G-STORM
GS4822

Instruction Manual

G-Storm 2012

Trademark Information

Contents

General Information

Policy Statement

It is the policy of G-Storm to improve products as new techniques and components become available. G-Storm reserves the right to change specifications at any time.

Warranty Statement

G-Storm guarantees that the thermal cycler you have received has been thoroughly tested and meets its published specification.

This guarantee is valid for 24 months only if the product and functions have been used according to the instruction manual. No liability is accepted for loss or damage arising from the incorrect use of the thermal cycler. G-Storm's liability is limited to the repair or replacement of the unit or refund of the purchase price at G-Storm's option. G-Storm is not liable for any consequential damages.

G-Storm's thermal cyclers are for research use only.

Read the Instruction Manual carefully before using the thermal cycler to ensure that you obtain the best possible results from the machine.

G-Storm thermal cyclers should only be used by suitably qualified and trained people. If the thermal cycler is not used as specified in this manual, the protection provided by the equipment may be impaired.

1 Safety Warnings and Precautions

1.1 Before Operating the Instrument

Ensure that anyone involved with the operation of the instrument is instructed in both general safety practices for laboratories and specific safety practices for the instrument.

Always place the instrument in a location where, if necessary, the main power supply can be disconnected immediately.

1.1.1 **Instrument Safety**

Please read this section before operating the thermal cycler. Operators of this instrument must be trained in both general laboratory safety practices and the specific safety requirements of the thermal cycler. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

All functions performed within the context of preparing, performing and completing a run should be done with caution and care, and with general respect both to the instrumentation and to associated chemicals, samples and other devices.

1.1.2 **Symbols and Conventions**

The following chart is an illustrated glossary of the symbols that are used in this manual.

⚠	**CAUTION** This symbol indicates a potential risk and alerts you to proceed with caution
⚡	**CAUTION** This symbol indicates the presence of high voltage and warns the user to proceed with caution
♨	**CAUTION** This symbol indicates risks associated with hot surfaces

1.1.3 **Potential Safety Hazards**

1.1.3.1 ELECTRICAL

Standard electrical safety precautions should be applied.

- Ensure that the proper voltage is supplied before turning the instrument on for the first time.

- The device must be connected to a grounded socket.

- Do not touch any switches or outlets with wet hands.

- Switch the instrument off before disconnecting the AC power cord.

- Unplug the instrument prior to cleaning up any major liquid spills and prior to servicing any of the electrical or internal components.

Only qualified personnel should perform electrical servicing.

1.1.3.2 EXPLOSIVE SUBSTANCES

Explosive, flammable and reactive substances should never be cycled or incubated in any thermal cycler.

Do not operate the thermal cycler in a hazardous or potentially explosive environment.

You must observe the relevant safety regulations when handling pathogenic material, radioactive substances or other substances hazardous to health.

1.1.3.3 FLUIDS

Reaction vessels should be filled outside the cycler so that no fluids penetrate the instrument.

Do not submerge the instrument in any liquid.

1.1.3.4 DANGER OF BURNS

Thermal block, inner side of heated lid and reaction vessels quickly attain temperatures of greater than 50°C. **Do not touch – Risk of Burns!** Keep the heated lid closed until temperatures of 30°C or lower are reached.

Do not use any materials (plates, sealings, foils, mats), which are not sufficiently temperature-stable (up to 120 °C).

1.1.3.5 OPERATING ENVIRONMENT

Please ensure that the ventilation slots of the device remain free to vent at all times. A space of at least 10cm should be left around the thermal cycler

The ambient temperature should be between 10°C and 30°C, the humidity between 0% and 95%.

> **WARNING**
>
> **G-Storm service engineers must carry out all repair work**
>
> **Only original G-Storm replacement parts must be used.**
>
> **Disconnect the instrument from the mains supply before opening.**

2 Installation

2.1 Requirements

The following steps must be followed for optimal and safe operation of the thermal cycler:

2.1.1 **Site**

- The thermal cycler should be placed on a rigid, flat, clean surface. Make sure that the instrument is completely stable.

- Adequate ventilation is important. Make sure there is sufficient space so that the rear and side air slots are not covered and to allow cooling air to circulate freely around the instrument.

- There should be no paper under the device as this may block the ventilation path. The unit should always have at least **10cm** distance to the next wall or neighbouring instrument.

- G-Storm thermal cycler instruments were developed for operation in laboratories in which there is normal ambient temperature and no explosive atmosphere. The ambient temperature should be between 10°C and 30°C the humidity between 0% and 95%.

