



**G-STORM**

**GS4M**

# **Instruction Manual**

G-Storm - 2011

## Release Information

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# 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 cyclers. 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.

	<b>CAUTION</b> This symbol indicates a potential risk and alerts you to proceed with caution
	<b>CAUTION</b> This symbol indicates the presence of high voltage and warns the user to proceed with caution
	<b>CAUTION</b> 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 PINCHING HAZARD

The closing lids present a potential pinching hazard. Do not place hands or fingers over the cyclers when the lids are being closed.

### 1.1.3.4 FLUIDS

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

Do not submerge the instrument in any liquid.

### 1.1.3.5 DANGER OF BURNS



The thermal blocks, inner side of heated lids 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).

### 1.1.3.6 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 trained 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 Blocks

- Reaction vessels should be filled outside the thermal blocks so that no fluids penetrate the instrument.
- To prevent damage to the blocks and the heated lids 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.
- Make sure plates are positioned correctly in the blocks to prevent damage to the blocks and the lids.
- Ensure that the heated lid is closed when heating tubes in a block, otherwise tubes may burst due to high temperatures, causing the escape of sample material.
- The closing lid presents a potential pinching hazard. Do not place hands or fingers over the cyclers when the lids close otherwise hands or fingers may be caught between the lid and housing.

## 2.2 Unpacking the Thermal Cycler

### 2.2.1 Package Contents

The following parts are included in delivery:

	<b>G-STORM GS4M</b>
Thermal Cycler	<b>X</b>
Power Cable 110 or 220V	<b>X</b>
Stylus (x3)	<b>X</b>
G-Storm Thermal Cycler User Manual on CD or a USB Stick	<b>X</b>

### 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.

### 2.2.3 Thermal Blocks

The thermal blocks are shipped in separate packaging from the unit. They should be removed from their packaging and located into position in the server or satellite unit. Ensure that you push down the front and the rear of the block so that the block is fully engaged in its correct position.

