

Spartan **DX-12**TM

Desktop DNA Analyzer

Quick Reference Guide

Version 3.02

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Research Use Only

This instrument is for research use only and is not intended for clinical or diagnostic applications.

PCR and real-time PCR processes are covered by patents issued and applicable in certain countries. Spartan does not encourage or support the unauthorized or unlicensed use of PCR or real-time PCR processes. Use of this instrument is recommended for persons that either have licenses to perform PCR and real-time PCR or are not required to obtain licenses.

Patents Pending

The Spartan DX-12™ is protected by patents pending in multiple geographic areas.

Trademarks

Spartan DX-12™ is a registered trademark of Spartan Bioscience Inc. All other trademarks are the sole property of their respective owners.

01/2009

Table of Contents

Table of Contents	iii
General Information	1
Intended Use	1
Contact Information	1
Warranty	1
Box Content	2
Instrument Installation	3
Unpacking	3
Instrument Contents	3
Operating Requirements	3
Installation	3
Spartan Graphing & Analysis Software Installation	4
System Requirements	4
Hardware	4
OS and Software	4
Support	4
About Spartan Graphing & Analysis Software	4
Importing Data	6
Saving Data	7
Opening an .sdx File	7
Operating Instructions	8
End-point/Real Time and Melt Curve Operational Modes	8
Reaction Set-up	8
Designing a Program	8
Run Program	9
Reverse Transcription	11
Thermal Cycling	11
Melt Curve	11
Data Analysis	12
Thermal Cycling	12
Melt Curve	13
Optional Settings	13

General Information

Intended Use

The Spartan DX-12™ is designed to analyze purified nucleic acids using nucleic acid amplification techniques such as Polymerase Chain Reaction (PCR).

The Spartan DX-12™ is for research use only and is not intended for clinical or diagnostic applications.

Contact Information

The Spartan DX-12™ was developed and is manufactured by:

Spartan Bioscience Inc.
203-15 Grenfell Crescent
Ottawa, ON K2G 0G3
www.spartanbio.com

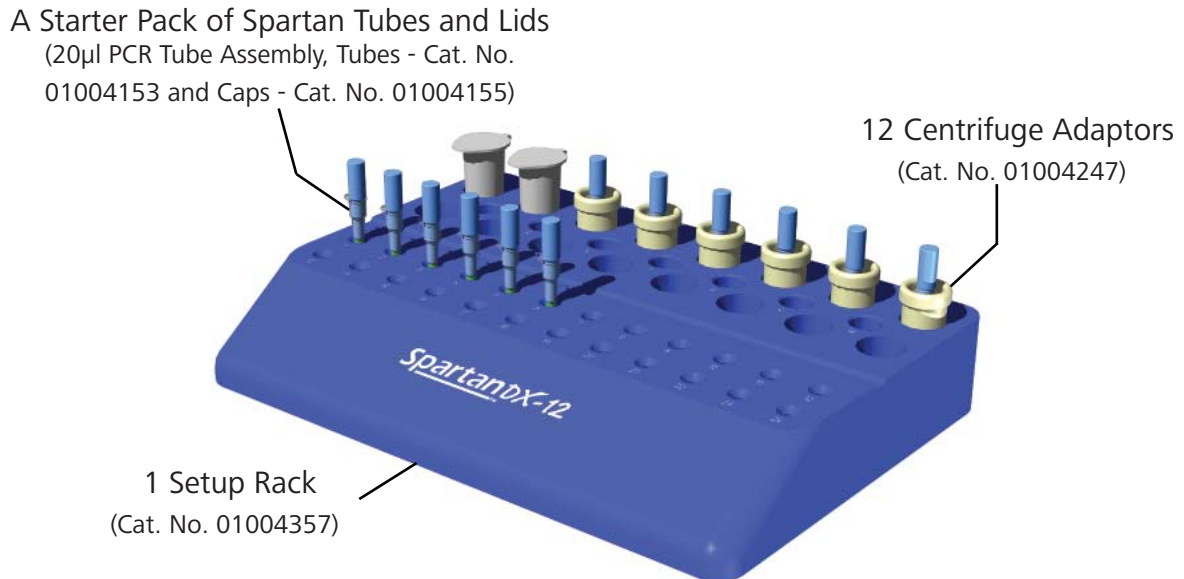
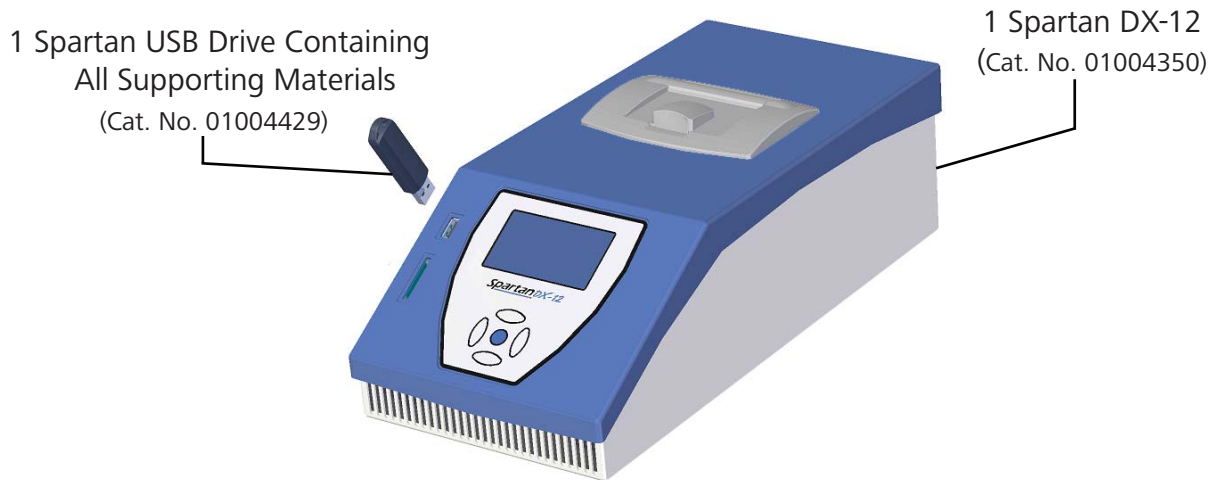
For more information: info@spartanbio.com
For technical support: support@spartanbio.com