2.1.2 **Electrical**

- The thermal cycler must be connected to a grounded socket.

2.1.3 **Thermal Block**

- Reaction vessels should be filled outside the thermal block so that no fluids penetrate the instrument.

- To prevent damage to the block and the heated lid make sure you use only recommended sample tubes. Unsuitable tubes can be damaged causing the escape of sample material. This may present a serious health hazard, especially when working with infectious materials.

- Ensure that the heated lid is closed when heating tubes in the block, otherwise tubes may burst due to high temperatures, causing the escape of sample material.

2.2 Unpacking the Thermal Cycler

2.2.1 **Package Contents**

The following parts are included in delivery:

	G-STORM GS4822
Thermal Cycler	**X**
Power Cable 110 or 220V	**X**
Stylus (x3)	**X**
G-Storm Thermal Cycler User Manual & PC software on CD	**X**

2.2.2 **Initial Inspection**

All parts of the instrument were thoroughly inspected and tested before the unit was shipped, therefore the instrument should be in good operating order. Carefully inspect the instrument and its accessories for any physical damage sustained in transit.

If the instrument is received in a damaged condition, please file a claim with the transport carrier immediately and contact G-Storm for advice.

2.3 Functional Overview

G-Storm thermal cyclers are automated instruments designed for carrying out methods for amplification of DNA templates.

Figure 2-1: G-Storm GS4822 thermal cycler (profile view)

The G-STORM GS4822 has two manually operated lids. The lids are sprung loaded to ensure adequate pressure is applied to the sample vessels.

The G-STORM GS4822 is operated via its own internal PC and a universal software application offering independent control of the thermal blocks.

Figure 2-2: G-Storm GS4822 thermal cycler Main Screen/Home Page

2.4 Cycler Installation

2.4.1 **Starting up the G-STORM**

Once you have set up the G-STORM as explained in section 2.1 and 2.2 you can connect it to the mains.

- Plug the AC power cord into the main power connector at the rear of the instrument and connect the other end of the cable into a grounded AC outlet.

- Press the power switch on the rear of the instrument.

- The cooling fan powers up and the thermal cycler will go through a short initialisation routine. Then, the Home Page appears providing access to the thermal cycler's navigation elements.

2.4.2 **Connecting Optional Devices**

Optional input devices such as a USB mouse can be connected to the the thermal cycler via a USB connection.

- Plug a USB cable into the USB port of the input device.
- Connect the other end of the USB cable to:
  - o the USB port on the GS4822, **OR**
  - o a USB hub, if you wish to connect several input devices to a G-STORM GS4822
- For further configuration of the device consult the manufacturer's instruction manual.

2.5 AC Power Connection

2.5.1 Operating Power Requirements

All G-Storm thermal cycler models have self-regulating power. See Instrument Specifications, Power & Dimensions for power specifications.

2.5.2 Fuses

WARNING: Disconnect the AC power cord before removing or installing a fuse to avoid the possibility of serious injury from electrical shock!

Fuse compartments are located on the rear of the instrument, above the main power connection. Check the voltage rating label to verify that the instrument is compatible with the AC voltage available at the installation site.

2.5.3 Grounding Requirements

DANGER: please read carefully!

To protect operating personnel, the National Electrical Manufacturers; Association (NEMA) recommends that the instrument be correctly grounded. The instrument is equipped with a 3 conductor AC power cord that, when connected to an appropriate AC power outlet, grounds the instrument. To preserve this protection feature, do not operate the instrument from an AC power outlet that has no ground connection.

3 Software Operation

3.1 G-STORM and GSPC Software

G-STORM thermal cyclers are operated via their own internal PC running under Windows and a universal software engine offering simple and intuitive instrument control.

The unique Program Wizard^{TM} function enables stepwise protocol definition, with no tedious calculations required. Icon-based commands make all steps quick, clear and intuitive throughout.

The programming software can be installed additionally on any laptop or desktop PC running WIN 2000 or XP. The memory stick supplied allows quick and easy data and program exchange between PC and the thermal cycler's internal PC.

3.2 Required Computer Skills

Users should have basic computing knowledge.

3.3 Main Screen

Upon power up of the system, the screen first displays a start-up routine followed by the Main Screen/Home Page.