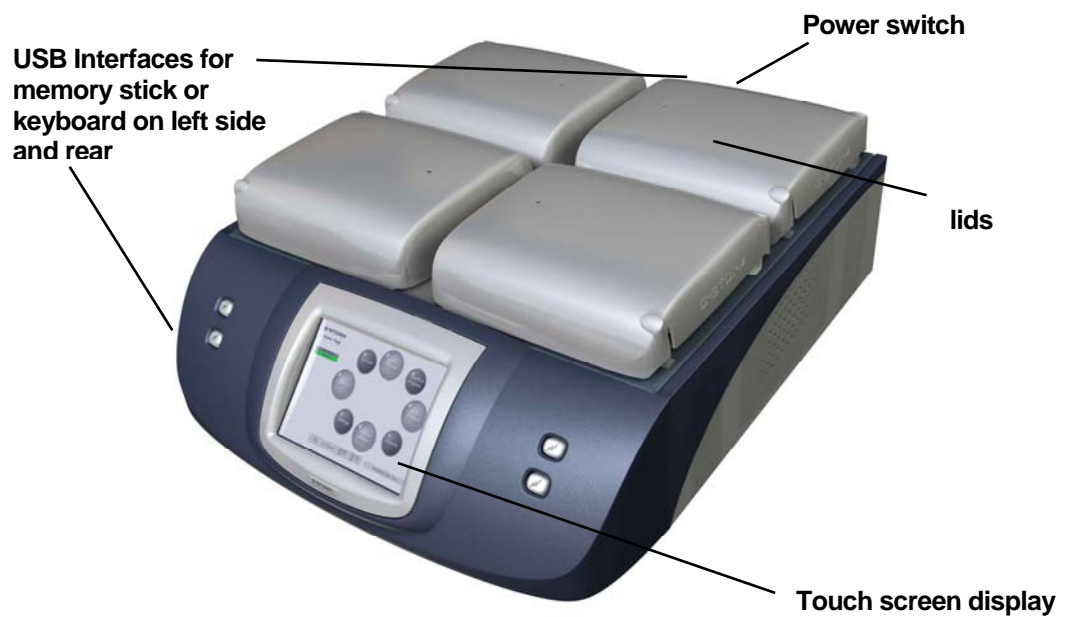


*Figure 2-1: GS4M thermal cycler - thermal block installation*



## 2.3 Functional Overview

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



*Figure 2-2: GS4M thermal cycler (profile view)*

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

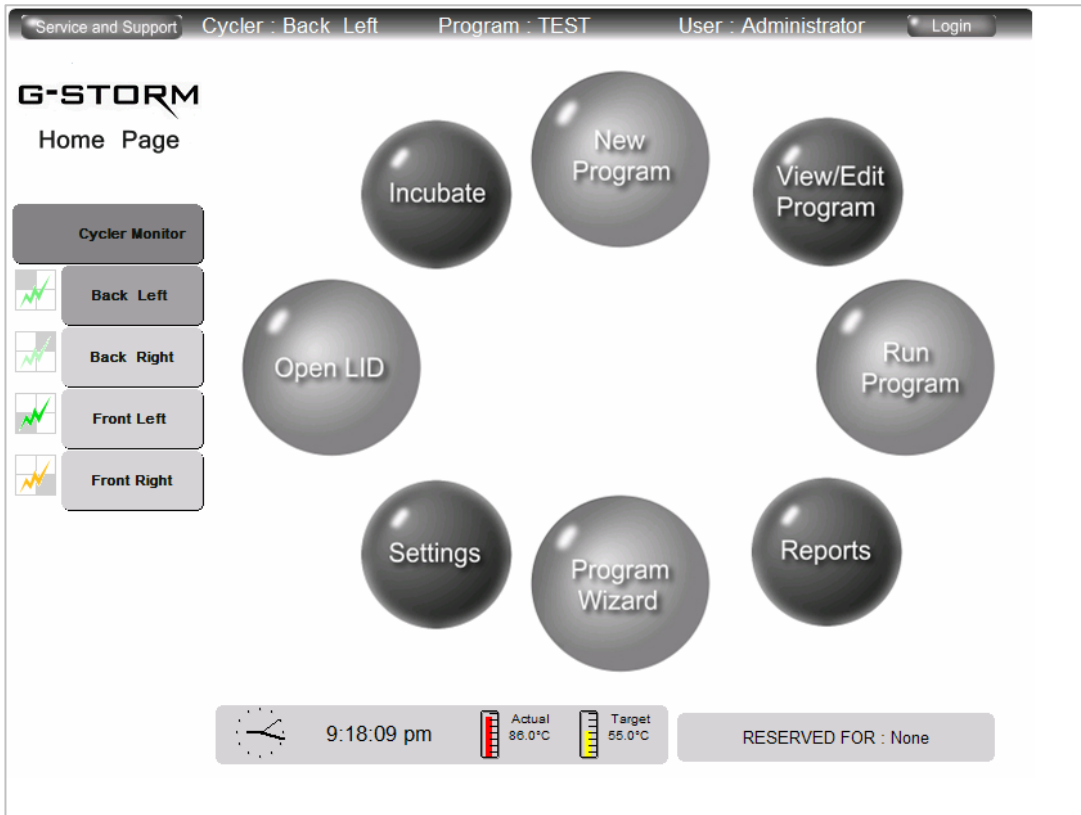


Figure 2-3: GS4M thermal cycler Main Screen/Home Page

## 2.4 Cyclers 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 side 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 Logging in as Administrator

Only the Administrator is authorised to change cycler settings and run the cycler validation tests:

1. Click on the **Login** button on the Home Page.
2. Select *Administrator* from the **Username** drop-down list and enter the administrator password. The default administrator password is **admin**.
3. Click **Login**.
4. You are now logged in as Administrator (visible in the top status bar).

**IMPORTANT: It is recommended that the factory-set login password be changed to prevent unauthorised access to the instrument (see section 3.4.2.3)**

### 2.4.3 Cyclor Validation Tests

Ensure a plate is in the block for this test:

1. Click **Settings** button
2. Click **Browse** cyclor management
3. Click **Cyclor Tests**
4. Highlight all cyclors in the top panel and click **Engine Test**.  
When completed, click **OK**

Cyclor Test procedures include specific instrument tests to ensure correct installation and operation of the thermal cyclor.

After the tests have been completed successfully, the instrument is installed, operational and ready for use.

### 2.4.4 Connecting Optional Devices

Optional input devices such as keyboard, mouse and barcode reader can be connected to the thermal cyclor systems via a USB connection.

- Plug the USB stick into the USB port of the input device.
- Connect the other end of the USB to:
  - One of the USB ports of the GS4M (port at rear of instrument is recommended), **OR**
  - a USB hub, if you wish to connect several input devices to a GS4
- When connecting several devices plug the cable connector of the USB hub into the rear USB port of the GS4M.
- 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™ function enables stepwise protocol definition, with no tedious calculations required. Drag-and-drop icon-based commands make all steps quick, clear and intuitive throughout. Optimised conditions from gradient protocols are converted to standard protocols with only a single point and click.

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 including using the mouse, selecting items, and drag and drop.

### 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.

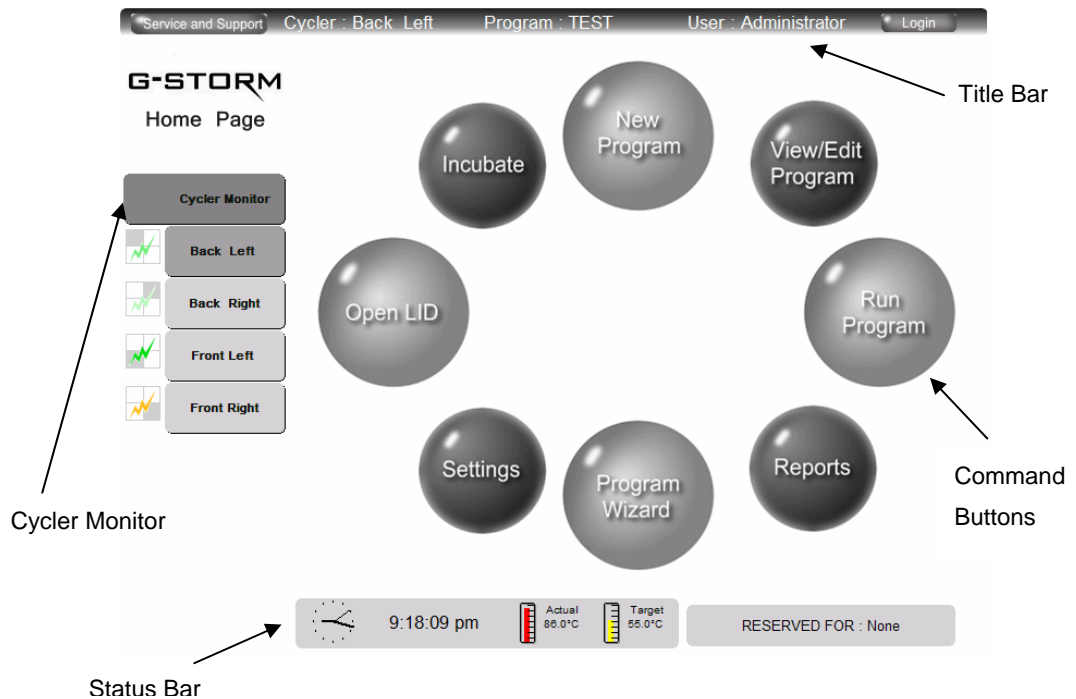


Figure 3-1: GS4M Main Screen with navigation elements

#### 3.3.1 Title Bar

The Title Bar displays general information:

**Service and Support** Displays contact details for service and application support

**Cycler:** Displays the currently selected cycler

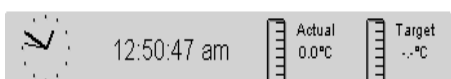
**Program:** Displays the currently loaded program of the selected cycler

**User:** Displays the current user

**Login** Displays the User Login screen

### 3.3.2 Status Bar

The Status bar displays the following information:



Displays information on the current time and temperature and defined target temperature of a program step.



