and temperature and time settings are correct. If the app requires preheating or positioning first, complete the required step for this instrument before starting the sample run.

Start the run and confirm operation

Start the current test in the app. Check that run status, Current Temp readings, or Heating countdown update as specified by the program. Record the start time and the program's defined timing reference, distinguishing warm-up time from effective reaction time. If there is no response, check the connection and device status first; do not repeatedly tap start.



04 Monitor the run and capture images

Keep the instrument stable and check status

Maintain the phone's network connection to the instrument throughout the run. Keep the lids closed and vents unobstructed. Do not move the instrument, remove tubes, or adjust optical components. Keep hands and tools away from the moving mechanism when changing faces. Do not issue duplicate automatic and manual commands at the same time.

App display	What to check
Current Temp	Check that readings continue to update and meet the temperature requirements for this run. Confirm that feedback is from the temperature zone being operated.
Heating countdown	Check that timing follows the program. When the countdown reaches zero, still verify run and heating status.
Data or curve area	Check that data have been returned and curve timestamps match this run. If no curve appears, first check the acquisition stage and connection.

Capture each face and verify positions

At the acquisition stage, use automatic or manual acquisition as configured. When the automatic program changes faces, wait for it to complete positioning and capture.

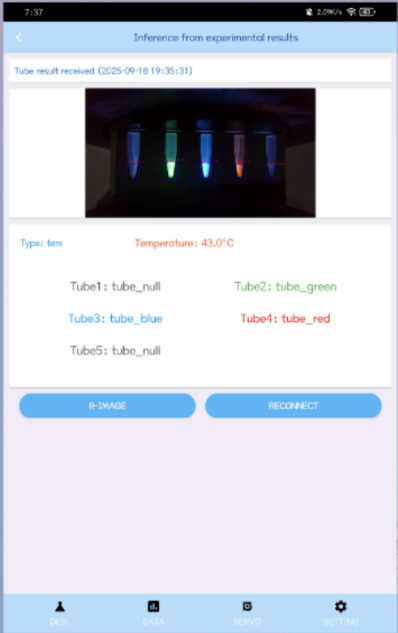
For manual operation, close the lid, select the target face, wait for the mechanism to stop, confirm its position, and trigger image capture. Check the face's tube positions against the record, then repeat for the remaining faces.

Each used tube position must have a corresponding image or record, including its face, position, and acquisition time. If the display has not refreshed, do not treat the previous face's image as the current position's result. Stop and investigate misalignment or jamming before continuing.

Open results after acquisition and analysis

After the image is returned, wait for automatic analysis or complete the verified analysis steps, as configured, before viewing results for the channels in use.

An unchanged image, blank result, or absence of data does not indicate a negative result. If a problem occurs, refer to the troubleshooting instructions on the last page.



Disconnecting the network, closing the app, or stopping automatic refresh does not stop heating. If the connection is lost, check the instrument's actual state first. After reconnecting, verify run and data completeness; do not simply restart the same run.

05 Check results and finish the run

Match results to individual tubes

Match each Tube number in the app to the loading record. Confirm that the sample ID, target, and actual position agree. Read results only for positions used in this run. Mark unused positions as unused, not negative.

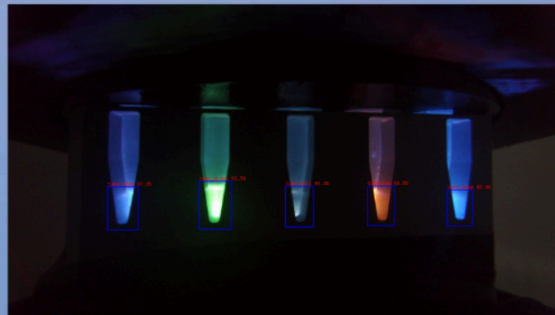
Confirm run validity before interpreting results

Review control results and check the run time, temperature, and acquisition records. Record sample results using the applicable interpretation rules only when the run meets the reagent protocol's validity criteria. If controls fail, data are missing, or the run is interrupted,

follow the protocol for handling or retesting. Image brightness alone, model confidence, or a risk label cannot replace a test conclusion.

Save test records

Record the run ID, sample-to-position mapping, run parameters, and test results. Save data or capture the results screen using the functions available in the current app. Check that saved content is clear and complete and that identifiers match this run. Record the reagent lot number and protocol version separately.



Stop the run and allow cooling

After recording, follow the instrument's end-of-run procedure and confirm that heating has stopped. Verify that the detection chamber is ready for tube removal. Do not open the lid and remove tubes merely because the countdown is zero or the app is closed. Do not touch heating components to judge their temperature.

Remove and account for all reaction tubes

Once tube removal is permitted, open the appropriate lid and remove tubes one by one according to the position record, keeping caps closed. Collect waste according to institutional rules. Check every used position for remaining tubes.

Complete the instrument's system shutdown, switch off the power, and disconnect the external supply.

Clean, store, and complete the record

After disconnecting power and allowing cooling, clean using a method compatible with the housing, metals, and optical materials. Do not spray liquid into the camera, fan, or connectors, or immerse the instrument. Once dry, close the lids for storage. Disconnect cables before moving it and support the housing securely. Record abnormalities and corrective actions for the next startup check.

Before ending the run, confirm: records are saved; the run and heating have stopped; all reaction tubes are removed; waste is collected; and the instrument is shut down and cleaned.

Troubleshooting

Problem	Action sequence
Cannot connect	Confirm that the instrument is ready, the phone is on the correct network, and Server IP and Port match the device configuration. Then reconnect.
Connection lost during a run	Restore the network and use Reconnect. Check whether the instrument is still running, image timestamps, and data completeness. Do not simply restart.
Temperature or countdown not updating	Check the connection and run status first. If heating status cannot be confirmed or the problem persists, stop the run and contact the person responsible for the instrument.
No curve or new image	Check that acquisition has begun, the network is working, and acquisition and analysis are complete. Blank or old data must not be treated as negative.
Abnormal image or incorrect position	Check the loading record and current view. Stop before checking loading and lids. Do not change exposure or thresholds to conceal a problem.
Rotation jam or incorrect face sequence	Stop motion and do not push the mechanism by hand. If controls do not respond, switch off power when safe. Allow cooling and have the responsible person investigate.
Liquid ingress or abnormal heating	Stop using the instrument immediately if there is smoke, an unusual odor, battery abnormality, or liquid ingress. Disconnect power when safe; do not continue charging or test-running it.

After resolving a fault, reassess the validity of the run record. If run time, temperature, or acquisition completeness was affected, decide on retesting according to the protocol. Do not automatically reuse results from before the fault.

Instrument configuration card

To be completed by the person responsible for the instrument and supplied with it. Update this card when the network or software changes. Test temperature and duration remain governed by the reagent protocol for each run.

Item	Instrument information
Device and software	Device ID_____ App version_____ Firmware version_____ Power rating_____
Connection	Wi-Fi name_____ Server IP_____ Port_____
Operating references	Protocol and version_____ Ready indication_____ Integration check date_____
Contact	Responsible person_____ Contact details_____

Keep each run ID and sample-position record so that the instrument, app, and test results can be linked.