The Home Page is the main location for entering and displaying information.
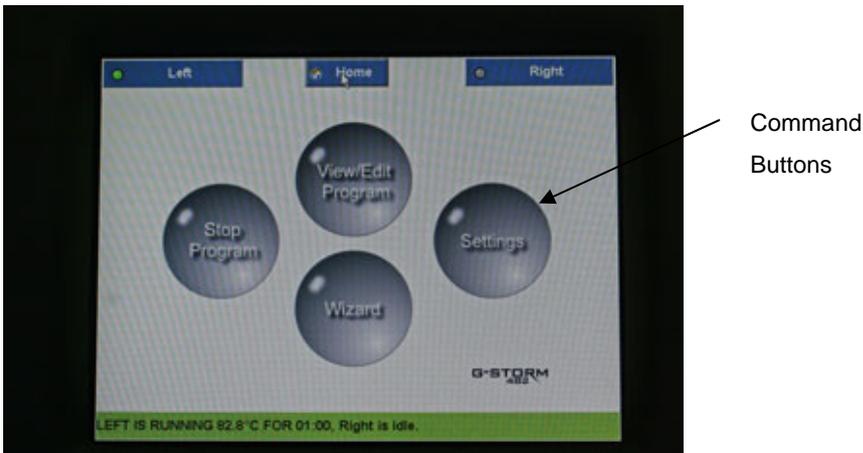

Figure 3-1: G-STORM GS4822 Main Screen with navigation elements

3.3.1 Command Buttons

The Home Page Window comprises command buttons which provide quick access to the functions that are available on the GS4822.

Start opens file list, enabling users to select a program to run.

Program opens the Program screen for writing a new program or viewing/editing an existing one.

Wizard opens the Program Wizard screen where you can generate a program by entering biological information.

Left opens the Profile/Status screen for a program which is running on the left block of the instrument. Flashes green when block is in use, yellow when paused, grey when idle and red when an error is detected.

Right opens the Profile/Status screen for a program which is running on the right block of the instrument. Flashes green when block is in use, yellow when paused, grey when idle and red when an error is detected.

Settings opens the System Settings screen where you can move files between the cycler and a USB memory stick, and view the last run report.

3.3.2 **Additional functions**
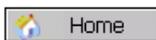
Home returns users to the main home screen

Bottom Info Bar: Provides information on current status of both thermal blocks (selected block is capitalised)

4 Programming

4.1 Creating Programs

G-STORM software offers two innovative ways of composing programs: *Standard Programming* and the *Program Wizard*.

4.1.1 **Programming**

Programming the GS4822 is easy and intuitive, creating programs step-by-step.

Programming is simply a matter of "adding" command elements from a command list into the program window. This opens a window where you can define further command-specific settings such as time, temperature, lid temperature, etc. In this way, you can create your program according to the planned programming sequence.

The command order can be changed easily by adding or deleting the selected command within the program window.

Once the program is started the cycler will process the commands from top to bottom according to the defined programming sequence.

To generate a new program, click on the Home Page. This will open the **Program** screen:
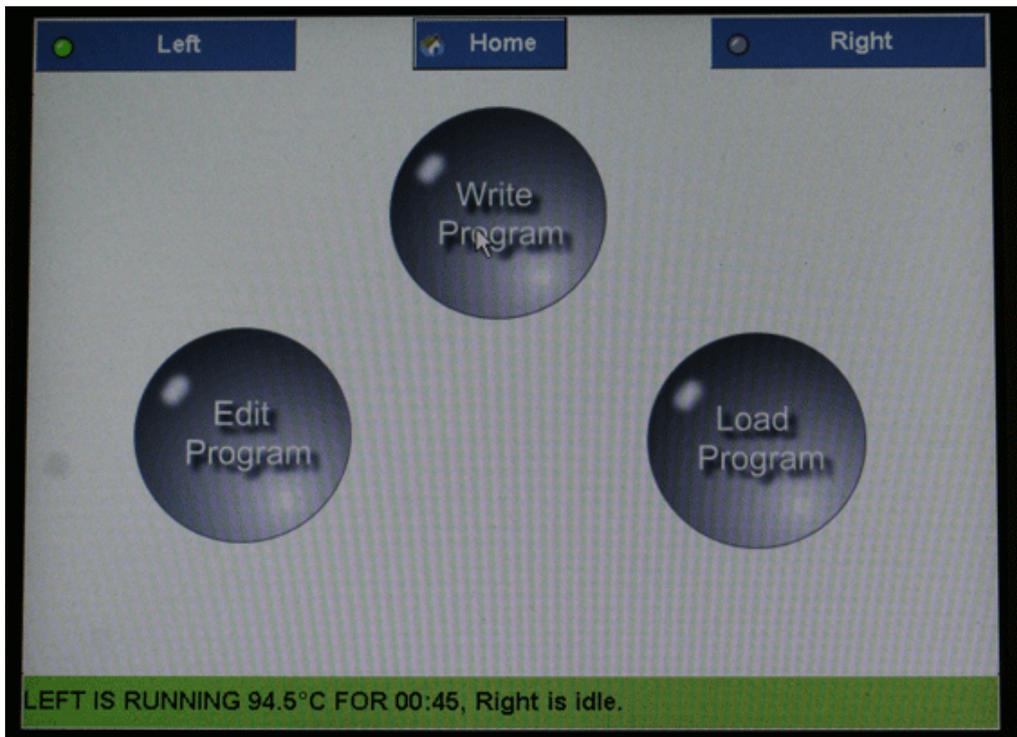
Figure 4-1: Program Screen