Opens the Reservation screen where you can reserve the thermal cycler for the next run. Upon successful reservation, the name of the subsequent user is displayed in the status bar.

### 3.3.3 Command Buttons

The Home Page Window comprises command buttons which provide quick access to the functions that are available on the GS4M.



**Run Program** opens file list, enabling users to select program to run



**New Program** opens the Compose/Edit a Program screen



**View / Edit Program** opens the file list to browse programs



**Incubate** opens the Incubate Temperature screen



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





**Reports** opens the report browser where you can search for stored reports



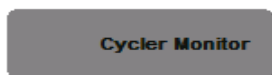
**Settings** opens the System Settings screen where you can view & edit cycler settings, manage users and run cycler tests

### 3.3.4 Additional functions

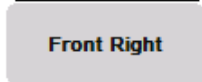
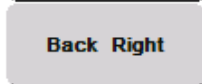
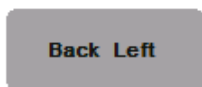


**Home Page**

This logo serves as a Home button. Clicking on it from any screen returns user to the Home Page.



Displays status information of all cyclers, and allows user to control multiple cyclers simultaneously.



The cycler buttons should also be used to select a cycler prior to running a program. Double-clicking these buttons displays the Status screen for each cycler. If a program is running the Run Profile is displayed.



Provides the operational status of each cycler (flashes green when the instrument is running)

## 3.4 System Settings

Specific system settings can be defined by clicking on the **Settings** button on the Home Page screen (when logged in as an Administrator). Use the **Settings** menu to add new thermal cycler devices or edit existing units, set time and date, run cycler tests, or manage user accounts.

### 3.4.1 Cycler Management

Browsing this option allows an Administrator to edit cycler settings and perform cycler validation tests.

### 3.4.2 User Management

Browsing this option allows an Administrator to manage cycler users.

#### 3.4.2.1 User Levels

Three different user levels are available:

- Administrator
- Registered User
- Guest User

Each level has specific user rights. Only administrators are authorized to set up new users and to change and/or assign user rights and passwords.

By default, the thermal cycler starts with Guest user rights.

User Rights	Functions allowed
Guest User	<ul style="list-style-type: none"><li>• Access rights to the Guest folder</li><li>• Creating, copying, editing and executing programs stored in the Guest folder</li></ul>
Registered User	<ul style="list-style-type: none"><li>• Access rights to the Guest and personal user folders</li></ul>

	<ul style="list-style-type: none"> <li>• Creating, copying, editing and executing programs stored in the Guest and personal folders</li> <li>• Access to GLP reports <b>denied</b></li> </ul>
Administrator	<ul style="list-style-type: none"> <li>• Access rights to all Guest and user folders</li> <li>• Setup and maintenance of users</li> <li>• Setup and maintenance of cyclers</li> <li>• Archiving/maintenance of all reports</li> </ul>

### 3.4.2.2 New Users

Only the administrator is authorised to set up new users and to change or assign user rights and passwords.

As a first-time user you will be logged in as "Guest" user visible in the top status bar. Guest users usually have only restricted user rights and work from the unprotected Guest folder, which can be accessed by all users.

Before you can operate the thermal cycler as a regular user, your administrator has to set you up as a new user. Once you are a registered user, you have a personal, encrypted file folder where you can administer your own program files.

### 3.4.2.3 Adding or Modifying User Accounts

---

**NOTE: Only the administrator can set up new users or modify existing user accounts.**

---

To add a new user, click **New User** to open the **Add a new User** screen.

Assign a user name and password.

Select the required user level (Guest, User, Administrator) from the drop-down list.

Now you can define the user's script reading and writing privileges by checking the appropriate boxes:

- |                           |   |
|---------------------------|---|
| <b>Edit/Rename Script</b> | The user has the right to edit or rename a program file |
| <b>Delete Script</b>      | The user has the right to delete program files          |
| <b>Create Script</b>      | The user has the right to create program files          |

Once you have entered all data, click on **Create User** to save the settings. After successful setup, a confirmation message will be displayed and the new user name will be added in the **User Management** list.

To modify an existing user, highlight the user name and click **Edit User** to open the **Edit a User** screen.

Here you can modify user data such as name, user level, password, user privileges and script directory protection.

Click **OK** to save the changes.

A confirmation message will be displayed after successful update of the user data.

#### 3.4.2.4 Deleting User Accounts

---

**NOTE: Only the administrator can delete User accounts.**

---

The **User Management** screen lists the available user names and corresponding user levels.

Select the user name you wish to remove.

Click on **Remove User** to remove the user name from the user list. It removes all user permissions that the user has and does not allow that user to access any the thermal cycler device. It also deletes all scripts and GLP reports associated with that user.

---

**NOTE: The Remove User command also deletes all scripts and GLP reports associated with that user. The Administrator user account cannot be deleted.**

---

#### 3.4.3 Cyclers Settings

Browsing this option allows an Administrator to edit date and time settings and select the language for the instrument. The Power Resume On/Off option determines whether a program should continue or not after a power failure.

## 4 Programming

### 4.1 Creating Programs

G-STORM and GSPC software offers two innovative ways of composing programs: *Drop-and-Drag Programming* (DND Programming) and the *Program Wizard*.

#### 4.1.1 DND Programming


Drag-and-Drop programming (DND programming) is an easy and intuitive method for conveniently creating programs step-by-step.