Warranty

The Spartan DX-12™ is warranted to meet or exceed the stated specifications. Spartan's sole obligation and the customer's sole remedy is limited to replacement of instruments free of charge in the event the instrument fails to perform as warranted. Spartan makes no other warranty of any kind whatsoever, and SPECIFICALLY DISCLAIMS AND EXCLUDES ALL OTHER WARRANTIES OF ANY KIND OR NATURE WHATSOEVER, DIRECTLY OR INDIRECTLY, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, AS TO THE SUITABILITY, PRODUCTIVITY, DURABILITY, FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, CONDITION, OR ANY OTHER MATTER WITH RESPECT TO SPARTAN PRODUCTS. In no event shall Spartan be liable for claims for any other damages, whether direct, incidental, foreseeable, consequential, or special (including but not limited to loss of use, revenue or profit), whether based upon warranty, contract, tort (including negligence) or strict liability arising in connection with the sale or the failure of Spartan instruments to perform in accordance with the stated specifications.

Visit www.spartanbio.com/products/warranty_service/ for complete Warranty details and Extended Warranty information.

Box Contents



12V Power Supply and Power Cord (Cat. No. 01004381)
Unpacking and Installation Instructions (Cat. No. 01001084)
DX-12 DNA Analyzer User Manual (Cat. No. 01001056)
Spartan DX-12 Quick Reference Guide (Cat. No. 01001057)
Spartan Analyzer Software User Manual (Cat. No. 01001044)
Release Notes (Cat. No. 01001058)

Instrument Installation

Unpacking

The Spartan DX-12™ is shipped in a cardboard container with molded inserts. The container should be carefully inspected for damage. Report any damage to your authorized Spartan Bioscience dealer before accepting the unit. We recommend you read the unpacking and setup instructions.

The instrument measures 17cm (W) x 36cm (L) x 12cm (H) and weighs 4.2 kg. It is easily handled by one person.

Instrument Contents

Spartan DX-12™ Desktop DNA Analyzer (Cat. No. 01004350)

12V Power Supply and Power Cord (Cat. No. 01004381)

USB Drive Containing All Supporting Materials (Cat. No. 01004429)

12 Centrifuge Adaptors (Cat. No. 01004247)

1 Set-up rack (Cat. No. 01004357)

Starter Pack of Spartan tubes (20µl PCR Tube Assembly, Tubes - Cat. No. 01004153 and Caps - Cat. No. 01004155).