To write a new program click on the Program screen. This will open the **Compose a Program** screen to write your program. This screen consists of a blank area in which commands are entered to create the program. The ADD, DELETE and EDIT STEP buttons at the bottom of the screen can be used to create and then modify the program if necessary. To begin writing the program, click on 'ADD' to open the list of available commands:
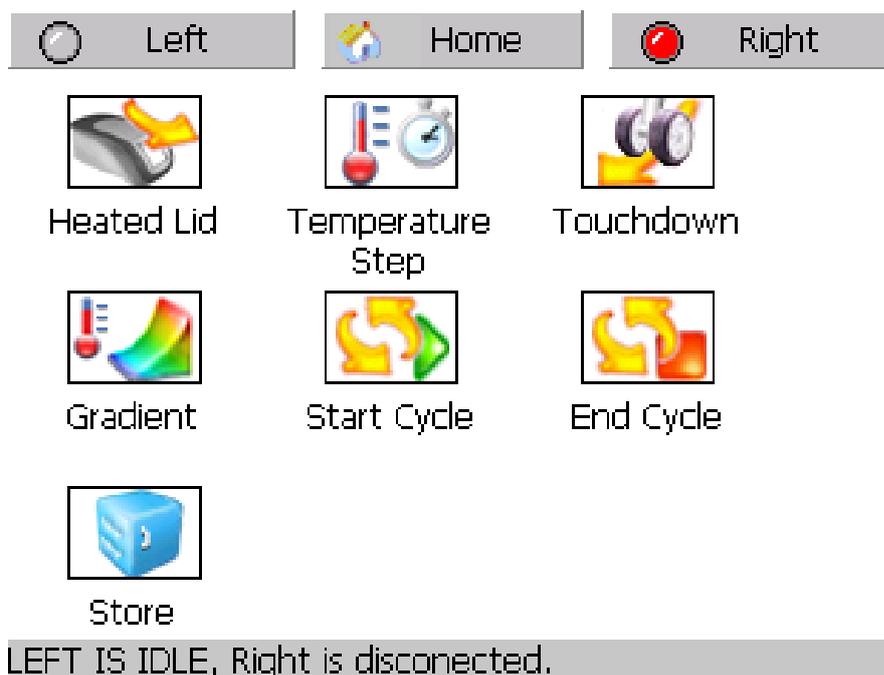
Figure 4-2: *Available Commands*

1. Select the command that you require and this will open a new window for the selected command (see 4.1.1.1).

2. Enter your settings in the relevant fields of the selected command.

3. Confirm your settings by clicking **OK**. This will return you to the **Compose a Program** window.

To add another command to your program, click on the ADD button and repeat steps 1–3 for each required command.

Commands may be edited or deleted by selecting the command and then clicking either the EDIT STEP or DELETE buttons.

Once you have finished creating your program, save it by clicking on SAVE AS**.** Enter the filename in the text box and click OK.

Name your file within Windows naming conventions

4.1.1.1 Program Steps

The following program steps are available in the Command List for creating customised programs in the Program Window:

Heated Lid

Use this command to set the required lid temperature.

Lid Temperature: The temperature may range from 80°C to 115°C. The minimum increment is 1°C.

NOTE: The heated lid automatically switches off at temperatures below 25°C.

Temperature Step

Use this command to select the required temperature (in °C) and to define the step duration.

Processing Temperature: Set the required temperature

NOTE: Temperature steps within a cycle must be 25°C or above.

Hold for: Set the required time in hours, minutes and seconds (max 59:59:59).

Temperature Ramp: Rate of change of the sample temperature. Rates can be from 0.1°C to 3°C per second. (Unit is defaulted to run at maximum ramp rate).

Temperature Increment: Temperature increment and decrement per cycle. Steps can be from 0.1 °C to 10 °C.

NOTE: For decrement use negative figures (e.g. -2)

Time Increment: Time increment per cycle in seconds.

