Biomeme

Franklin Real–Time PCR Thermocycler

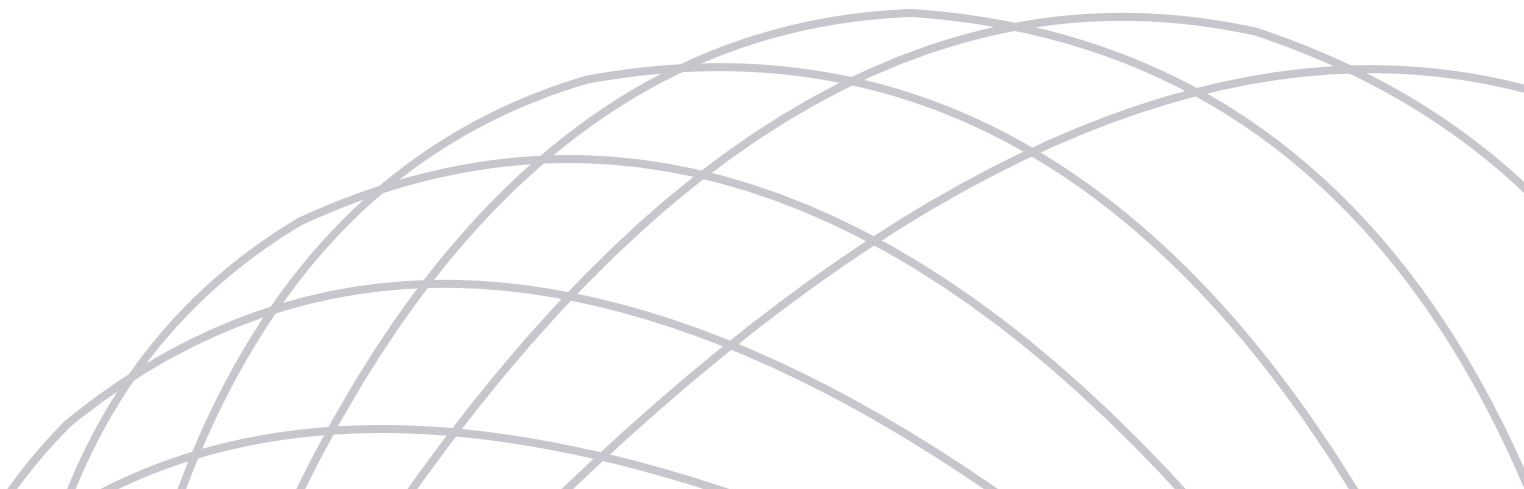# Table of Contents

Franklin Thermocycler

The **Biomeme Franklin** transforms your smartphone into a thermocycler for real-time PCR or isothermal analysis with sample-to-result in 30-60 minutes, depending on test protocol. This **mobile** thermocycler enables multiplex real-time detection of up to 27 targets from 1 sample or test 9 samples for up to 3 targets each. Just under 3 lbs, **hand-held**, and **battery-operated** for maximum **portability** enabling a full day's work out in the field on a single charge. For your convenience, we offer 3 different variations of the Franklin - one9, two9 and three9.
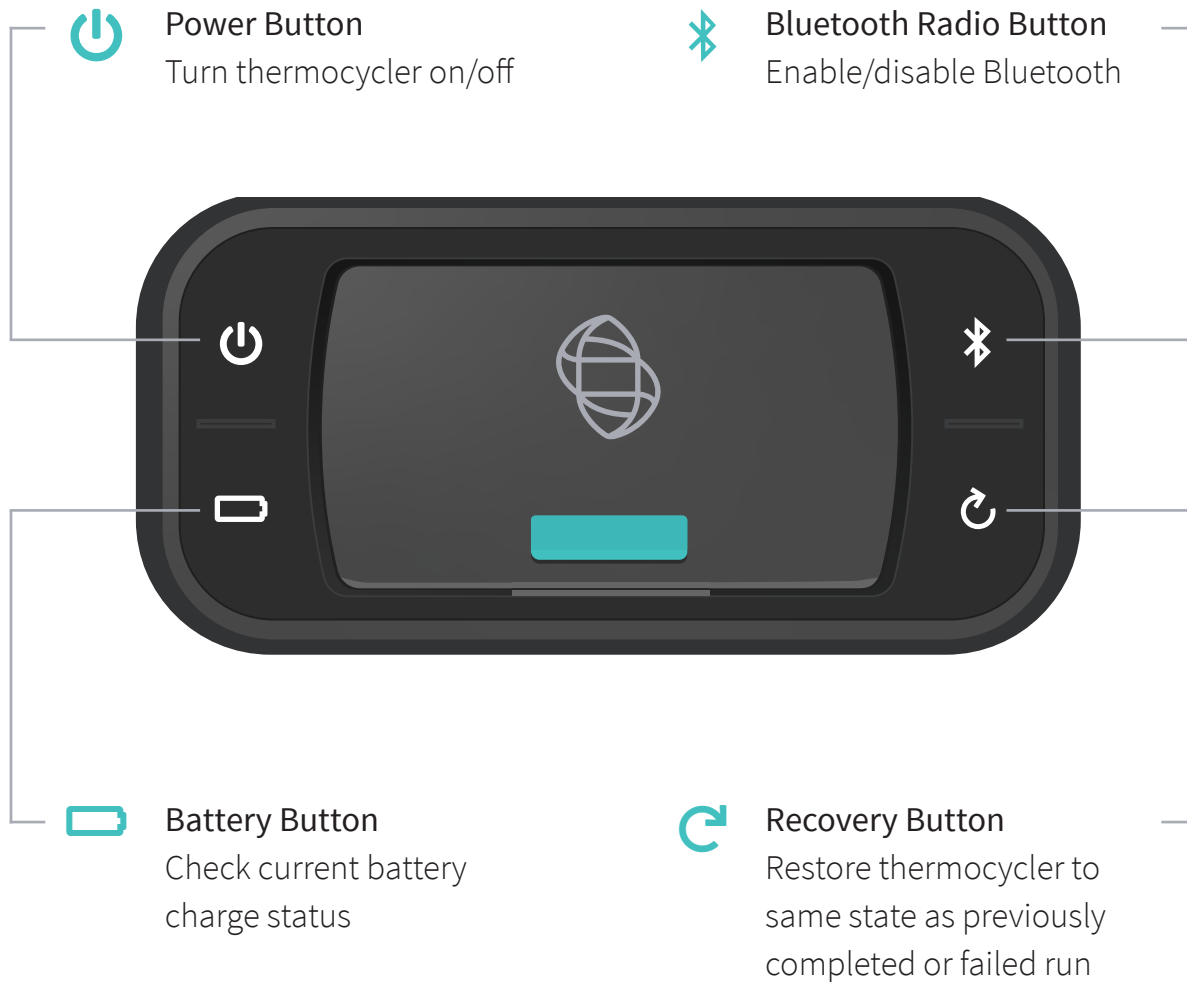
Technical Specifications

SPECIFICATIONS	DIMENSIONS
Sample Capacity	9 Wells
Reaction Volume per Well	20 - 50 μL
Total Channels	3
Recommended Fluorophores*	FAM / SYBR (Green), TexasRedX (Amber), ATTO647N (Red)
System Control & Data Transfer	Wired or Wireless (BLE)
Integrated Barcode Scanner	Yes
Max Samples per Run	9
Max PCR Targets per Run	27
Weight	1.36 kg / 3 lb
Operating Ambient Temperature	4 - 40°C / 39 - 104°F
Operating Humidity Limit	0 - 99%
Operating Altitude Limit	3,048 m / 10,000 ft
Wall Power (VAC)	100 - 240V
Internal Battery	5 hrs
Quantitative	Yes

*Note that the Darwin one9 is limited to the FAM/SYBR (Green) channel and the Darwin two9 is limited to the FAM/SYBR (Green) and ATTO647N (Red) channels only. You can upgrade your thermocycler(s) at any time!

Thermocycler Button Layout

There are a total of 4 buttons located on the top of your Franklin thermocycler:

Power Button
Turn thermocycler on/off

Bluetooth Radio Button
Enable/disable Bluetooth

Battery Button
Check current battery charge status

Recovery Button
Restore thermocycler to same state as previously completed or failed run

LED Status Indicators

Vertical LED on the front of your Franklin thermocycler

The Franklin has 5 LEDs on the front of the unit. The LEDs are used to convey various states of the thermocycler as outlined in the table below.