The basic idea of DND programming is that you simply choose the required command from a command list, drag it with the mouse into the program window on the left and drop it into the desired program position. This opens a window where you can define further command-specific settings such as time, temperature, lid pressure, etc. In this way you can create your program command by command according to the planned programming sequence.

The command order can be changed easily any time just by dragging the selected command to the desired position within the program window.

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



To generate a new program using DND, click  on the Home Page. This will open the **Compose / Edit a Program** screen with its drag-and-drop functions:

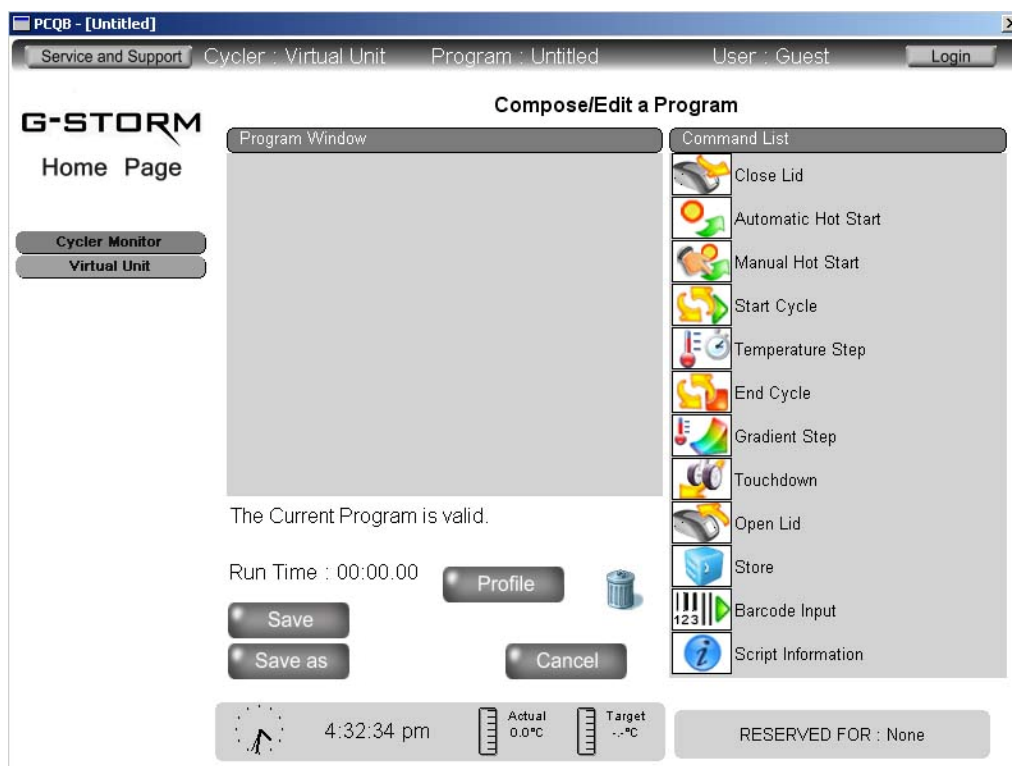


Figure 4-1: Compose / Edit a program screen

The *Compose / Edit a Program* screen consists of the *Command List*, which contains all available program steps, and the *Program Window* where you can create or edit programs.

1. Select a command from the *Command List*, then drag and drop it into the *Program Window*. This will open a new window for the selected command.
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 / Edit a program** window.

To add another command to your program, repeat steps 1–3 for each required command.

Once you have finished creating your program, save it by clicking on **Save As** and you will be prompted for a file name.

Name your file within Windows naming conventions.

Click on **Profile**, if you wish to view a graphical representation of the defined temperature profile.

### 4.1.1.1 Program Steps

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



#### Barcode Input

Use this command to define barcode settings. When composing the program, it is recommended to place the barcode command at the beginning. During program run you will be asked to read the plate's barcode. You may do this with a handheld USB barcode scanner or by manually entering the barcode. If you use the barcode scanner, the barcode cannot be edited after reading.

The program will continue after you have placed the plate into the cyclor and pressed *OK*. The barcode will be recorded in the GLP and LabBook report and displayed in the *Info* section of the Cyclor screen.

*Scan Using Barcode Entry:* Barcode reading using the barcode scanner

*Scan Using Keyboard Entry:* Manual entry of the barcode via keyboard

*Path for worklist:* Specifies the path for the worklist.

*Lid Temperature:* This defines the temperature of the heated lid. The temperature may range from 112°C to 120°C. The minimum increment is 1°C.

*Lid is ON:* Select this option to activate lid heating. The heated lid automatically switches off at temperatures below 25°C.

NOTE:

***Heated Lid* commands cannot be used within a cycle**



### Automatic Hot Start

*Automatic Hot Start:* This step should be incorporated into a program when using a hot start polymerase. Select the denaturation temperature and time. When running the program, the next command will be executed immediately after the denaturation time is elapsed.

---

**Please also refer to the polymerase manufacturer's recommendations**

---



### Manual Hot Start

***Manual Hot Start:* this step should be incorporated into a program when using a standard polymerase. Select the denaturation temperature and time. When running the program, the instrument will notify you after the denaturation time has elapsed. You will then be asked to open the lid and add the enzyme. The instrument timer is now on hold and will continue only after you have pressed**



### 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 which are within a cycle must be 25°C or above**

---



*Hold for:* Set the required time in hours, minutes and seconds. If the 'hold at this temperature' is option is selected, the cycler will remain at the temperature until the program is resumed. This allows the user to determine when to continue to the next step.

*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.

*Step Type:* Indicates the selected step type for information purposes. The supplied step type information will then be displayed in the cycler monitor.



### **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.

*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 T<sub>m</sub> Primer 1 is 60°C and T<sub>m</sub> Primer 2 is 54°C, the resulting Touchdown will be from 62°C to 52°C.

*Elongation Temperature:* Sets the elongation temperature.

*Cycles:* Number of required cycles for the Touchdown section.