Touchdown

Touchdown is an advanced technique used to reduce non-specific binding. With the G-Storm thermal cycler, Touchdown is provided as a one-step command for easy implementation in the programming sequence.

Denaturation Temperature: Defines denaturation temperature.

Cycles: Number of required cycles for the Touchdown section.

Maximum Annealing Temperature: Sets the maximum annealing temperature.

Minimum Annealing Temperature: Sets the minimum annealing temperature.

Hint: The temperature difference is commonly between 5°C and 10°C starting with a temperature that is 2°C above the higher Primer melting temperature. Example: if Tm Primer 1 is 60°C and Tm Primer 2 is 54°C, the resulting Touchdown will be from 62°C to 52°C.

Elongation Temperature: Sets the elongation temperature.

Duration: Duration of the temperature step in seconds.

Gradient Step

Use this command to define settings for the gradient function. The gradient spans the block from left to right. Select the required minimum temperature for the gradient from the '*Gradient Start'* box. Select the required temperature span from the '*Gradient Range'* box. Enter the duration of the gradient step.

NOTE: The maximum temperature of the gradient cannot exceed 80℃.

The calculated temperatures of each column (1-8) are shown on the left side of the screen. Gradient capability is not available in all countries.

Start Cycle

Starts a cycle.

Cycle Name: Enter the name of the cycle (optional).

Number of Cycles: Enter the required number of cycles.

End Cycle

Insert this command to terminate a cycle.

NOTE: All programs with a Start Cycle, must have an End Cycle.

Store

Cools the thermal cycler down to a temperature between 4-12°C for a specified period of time.

Store Temperature: Storage temperature in °C. The default temperature is 10°C.

Hold for: Duration of the Store step.

Infinite: Holds the specified temperature for an unlimited period of time.

4.1.2 **Program Wizard**

The Program Wizard^{TM} is a unique feature that makes it easy for first-time users to write their own protocol. The Program Wizard utilises biological data to generate a program. Enter primer and template information e.g. Primer sequence or melting temperature, template length and origin of DNA.

The Program Wizard is also an ideal tool for first shot reactions as it uses proven calculations, e.g. for the Annealing Temperature.

To generate a new program click on on the Home Page.

1. **Primer Information:** Enter either primer sequences or melting temperatures

2. **PCR Product Length:** Enter the length of your product.

3. **DNA Source Information:** Select from Bacterial, Eukaryotic or Plasmid

4. **Specials:** Select any special requirements or improvements that your program may require, e.g. type of enzyme, high AT or GC content.

5. After you have supplied all required data click on **Generate PCR**. The **Compose / Edit a program** screen window opens where you can view and edit the program steps.

To edit a program step, select the relevant command and click EDIT STEP.

4.2 General Programming Guidelines

To ensure a correct run, the following guidelines should be followed when composing a new program:

- A program must contain at least one *Temperature Step*.

- Cycles cannot be nested. A started cycle must have an *End Cycle* command before starting the next *Start Cycle* command.

The following commands or command combinations are considered "stages":

- A string of up to ten single Temperature steps
- Single Gradient steps
- A complete cycle including Temperature or Gradient steps within a start cycle / end cycle pair.
- A Touchdown command
- A Store command

When using these stages in a script, the following rules apply:

- The maximum number of stages within a script must not exceed 10.

- The maximum number of Temperature and Gradient commands inside a cycle must not exceed 10.

- The maximum number of cycles within a stage is 99.

4.3   Saving Programs

To save a program script, click on **Save As** in the **Compose a Program** window. Enter a program name and click **OK** to save the file.