The Spartan DX-12™ should be used with manufacturer-supplied accessories only.

Operating Requirements

This instrument is designed for indoor use only.

Operate in ambient temperature between 15 and 25°C (59 and 77°F).

Do not operate in a cold room or a refrigerated area.

Operate in ambient relative humidity of 20 to 50%.

These specifications have been calculated for altitudes between 0 and 2,000 meters.

Ensure adequate front and rear ventilation.

Installation

1. Unpack and position the instrument on the workbench in the upright position. Allow 30 cm space in front and behind the instrument to ensure sufficient cooling of the electronic components.



Failure to provide ventilation space may impact the instrument's ability to maintain proper operating temperatures. This could negatively impact your reaction results and cause the instrument to overheat.

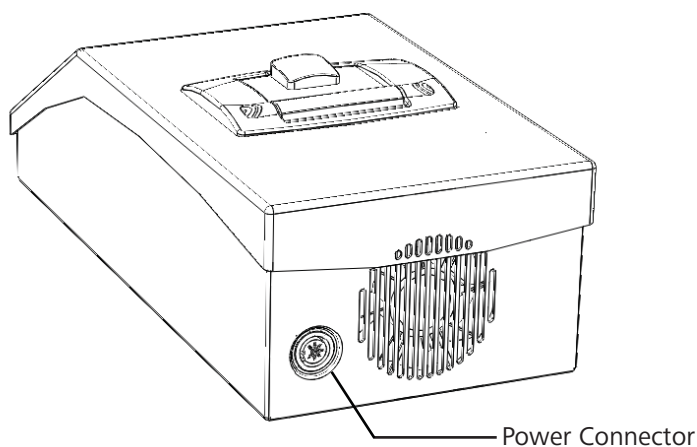
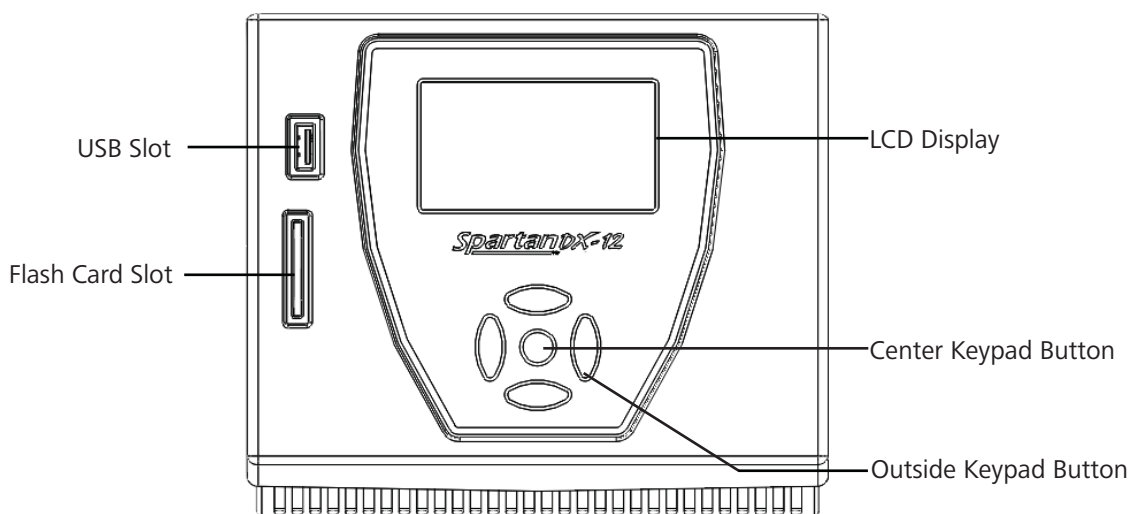
2. **Store original packaging in a safe location in case, at any time, the instrument should require shipping.**
3. Select a site for the instrument where:
 - Ambient temperature is maintained at 15 to 25°C. Avoid direct exposure to air conditioning, heating vents, and direct sunlight.
 - Relative humidity is 20 to 50%, non-condensing.
 - Exposure to dust and drafts is minimal.
 - There is minimal vibration to the instrument.
 - An electrical outlet is available. The power supply automatically accommodates incoming voltages between 100-240 V AC and 50-60 HZ. Use of an un-interruptible power supply (UPS) is recommended.
4. Plug the power supply into the instrument and connect the power supply to power source.
5. The instrument is now operational.