*Duration:* Duration of the temperature step in seconds.



### **Gradient Step**

Use this command to define settings for the gradient function. The gradient will span the blocks in the direction shown by the arrows below.



Enter the required minimum and maximum temperatures for the gradient and duration.

*Minimum Temperature Gradient:* Enter the minimum temperature of the gradient step. Temperature must not be below 30°C.

*Maximum Temperature Gradient:* Enter the maximum temperature of the gradient step. Temperature must not exceed 80°C.

---

**NOTE: The maximum / minimum gradient span is 30°C / 1°C.**

---

*Hold for:* Duration of the Gradient step.

*Convert Gradient Step to a standard temperature step:* The Gradient step can be converted easily to a temperature step after the annealing temperature optimisation experiment. To do so, click the checkbox and select the temperature column with the best result from your optimisation experiment.

The converted gradient step will then automatically use the temperature of this best-performing column.

**NOTE: Resulting temperature steps may be reconverted to gradient steps any time by disabling the *Conversion* option**

Gradient steps are not available in Japan, USA and Germany



### 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.



### Script Information

Use this command to record your comments about the program.

#### 4.1.2 Program Wizard

The Program Wizard™ 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 **Program Wizard** on the Home Page.

1. **Primer Information:** Enter either primer sequences or melting temperatures. Sequences can be uploaded from a .txt file on a memory stick. Click **Browse** in the Sequence Primer One/Sequence Primer Two section and browse for the required files in the **Upload Sequence from USB Memory Stick** screen window. Select the desired file and click **Open** to upload the file to the thermal cycler.
2. **Product Length:** Enter the length of your product either manually or using the slide bar
3. **DNA Source Information:** Select from Bacterial, Eukaryotic or Plasmid
4. **Specials:** Select any special requirements that your program may require, e.g. type of enzyme, high AT, GC content.
5. After you have supplied all required data click on **Generate Program**. The **Compose / Edit a program** screen window opens where you can view and edit the program steps.

To edit a program step, double-click the respective command.

To view a graphical representation of the defined temperature profile, click **Profile**.

## 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.
- Heated Lid and *Barcode Input* commands cannot be programmed inside a cycle.
- Only a single *Script Information* command is valid within a program.

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

- Automatic Hot Start
- Manual Hot Start
- 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 / Edit a Program** window. Enter a program name and click **Save** to save the file to your user directory. Users can create folders within their user directory to organise their programs. After entering the program name, click **Create Folder**, enter a folder name and click **OK**. Select '+' beside the Scripts folder to show all available folders, and click on the newly created folder. Click **Save** to save the program script to this folder. A program can also be saved to an existing folder by selecting it as described above.

## 4.4 Editing Programs

### 4.4.1 Editing Program Parameters

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

To edit an existing program:

- Click  on the Home Page

Depending on your user level (guest or registered user), the specific user directory or guest directory is displayed listing all existing program files.

Select the program you wish to edit.

- Click **Open**.  
*Opening the file automatically loads the program and the program steps are displayed in the Program Window of the **Compose / Edit a Program** screen.*
- Double-click the command you wish to edit. 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 / Edit a Program** screen.
- After you have modified all data, click **Save** in the **Compose / Edit a Program** screen, if you wish to store your changes in the existing program.
- Click **Save As**, if you wish to rename the program. You will then be prompted for a file name.

#### 4.4.2 Deleting a Program Step

To remove a program step from the program just drag it from the Program

Window and drop it into the recycle bin



icon located below the Program Window.

Save the program as described above.

#### 4.4.3 Converting a Gradient Step

A gradient step can be converted to a standard temperature step with a few mouse clicks.

- After performing the gradient experiment, have a look at the gel image and select the best-performing column.
- Double-click the Gradient Step command.
- Select the **Convert Gradient Step to a standard temperature step** checkbox.
- Select the appropriate column from the drop-down list in the Conversion section.

The thermal cycler software will now convert the gradient step into a temperature step and automatically select the right temperature in the chosen column.

---

**NOTE: If it is required to repeat the gradient experiment, the converted temperature step can be set back to a gradient command just by unchecking the Conversion option**

---

## 4.5 Deleting Programs

To delete an existing program:

- Click  on the Home Page.


Depending on your user level (guest or registered user), the specific user directory or guest directory is displayed listing all existing program files.

Select the program you wish to remove.

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

## 4.6 Incubate temperature

To run the cycler for incubations or ligations utilise the **Incubate** temperature function.

- Click  on the Home Page.
- Select the temperature that you require
- Select the time you require

OR

- Select infinity (Cycler will run until you **Stop** the program)
- Select the heated lid, if required and the pressure setting.



## 5 Run / Operation

### 5.1 User Login

#### 5.1.1 Guest Users

When powering up the instrument the default user level is Guest. If you wish to continue to operate the cyclotron with Guest user rights, no special login procedure is required. In this case you can access the unrestricted Guest folder and operate the cyclotron as described in the relevant chapters.

#### 5.1.2 Registered Users

Once the administrator has set you up as a registered user (see 3.4.2.3), you can operate the thermal cyclotron using your personal data and file folders.

To log into the system as a registered user proceed as follows:

- Click on **Login** – the **Login** screen opens.
- Select your user name from the Username drop-down list and enter your password.
- Click on the **Login** button. This will log you into the system giving you reading and writing rights as specified for your user level.
- After successful login your user name is displayed in the top status bar.

---

**NOTE: In case a user forgets his or her password, the logged-on administrator can assign him/her a new one.**

---

### 5.2 Changing Users

In order to log into the system when another user is already logged in, proceed as described in section *Registered Users* above.

## 5.3 Making an Instrument Reservation

The thermal cycler is equipped with a visual reservation function. The reservation is not blocking or restricting the instrument to any user. It only indicates that the instrument is needed for a certain user after the current run.