4.4 Editing Programs
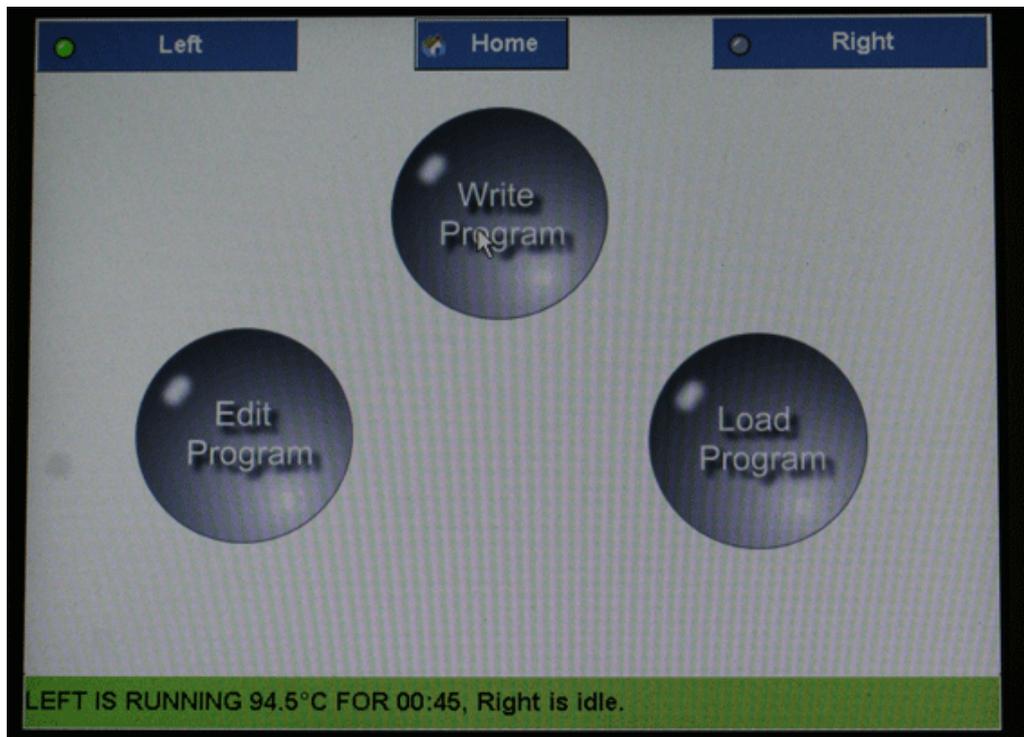
4.4.1 Editing Program Parameters

Figure 4-3. Program Page

You can edit the parameters of existing programs and store the program with the same name or rename the edited program.

To edit the last program opened on the cycler, click

- *Opening the file automatically loads the program and the program steps are displayed in the Program Window of the **Compose a Program** screen.*

- Select the command you wish to edit and click EDIT STEP. This will open the window of the respective command.

- Edit the parameters as needed.

- Click **OK** to save your changes and to return to the **Compose a Program** screen.

- After you have modified all data, click **Save As** in the **Compose / Edit a Program** screen.

- If you wish to store your changes in the existing program, click **Save**.

- If you wish to rename the program, enter the new filename in the text box and click OK.

-

To edit an existing program, click on the Program Page.

Select the program you wish to edit, click OPEN and follow the above steps.

4.4.2 Deleting a Program Step

To remove a program step from the program, select the step, then press DELETE.

Save the program as described above.

4.4.3 Adding a Program Step

To add a program step, select the step below the position where the new step is to be inserted. Click ADD and select the appropriate command.

Save the program as described above.

4.5 Deleting Programs

To delete an existing program, click on the Program Page.

Select the program you wish to remove.

Click **Delete**. This will remove the program from the script folder.

5 Run / Operation

5.1 Opening and Closing the Lid

The lid can be opened and closed manually at any stage.

5.2 Loading the Cycler

WARNING:

⚠️ **Danger of Burns! The thermal block, test tubes and plates may reach temperatures as high as 100°C! Before loading or unloading the cycler, keep hands away until temperature reaches 30°C or less**

5.2.1 Loading Tubes

G-STORM thermal cyclers can be loaded with up to 48 tubes (0.2 ml) per block

5.3 Setting the Lid Pressure

Close the lid and the spring mechanism will ensure contact is made between the heated lid and tubes.

5.4 Program Execution

5.4.1 **Starting a Run**

To start a run, click   on the Home Page.

The Program list screen will open. Select the program you wish to run and click **Run.** Select the block, or blocks, that you wish the program to be executed (left, right or both). If a program is already running on one or both blocks, these will be greyed out and only an idle block will be offered as available. Click **Start**.

Enter your sample volume (2 -150ul), and click **OK** to start the selected program.

5.4.2 **Viewing Current Program Step Information**

After a run has started, information is displayed on the screen providing the following details:

- Step Info – Target temperature and duration of current step.
- Selected Cycler – Left or Right block. Click on LEFT or RIGHT buttons to view information for each block.
- Program Name
- Elapsed Time – also shows current cycle number e.g. Cycle 1 of 30.
- Time Remaining
- Lid Temp – Actual & Target temperatures.

A graphical representation of the run is displayed by clicking VIEW TRACE. It is also possible to click PAUSE to hold the cycler at the current step (click RESUME to continue the run).

During a run, it is possible to return to the Home Page by clicking on the **Home** button.