Instrument Installation (continued)

6. Upon initial instrument running, we recommend you insert 12 empty tubes into the instrument, mount the provided UBS stick, navigate to the Options menu and initiate a report. This should take 10-15 minutes to run. DO NOT remove the USB stick during this process. Once it has been completed, please forward the results (3 files) to support@spartanbio.com so that we may verify the functionality of the unit.

To set date/time:

1. The first time the instrument is started, you will be prompted to set the date and time.
2. Move to the appropriate "Set Date/Time" field using the outside buttons and select using the center button.
3. Modify the fields using outside buttons and unselect by pressing center button.
4. Select "Save" using the center button to save your new date and time settings.



Spartan Graphing & Analysis Software Installation

System Requirements

Hardware

800 MHz x86 processor or higher

1024 x 768 display or higher

512 Meg of RAM minimum

OS and Software

Windows XP or higher

Software Installation

Spartan Graphing & Analysis software can be found on the USB memory key included with the Spartan DX-12™ instrument. To install the software, insert the USB key into your computer and run the installation program. The Spartan Graphing & Analysis Setup Wizard will guide you through the steps required to install Spartan Graphing & Analysis software on your computer. Note that use of the software is intended for persons that either have licenses to perform PCR and real-time PCR, or are not required to obtain licenses. You must agree to the License Agreement in order to complete the installation.

To uninstall Spartan Graphing & Analysis software, run the installation program and select Remove **Spartan Graphing & Analysis**. Upgraded versions of software can be installed without the need to uninstall previous versions.

Support

For more information or help with Spartan Graphing & Analysis software, contact Spartan Bioscience by e-mail at support@spartanbio.com.

About Spartan Graphing & Analysis Software

Spartan Graphing & Analysis software is a full-featured analysis package for data produced by the Spartan DX-12™ instrument. The Spartan DX-12™ instrument produces run data in the form of data files, which are transferred between the device and a PC by USB memory key, or SD card. Spartan Graphing & Analysis software automatically analyzes data from imported data files, displays results in convenient graphical form, and provides the option to adjust analysis settings to your preferences. The software is organized into three tabs: Run Data tab, Quantification tab, and Melt Curve tab.

Note - The default display in Spartan Graphing & Analysis software is the Run Data tab. The view can be toggled between the three tabs (Run Data, Quantification, Melting Curve) by clicking with the mouse on the appropriate tab name (Figure 1).

About Spartan Graphing & Analysis Software (continued)