- Click on the RESERVED FOR field in the right corner of the bottom status bar.
- Select **Reserve next run for Current User**, if you are already logged in.
  - If you are not logged in, select **Reserve next run for User** to reserve the subsequent run.
  - Select your user name from the **Username** drop-down list and enter your password.
- Click on **Reserve** to confirm the reservation.

### 5.3.1 Cancelling a Reservation

To cancel an existing reservation, check the **Clear Reservation** button.

To quit the reservation window without saving any changes, click **Cancel**.


## 5.4 Viewing Script Temperature Profiles Prior to Run

Before starting a run, you can view the temperature profile of a new or stored program.

Click on **Profile** in the **Compose / Edit a program** screen window.

An information screen is displayed detailing all the parameters of the selected program.

## 5.5 Loading the Cycler

Press the **Open/Close button** on the front of the instrument or click  on the start screen to access the block.

### 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**

**Pinching Hazard! Do not place hands or fingers in to the cycler when the lid is being closed**

### 5.5.1 Loading Plates

Depending upon the thermal block installed, the thermal cycler can be loaded with one 96-well plate or one 384-well plate. Ensure the plates are used in conjunction with a suitable seal.

Put your plate on the block and ensure that it is correctly positioned in the provided space.

### 5.5.2 Loading Tubes


G-STORM thermal cyclers can be loaded with up to 96 tubes (0.2 ml) when using the 96-well block.

## 5.6 Program Execution

### 5.6.1 Starting a Run on a Single Cyclers

To start a run:

- Select a cyclers by clicking on the appropriate Cyclers button and

click  on the Home Page.


Your personal file folder opens or, if you are logged in as a guest, the guest folder opens displaying all available programs.

Select the program you wish to run.

Click **Run selected** on the right-hand side of the window, enter your sample volume (2-150ul), and click **OK** to start the selected program.

### 5.6.2 Starting a Run on Multiple Cyclers

Select one of the cyclers you wish to use by clicking on the appropriate Cyclers

button. Click  on the Home Page, and open the program which you wish to run. Your program is now loaded on to this cyclers. Click on the Cyclers Monitor button to bring up the Cyclers Monitor screen (Figure 5-1). The profile panes of all four cycles are displayed.

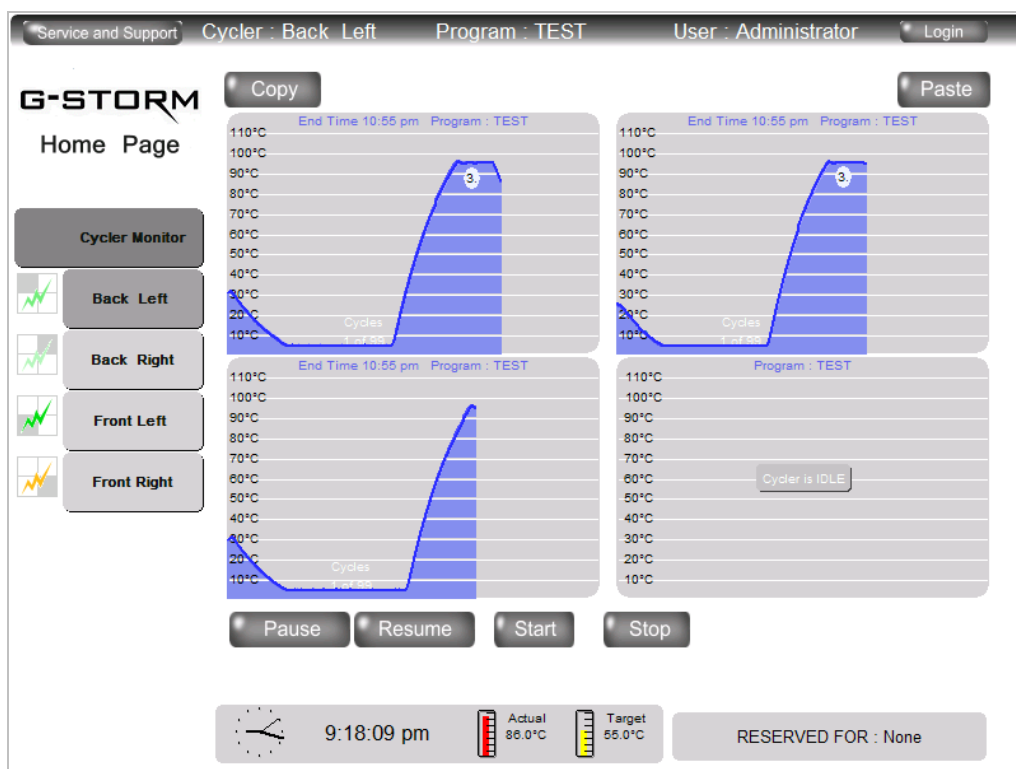


Figure 5-1: GS4M Cyclers Monitor Screen

To copy your program onto other cyclers, click on the profile pane of the cycler which has your program loaded, and click on the **Copy** button. Select the additional cyclers on which you wish to run the program by clicking on the appropriate profile panes, to highlight them and, click on the **Paste** button. Your program is now loaded on to the cyclers. Ensure that all appropriate cyclers are selected/highlighted, and click on the **Start** button. Enter your sample volume (2-150ul), and click **OK** to start the selected program.

Several cyclers can be controlled simultaneously from the Cyclers Monitor screen. Click on the profile panes to select/highlight the cyclers. The buttons below the profiles:



can be used to control all of the selected cyclers.

### 5.6.3 Viewing Current Program Step Information

After a run has started, a graphical representation of the temperature parameters is displayed on the Profile Screen. In addition, detailed program and instrument information can be viewed using the **Program** or **Info** buttons located in the right-upper corner of the information screen.

Click **Program** to display the program steps of the running protocol. The executed step is highlighted.

Click **Info** to view detailed instrument information such as lid status, remaining time and step time or GLP file name.