5.4.3 Terminating a Run

To stop a program manually before it completes, click on the LEFT or RIGHT buttons on the Home Page to select which block to stop. Click the **Stop** button on the Run Info screen followed by YES at the prompt.

5.4.4 Last Run Report

Figure 5-1: Settings Screen

To view the Last Run Report click **Settings** on the Home Page, followed by

5.5 Switching Off the Instrument

The unit can be switched off at any time during operation using the power button at the rear of the instrument. There is no need to exit the thermal cycler software prior to switching off the instrument. If the instrument is switched off, or there is a power failure during a run, the run will continue automatically when power is resumed.

6 USB Memory Stick Operation

6.1 Importing and Exporting Files

Using a USB memory stick you can import programs created on another G-Storm thermal cycler (or on a PC) to the GS4822, and export programs from the cycler.
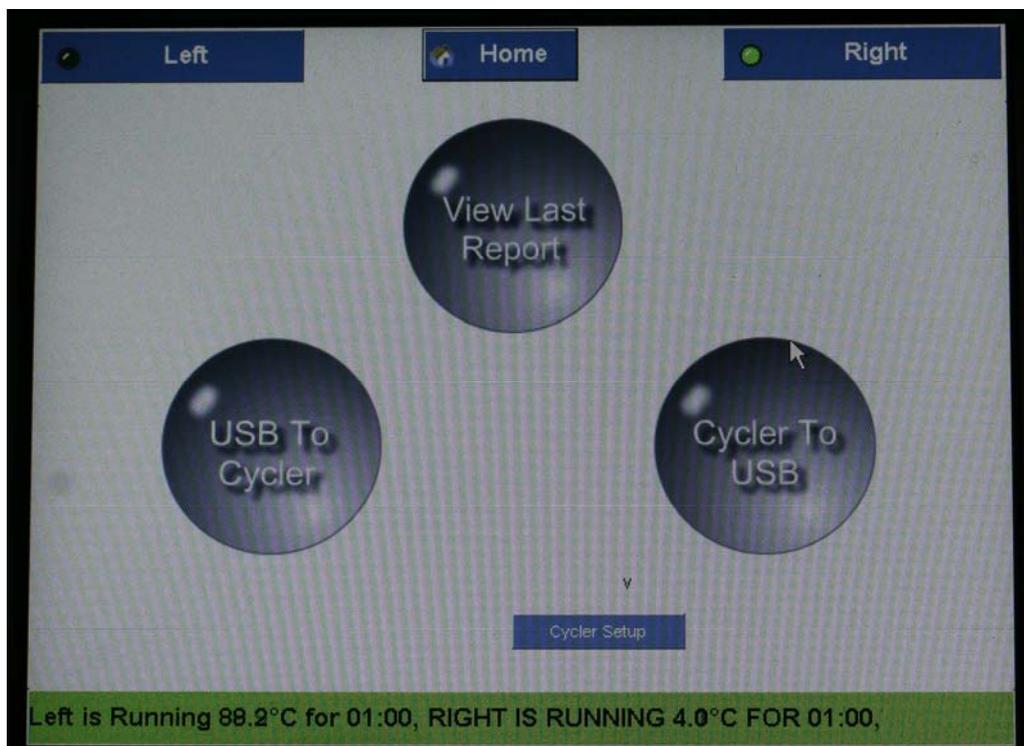
Figure 6-1: Settings Screen

6.1.1 **Exporting Program Files to a memory stick**

- Make sure the USB memory stick is inserted in the USB slot at the rear of the instrument.
- Click **Settings** on the home page
- Click **Cycler to USB**

- Select the desired program from the **Cycler** list.

- Click on the **>>** button, to direct the file to the USB stick.

- Click on the **<<** button to unselect a file.

- Once all of the desired programs have been selected, click on **Copy** to transfer the files to the USB stick.

- There is also the option to transfer files to the USB stick without retaining a copy of the file on the cycler. To do this click on **Move** instead of **Copy**.

NOTE: the lock button on the memory stick may prevent data access. Please ensure the lock button is in the unlocked position.

6.1.2 **Importing Program Files from a memory stick to the GS4822**

- Make sure the USB memory stick is inserted in the USB slot on the rear of the instrument.

- Click **Settings** on the home page

- Click **USB to Cycler**

- Select the desired program from the **USB Memory Stick** list.

- Click on the **>>** button, to direct the file to the cycler.

- Click on the **<<** button to unselect a file.

- Once all of the desired programs have been selected, click on **Copy** to transfer the files to the cycler.