COLOR	INTERPRETATION
WHITE	5 solid indicates your thermocycler is on 5 blinking indicates Bluetooth (BLE) pairing
GREEN	2 solid indicates remaining battery is between 21 and 40% 3 solid indicates remaining battery is between 41 and 60% 4 solid indicates remaining battery is between 61 and 80% 5 solid indicates remaining battery is between 81 and 100% 1 blinking indicates charging
YELLOW	1 solid indicates run start to 9% complete 2 solid indicates run is between 10 and 31% complete 3 solid indicates run is between 32 and 53% complete 4 solid indicates run is between 54 and 75% complete 5 solid indicates run is between 76 and 99% complete
RED	1 solid indicates remaining battery is between 0 and 20% 5 blinking indicates thermocycler lid is open or an error ⚠ NOTE *If the battery is in the red, you shouldn't start your run until you plug your thermocycler into power.*
BLUE	5 blinking indicates your test is complete and data is ready to be synced to your smartphone

Turning Your Thermocycler On and Off

To power on your thermocycler, press and hold the power button ⏻ (located on the top of the unit) for roughly half a second. The status LED on the front of your thermocycler will illuminate white to indicate it has successfully turned on. To turn the unit off, press and hold the power button for 1.5 seconds and the status LED will turn off upon release of the button. The unit will also turn itself off after 15 minutes of inactivity.

Charging & Checking Battery Status

MICRO USB

POWER CONNECTOR

⚠ **NOTE**

To preserve your smartphone's battery life, disconnect your smartphone from the thermocycler when it's not in use.

If your battery is running low, simply plug the AC power adapter into an outlet and insert the power connector into the back of your thermocycler. When the battery button ▭ is held, the LED on the front of your thermocycler indicates the battery charge status as follows:

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LED STATUS		BATTERY PERCENTAGE
5 solid	GREEN	81 - 100%
4 solid	GREEN	61 - 80%
3 solid	GREEN	41 - 60%
2 solid	GREEN	21 - 40%
1 solid	RED	0 - 20%

A single green LED will blink while charging. If your battery charge is between 0 and 20%, the bottom most LED will blink green while charging. If your battery charge is greater than 20%, the top most LED will blink green while charging.

Enabling & Disabling Bluetooth (BLE)

Bluetooth (BLE) can be turned on or off at any time by pressing and holding the Bluetooth button ✳ on the top of your thermocycler for roughly half a second. By default, Bluetooth is disabled. A blue LED will light up next to the BLE button indicating it is enabled.

Once enabled, tap **"Connect via BLE"** when prompted in the smartphone app. If working with multiple Franklin thermocyclers, select the appropriate unit and tap **"Confirm"**. The LED on the front of your thermocycler will flash white indicating it's connected.

If you prefer wired control over wireless, connect your smartphone and Franklin unit using your preferred OTG adapter and micro USB cable.

Recovering & Reattaching Test Data

Recovery

Pressing the Recovery button ↻ on the top of your thermocycler will safely restore the unit to the same state as the previously completed or failed run such that your smartphone can collect the result data. The recovery feature is most commonly used when:

- A user accidentally turns their unit completely off
- A user starts their test run, walks away, and doesn't realize their unit is running on battery power before it eventually dies and needs to be charged

> ⚠ **NOTE**
>
> *This feature is not intended to restart an interrupted test, but only to recover partial or whole test data. Once a new test is started, any previous data will be erased.*
>
> *For security reasons. the same smartphone that was used to initiate the test must be used to download the test results.*

Reattaching

The connection may be lost between your smartphone and your thermocycler for a number of reasons (i.e. phone battery died, mobile app crashed, etc.).
If this happens, you can easily reattach your smartphone to the thermocycler.

To do so, relaunch the Biomeme mobile app and on the app home screen tap the **"Reattach Test"** button. From there, select your test from the list of incomplete runs. After selecting your test, please wait roughly 30 seconds before your run data begins to populate.

Reattaching (continued)

Be sure to connect to the thermocycler via wire or Bluetooth so the app can automatically transfer data off the unit once available.

Transferring Data
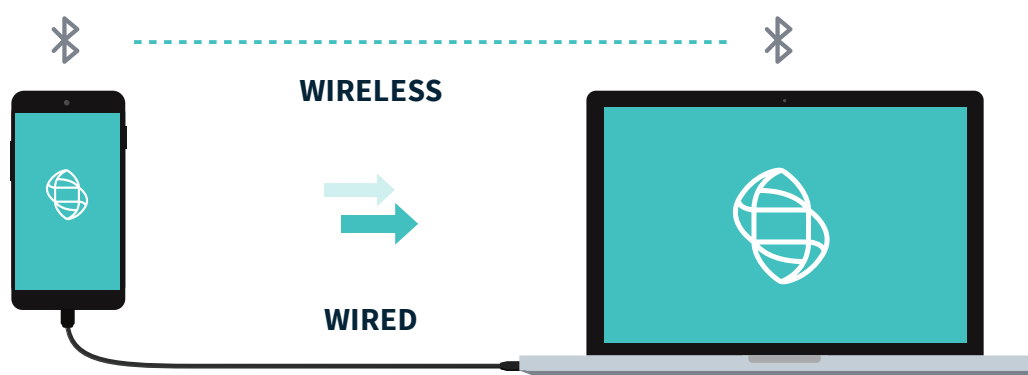
Wireless (Bluetooth)

On your computer, make sure your bluetooth is set to "Receive a File". This will prepare your computer to accept the data transfer from your smartphone.