During a run, it is possible to return to the Home Page, and navigate the command buttons, by clicking on the **Home** button. To return to the Profile Screen, click on the relevant thermal cyclers button (below **Cycler Monitor**) on the Home Page.

You can view current program step information of all connected thermal cyclers any time during the run by clicking on the **Cycler Monitor** button.

### 5.6.4 Terminating a Run

To stop a program manually before it completes, click the **Stop** button on the Profile Screen, or on the Cycler Monitor screen.

Alternatively, use the **Stop Program** button on the Home Page (changes from **Run Program** during a run).

The manual cancel of the program will be recorded in the GLP and lab book reports

## 5.7 Reports

### 5.7.1 Viewing Reports

Depending on the assigned user level, you are allowed to view and archive reports stored in the following file folders:

User rights	File folder	Action
Guest users	Guest folder	Viewing Lab Book and GLP reports
Registered users	Guest folder & Personal file folder	Viewing Lab Book and GLP reports
Administrator	All guest and user folders	Viewing and archiving Lab Book and GLP reports

To view reports proceed as follows:

Click **Reports** in the Home Page. This will open the **Browse Generated Reports** window listing the generated reports.

Group the displayed reports by selecting one of the sorting criteria below:

**Group by Date:** Sorts records in ascending order by date.

**Group by Cyclers:** Sorts records by cycler name.

**Group by Program:** Sorts records by program name.

For viewing GLP and/or LabBook reports select one of the following options:

**Show GLP:** Displays the generated GLP records (only for users with administrator rights)

**Show LabBooks:** Displays the generated LabBooks

## 5.8 Language Selection

G-Storm thermal cyclers can be operated in English (Default) and French.

To change the default language:

- Login as an administrator
- Click **Settings** on the Home Page
- Click **Browse** on Cyclers Settings
- Select the language you require
- Click OK

The unit will then remain in the selected language.

## 5.9 Switching Off the Instrument

The unit can be switched off at any time during operation using the power button at the back of the instrument. There is no need to exit the thermal cycler software prior to switching off the instrument.



## 6 USB Memory Stick Operation

### 6.1 Importing and Exporting Files

You can import Primer sequences and programs created on a different thermal cycler or on a PC to the G-STORM thermal cycler and GSPC software, or export programs and reports that have been created using a USB memory stick.

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

- Make sure the USB memory stick is inserted in the USB slot on the side of the instrument.
- Click **View & Edit Files** to display your personal file folder. Files can only be transferred individually.
- Highlight the desired program by clicking on it once.
- Click **Archive Programs**.
- Click **View USB** to check that the file has been transferred.

---

**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 GS4M

- Make sure the USB memory stick is inserted in the USB slot on the side of the instrument.
- Click **View & Edit Files** to display your personal file folder.
- Click **View USB** to access the USB files.
- Highlight the desired program by clicking on it once.
- Click **Restore Programs**.

### 6.1.3 Uploading Primer Sequences from a memory stick

The Program Wizard™ function offers the option to upload primer sequences stored in an external memory stick.

- Click the **Program Wizard** button.
- Click **Browse** in the Sequence Primer One/Sequence Primer Two section and browse for the required files in the **Upload Sequence from USB Memory Stick** screen window.
- Select the desired file and click **Open** to upload the file to the thermal cycler.

---

**NOTE: Primer Sequence files must have \*.txt file format.**

---

## 6.2 Archiving Reports

GLP and LabBook reports cannot be deleted from the cycler. An Administrator is authorised to archive reports to a USB Stick, thus removing them from the instrument.

- Login as the Administrator
- Insert the USB memory stick in the USB slot on the side of the instrument.
- Click the **Reports** button on the Home Page
- Select the directory from which reports are to be archived. Click **Archive Reports** (this button will only be visible when a USB stick is detected)
- A message will appear once the archiving is complete. Click **OK**.

To view and print archived reports, use the PC/demonstration version of G-Storm software which can be downloaded from the Software page at [www.gstorm.co.uk/home](http://www.gstorm.co.uk/home). Insert the USB stick containing archived reports into the PC USB port. Click on the **Reports** button and select **Import Reports**. All of the reports on the USB stick will be uploaded into the

software. To view and print a report, double-click on the desired report and select **Print**.

# 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 if set to do so in the cycler settings.

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. <b>Corrective action:</b> 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 at the bottom of the application	Block not correctly inserted in the machine. Check that the block is inserted correctly and reboot the machine.
Poor experimental yield	1. Run Thermal Engine OQ test <sup>(1)</sup> to check that thermal engine operation is within specification. 2. If transferring protocol from a different make of thermal cycler, use TAS <sup>(2)</sup> system to determine new protocol parameters.
Program does not start	Block not correctly inserted in the machine. Check that the block is inserted correctly and reboot the machine.
Experiments work with tubes but not with plates or vice versa	Make sure correct lid pressure is applied.
Tubes are crushed	Applied pressure too high.
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.
Sealed microplate losing sample volume	Poor quality microplate/sealing system or inadequate pressure.
USB devices including memory stick 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.
Abnormal block heating/cooling performance	Run Thermal Engine OQ test <sup>(1)</sup> to check performance.

- (1) Please refer to the thermal cycler IQ/OQ Protocol document for instructions on performing instrument qualification tests.
- (2) The Temperature Acquisition System (TAS) can be purchased separately.

## 9 Block Exchange

Block exchange can be performed within seconds. No tools are required for this purpose.

CAUTION:



**Turn power off and interrupt power line before changing the block**



### Removing the Block

Remove the block by simply holding it with two hands on the left and right side and lift it up.



*Figure 9-1: Exchanging the block*

### Inserting the Block

Hold the block with two hands on the left and right side, with the block connector at the back of the block, and place it into position in the thermal cycler.