- There is also the option to transfer files to the cycler without retaining a copy of the file on the USB stick. To do this click on **Move** instead of **Copy**.

7 Maintenance

7.1 Cleaning

G-Storm thermal cyclers are designed to require a minimum amount of maintenance by the user. They can be cleaned using water or a mild laboratory-cleaning agent.

The instrument should not come into contact with organic solvents or aggressive solutions. Ensure that no liquid enters the thermal cycler. For safety reasons, the device must be switched off and disconnected from the power supply prior to cleaning.

The electrical safety fuses are located above the main power switch and the main power plug at the rear of the device. Before the fuses are replaced, the device must be switched off and disconnected from the mains supply. Only fuses with the correct voltage values may be used.

Only qualified service personnel should perform servicing of the thermal cycler.

No warranty obligation is assumed by G-Storm in the event of damage caused by unauthorised servicing.

8 Trouble-Shooting

8.1 If a Power Failure Occurs

All G-Storm thermal cyclers are equipped with an auto power fail restart function that allows for power failures and safe continuation of a run after resumption of power.

The autopower fail restart function restarts the script from the beginning of the temperature step in which it failed.

The following table lists the three power failure scenarios and the actions the instrument takes if the power is interrupted during operation.

Observation	Explanation / Remedy / Actions
The computer fails but the thermal cycler unit still has power	In this case the thermal engine will continue to execute the script without any interruption.
The thermal cycler fails but the computer still has power	The execution of the script will be affected and will halt whilst the power is off. Once the power resumes, restart the unit and the script will resume from the beginning of the step it was executing when the power failed.
Both the computer and the thermal cycler unit lose power	The execution of the script will be affected and will halt whilst the power is off. Once the power resumes the script will resume from the beginning of the step it was executing when the power failed. **Corrective action:** Restart the application and the connection will be restored.

8.2 Troubleshooting Information

Refer to the following table for a description of potential problems and recommended actions that you should take.

Observation	Explanation / Remedy / Actions
No actual temperature displayed	Reboot the machine.
Poor experimental yield	If transferring protocol from a different make of thermal cycler, use TAS* system to determine new protocol parameters.
Program does not start	Reboot the machine.
Condensation in tubes during a run	Condensation will appear naturally at the end of a run and has no deleterious effects. Simply spin or flick the liquid back to the bottom of the tube and continue with the post reaction steps. However, condensation during a run will result in sub-optimal cycling. If this is experienced try increasing the lid temperature.
USB devices including memory stock and barcode scanner not recognized	Reboot machine.
Machine does not power up and power light is not illuminated	Check power is on at supply. Check fuses at rear of instrument above power inlet.
Blank Display lit but showing no information	Reboot machine. If the problem persists there is an internal connection problem: call Technical Support.

*The Temperature Acquisition System (TAS) can be purchased separately from G-Storm.

Appendix

Instrument Specifications

Thermal Blocks

Block Materials	2 x 48 well Modular anodised aluminium blocks with 4 Peltier Heat Pumps and 2 sensors per block
Traceability	NIST traceable temperature calibration

Heated Lid

Lid Temperature	112°C
Ambient temperature	10°C to 30°C
Relative Humidity	0% to 95%

User Interfaces

Screen Type	6.4-inch TFT colour touch-screen, stylus supplied.
System Input	Touchscreen & mouse (USB) (Optional)
Temperature Display	Real-time graphical display of actual block temperatures
Communication Interfaces	1x USB rear (personal memory stick, mouse, USB hub)

File Management

Program Storage	Circa 1000 Programs on board

Validation

Validation	Internal auto validation prior to each program start
	Thermal engine validation function

Thermal Engine Characteristics

Temperature Control	4°C - 99°C with simulated volume dependent control algorithm
Sample Volume Range	2-150µl
Sample Accuracy	+/- 0.4°C (20-99°C), +/- 1°C (4-20°C)
Sample Homogeneity	+/- 0.4°C
Ramp Rate	Up to 3°C per second
Sample Overshoot	< 1°C

Gradient Temperature Range	30°C - 80°C
Maximum/minimum Gradient Span	30°C / 10°C

Power & Dimensions

Electronic Power Supply	100V to 240V (frequency 48 to 62Hz)
Dimensions (LxWxH)	291mm x 246mm x 311mm
Weight	14kg approx
Operating conditions	10°C - 30°C, 0 - 95% relative humidity
Regulatory	CE, UL, CSA compliant
Warranty	2 years on all systems

Order Information

Cat. No.	Product Description
Thermal Cycler	
GS004822	G-STORM GS4822 Thermal Cycler

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Index