1. In the mobile app, navigate through "View Results" and select a test
2. Once on the test result screen, tap "Send" in the top right corner
3. A menu will slide in with sharing options; select "Bluetooth" and transition to the "Choose Bluetooth Device" screen

> ⚠ **NOTE**
>
> *Instructions could vary depending on your computer and/or smartphone Operating System. If you require further assistance, please contact **support@biomeme.com**.*

Wired

Results from your tests can be transferred from your smartphone to a computer via a micro USB cable. Plug one end of the micro USB into the smartphone (may require OTG adapter depending on type of smartphone) and plug the other end of the cable into your computer. On the smartphone, make sure to select **"Use USB for Charging"** and select file transfers.

On your computer, select:

1. File Explorer > This PC
2. Under Devices and Drives, click s60
3. Select Internal Storage > Android > data > com. biomemebase > files

All of your test runs will be listed within this folder. Copy the .xlsx files to your computer.

⚠ **NOTE**

Cutting and pasting OR deleting the .xlsx files will permanently delete them off the smartphone. If you want them to remain, make sure to only copy and paste.

⚠ **NOTE**

If you start your test with a serial connection, you must finish your test on a serial connection.

⚠ **NOTE**

*Instructions could vary depending on your computer and/or smartphone Operating System. If you require further assistance, please contact **support@biomeme.com**.*

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Loading Sample into Go-Strips

Transfer 20 µL purified DNA into each well of the Go-Strip. Once all wells are filled, place the void filling cap into the strip. Align the Go-Strip and void filling cap so that the strip connections are visible through the cap cutouts.

Hold the strip firmly between your fingers and use one finger to secure the void filling cap inside of the strip. Then, with a whipping motion of the wrist, flick the tubes a few times to ensure bubbles are removed from the bottom of each tube.
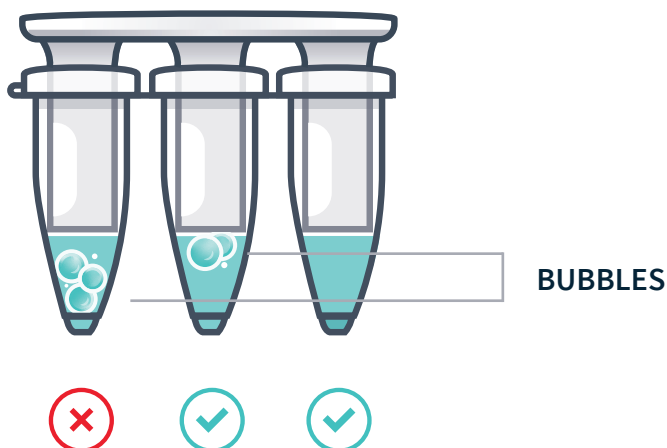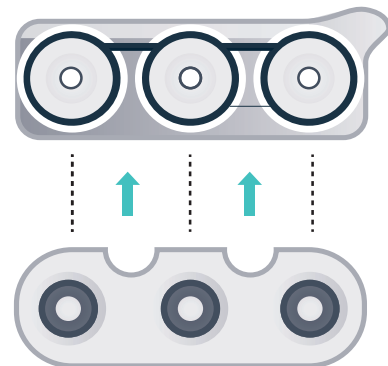
BUBBLES

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Placing into Biomeme Thermocycler

Open the lid of the Biomeme thermocycler. Place your test strip, with the void filling cap inserted, into a 3-well slot. Don't worry if the void filling cap feels slightly loose. When the lid of the thermocycler is closed it will further secure the caps into place.

It's important to make sure your Go-Strip is oriented correctly when placing it into your thermocycler. Make sure the strip connections that are visible through the void filling cap cutouts are facing the back of your thermocycler. This will ensure sample 1 is always to the far left.

Navigate to the Biomeme App to begin your testing protocol. For further instructional information about your thermocycler, contact Biomeme.

Maintenance & Cleaning

The Biomeme Franklin thermocycler is maintenance-free and has no serviceable parts. In the case of thermocycler failure or damage, please contact support@biomeme.com.