# Appendix

## Instrument Specifications

### Thermal Blocks

Block Materials	Modular anodised aluminium blocks with 4 sensors
Traceability	NIST traceable temperature calibration
Blocks Available	<ul style="list-style-type: none"><li>- 96 well gradient block: For 96 well plates or 96x 0.2 ml tubes</li><li>- 96 well Fast gradient block: For 96 well plates, 96 x 0.2 ml tubes</li><li>- 384 well gradient block: For 384 well plates</li><li>- 384 well Fast gradient block: For 384 well plates</li><li>- <i>In situ</i> block for 4 slides</li></ul>

### Heated Lid

Lid Temperature Range	112°C - 120°C, user selectable in 1°C increments
Lid Pressure Range	Manual lid pressure setting. Compatible with all vessels & seals
Ambient temperature	10°C to 30°C
Relative Humidity	0% to 95%

## User Interfaces

Screen Type	8.4-inch TFT colour touch-screen, stylus supplied.
System Input	Touchscreen, external keyboard (Optional) & mouse (USB) (Optional), barcode scanner (USB) (Optional)
Temperature Display	Real-time graphical display of actual & set block temperatures
Communication Interfaces	1x USB front (personal memory stick, keyboard, barcode reader, mouse, USB hub)  1x USB rear

## User & File Management

User Level Management	3 levels: Administrator, User with administrator selectable restricted rights, Guest
User File Protection	Yes, for programs and reports
File Organization	Windows® Explorer, user-defined folders & subfolders
Program Storage	Minimum 99 (internal memory or USB stick). Circa 500. Unlimited PC program storage

## Reports and Validation

Report Function	Encrypted GLP report, LabBook report
Validation	Internal auto validation prior to each program start  Thermal engine validation function

## Barcode Option

Networking	PC controlled cycler network up to 15 units via USB hubs
Barcode Option	Barcode documentation via handheld barcode scanner

## Thermal Engine Characteristics

Temperature Control	4°C - 99°C with simulated volume dependent control algorithm
Sample Volume Range	5-150µl
Sample Accuracy	+/- 0.4°C (20-99°C), +/- 1°C (4-20°C)
Sample Homogeneity	+/- 0.4°C
Heating	Up to 3°C per second
Cooling	Up to 3°C per second
Sample Overshoot	< 1°C
Gradient Temperature Range	30°C - 80°C
Maximum/minimum Gradient Span	30°C / 1°C

## Power & Dimensions

Electrical Power Supply	100V to 240V (frequency 48 to 62Hz) 1700watts Max.
Dimensions (LxWxH)	600mm x 600mm x 264mm
Weight	32kg approx
Operating conditions	10°C - 30°C, 0 - 95% relative humidity
Regulatory	CE, UL, CSA compliant
Warranty	2 years on all systems

## Compatible Barcodes

The following barcodes are compatible with G-STORM's documentation system:

- 2 of 5 interleaved
- Codabar
- Code 128
- Code 39
- Code 39 full ASCII
- Code 93 full ASCII
- EAN-13, EAN -13 with 2 supplement, EAN -13 with 5 supplement
- EAN-8, EAN -8 with 2 supplement, EAN -8 with 5 supplement
- EAN-128
- UPA, UPA -13 with 2 supplement, UPA -13 with 5 supplement
- UPE, UPE -13 with 2 supplement, UPE -13 with 5 supplement
- MSI
- C.I.P

## Compatible Plate Formats

Gene Technologies recommend using G-Storm consumables with G-Storm Thermal Cyclers.

Cat. No.	Product description
<b><i>G-Storm RIGID Plates</i></b>	
GSR0960/C GSR0961	GS RIGID 96, clear frame, clear wells GS RIGID 96, Black Frame, white wells
GSR0384/C GSR0385	GS RIGID 384, clear frame, clear wells GS RIGID 384, black frame, white wells
<b><i>G-Seals</i></b>	
GS-0500	Adhesive Clear Seal
GS-0521	Peelable Foil Heat Seal
GS-0536	Piercable Foil Heat Seal
GS-0541	Clear Heat Seal
GS-0550	Adhesive Foil Seal

The following plate formats are compatible with G-Storm thermal cyclers:

Manufacturer	Art. No. & Product Name	Type
<b>BioPlastics</b>		
	B70511 96 Well thin wall plate	96 well, non skirted
	B70661 96 Well thin wall plate	96 well, semi-skirted
	B70521 384 Well thin wall plate	384 well skirted
<b>Abgene</b>		
	AB 600	96 well, non-skirted
	AB 800	96 well, skirted
	AB 900	96 well, semi-skirted
	AB 1111	384 well
	TF-0384	384 well
<b>Bilatec</b>		
	THERMOSPRINT® 96 PP, transparent, 311296; only w/o workstation	96 well, non-skirted
	THERMOSPRINT® 384 PP, transparent, 310384	384 well
<b>NUNC</b>		
	Art. No.: 240600, 96 well, non-skirted.	96
	Art. No.: 230013, 96 well, semi-skirted	96
	Art. No.: 230012, 96 well, skirted	96
	Art. No.: 230584, 384 well	384
<b>Eppendorf</b>		
	Art. No.: 0030 128.648, twin tec plate, 96 skirted	
	Art. No.: 0030 128.575, twin tec plate, 96 semi-skirted	
	Art. No.: 0030 128.508, twin tec plate, 384	
<b>Corning</b>		
	Thermowell®96 Well Polypropylene Microplate, Natural (#6551)	
	Thermowell™ 96 Well Polycarbonate Microplate, Model M (#6511)	
	Corning® 384 Well Polypropylene Microplate (#6500)	
	Corning® 384 Well Polyethylene Microplate (#6502)	

## Order Information

Part #	Description
<b>Thermal Cyclers</b>	
GS00004M	G-STORM GS4 with Manual Lids
<b>Thermal Blocks</b>	
GSB00096	96 well block
GSFAST96	96 well Fast block
GSB00384	384 well block
GSFAST384	384 well Fast block
GS00SITU	<i>In situ</i> block

## **Sales & Service**

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