The Franklin thermocycler can be cleaned using 70% ethanol, 10% bleach or a disinfecting wipe (e.g. Lysol) solution. Do not spray or pour solution directly onto the thermocycler when cleaning. Ensure no excess liquid is used when cleaning as it may damage the unit.

- Do not disassemble the thermocycler for cleaning
- Do not immerse in water or cleaning solutions
- Do not clean with soap or other solutions
- Avoid cleaning the heating wells (silver)

If you do need to clean your heating wells because it's impacting performance, please contact support@biomeme.com for specific instructions.

Troubleshooting

Why is my Bluetooth not connecting?

If you are having trouble connecting, ensure that you enabled Bluetooth on both your smartphone and thermocycler.

Why is my thermocycler not showing up in the connection list?

Ensure that Bluetooth is turned on. The LED next to the button should be illuminating blue. If your thermocycler is still not showing, try scanning multiple times to allow for discovery.

My Bluetooth connection was lost during a test run…

If you lose Bluetooth connection, the smartphone app will notify you that the connection has been lost. It will prompt you to reconnect to the thermocycler if you are able to. Upon reconnecting, the test data will update on the smartphone after a short delay (1-2 seconds).

What happens if my test stops prematurely?

If your test fails, the smartphone will notify you of the error returned from the thermocycler. Your last run will be saved in the Biomeme mobile app up to the point of failure, but the data will not be processed resulting in no CQ values, baseline, or graph of smooth data. The raw data and information about your run is still exportable through the xlsx spreadsheet, however.

My thermocycler turned off during a test run…

If your thermocycler turns off during a test, then the thermocycler battery may be dead and the unit should be plugged into power. Your connection to the smartphone will also be lost. If this happens, we recommend you to stop the run in the smartphone mobile app. See Recovering & Reattaching Test Data for more details.

I have a low battery warning at test start...

You are able to start a test, but ensure that you are plugged into a charger before the thermocycler runs out of power.

My app closed during a test run...

If the smartphone app closes during a test, you can sync to the test by reopening the app and pressing the incomplete runs option. This will display the previous incomplete run. See Recovering & Reattaching Test Data for more details.

I reconnected to the wrong thermocycler...

If you accidentally reconnect to the wrong thermocycler, the app will notify you that you are connected to the wrong thermocycler and not fetch any data from the current run.

How do I stop a test?

While the test is running, you have the ability to press the stop run button. Doing so will prompt the mobile app to ask you to confirm that you would like to stop the test in progress. Upon stopping, your run will be saved to the current point, and available in the test results section of the mobile app.

The thermocycler failed to start test...

If your run fails to start, the app will return to the home screen and have you restart the setup of your test. Restart the thermocycler then reconnect the smartphone. If starting still fails after many retries, please contact support@biomeme.com.

The USB failed to send the protocol...

Make sure your thermocycler is on. If on and still failing, power cycle your thermocycler and go through the setup again.

How do I upgrade my one9 and/or two9 thermocycler to add additional color channel detection?

Adding additional color detection channels to your thermocycler is easy and does not require you to return your unit or purchase any new parts. All you'll need is the MAC address for the thermocycler(s) requiring an upgrade which can be found on the label on the bottom of your unit(s).

Start by navigating to the settings menu (⚙) in the Biomeme mobile app and tap upgrade. From there, you'll be re-directed to our mobile-friendly online store where you can purchase additional color channels such as ATTO647N (Red) and TexasRedX (Amber). Once your order is received, a Biomeme representative will follow up regarding your MAC address(es) and use this to provide you with a unique 16-character unlock code (per unit) to be entered using the Biomeme mobile app. Please note, your smartphone must be connected to the thermocycler via Bluetooth or serial in order to complete the upgrade.

What should I do if I receive a heater error message?

Retry running your test, but if the error persists please contact support@biomeme.com.

What should I do if my test is complete, but I can't reattach my smartphone to get my results?

Steps to try, in order:

1. Turn off Bluetooth on your smartphone. Then, turn Bluetooth back on and attempt to reconnect to the thermocycler.

2. Close the Biomeme mobile app completely then re-open it and attempt to access Incomplete Runs from the app home screen to recover your test results.

Disclaimer

For Research Use Only. Not for use in human or veterinary diagnostics. The performance characteristics of this product have not been established.

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Biomeme warrants every thermocycler to be free of defects in material and workmanship for one year from date of shipment to buyer. All warranties are subject to our Terms and Conditions and Privacy Policy (https://biomeme. com/privacy-policy-and-terms-of-use/).

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