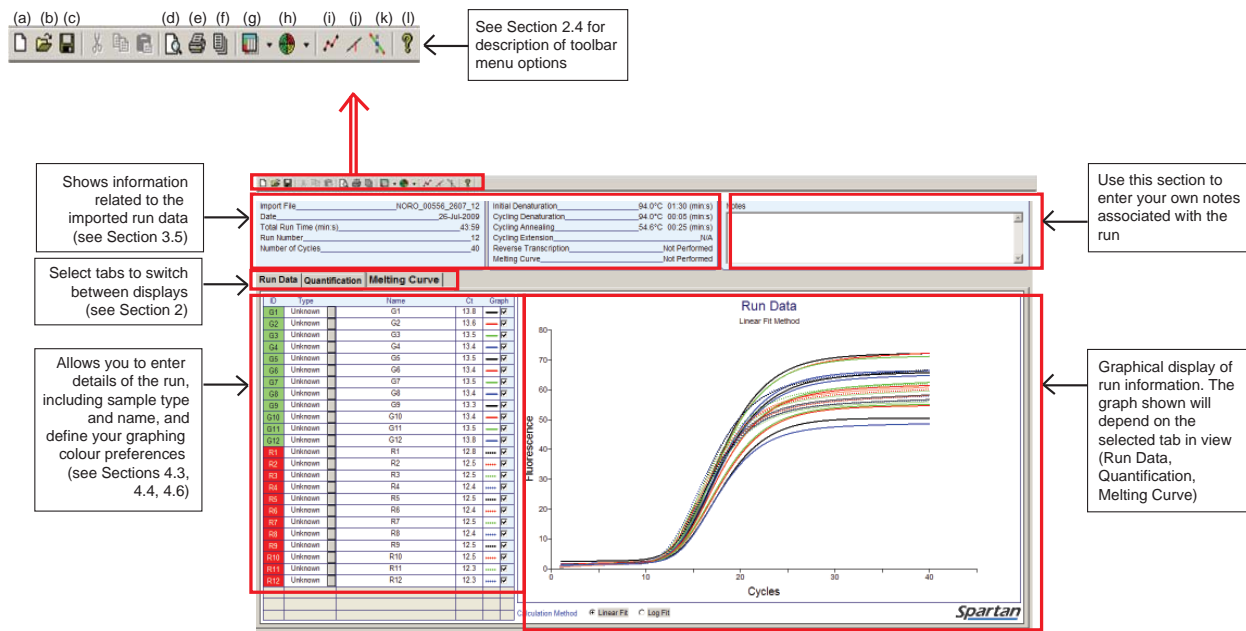


Figure 1. Default window display (Run Data tab) in Graphing & Analysis software.

There are two ways to load data into Spartan Graphing & Analysis software:


- "Import" (Importing Data) - this option is used to load raw data generated from a run on the Spartan-DX-12 instrument into the graphing software. Files generated by the Spartan DX-12 have the extension .txt. Once a .txt file has been imported into Spartan Graphing & Analysis software, the data can be saved as a .sdx file.
- "Open" (Opening a .sdx file) - this option is used to open a previously saved Spartan Graphing & Analysis file with the.sdx extension. Files with the extension .sdx can be reopened from within the software or can be opened directly, i.e. double-clicking on the file will launch the software and display the related data

Importing Data

Results of Spartan DX-12 runs are saved on the Flash card or USB drive as non-editable encrypted data files, with the naming convention: AAAAAAA_UUUUU_DDMM_RR.txt (where: AAAAAAA is the name of the program ran on the Spartan DX-12; UUUUU is the Spartan-DX-12 instrument number (can be found on the instrument welcome screen); DDMM is the day and month; RR is the run number of the day). Files are saved to the following location on the Flash card or USB drive:

/rundata/UUUUU/DDMM_RR

UUUUU is the unit ID number, DDMM are day and month, and RR is run of the day). Encrypted data files can only be opened in Spartan Graphing & Analysis software. To import data into the software, use one of the following options:

- Select **File** then **Import** from the toolbar menu
- Click on the Import icon  on the toolbar
- Use the Hotkey <Ctrl + I>

The Import dialogue window will open (Figure 2). Navigate to the location of the saved data file and select Open. The data should now be loaded into the Spartan Graphing & Analysis software. The display will default to the Run Data tab (Figure 1).

About Spartan Graphing & Analysis Software (continued)

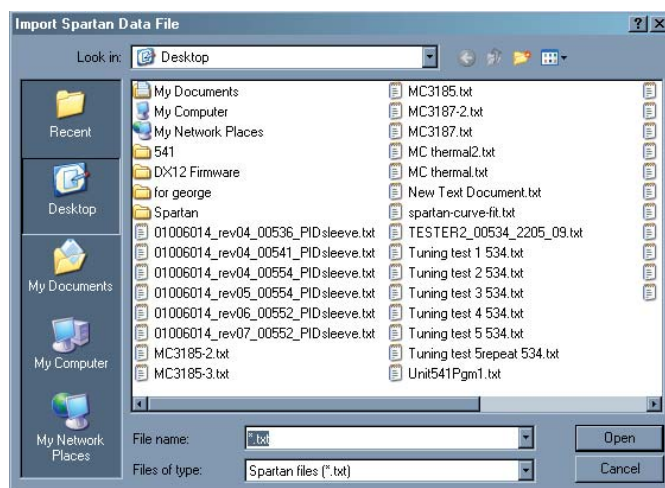



Figure 2. Import Data File dialogue window

Saving Data


Data imported into the software from a data file can be saved as a Spartan Graphing & Analysis file (.sdx extension), which can be reopened directly in the software. To save data as a .sdx file, use one of the following options:

- A) Select **File** then **Save** from the toolbar menu
- B) Click on the Save icon  on the toolbar
- C) Use the Hotkey <Ctrl + S>

Once the data is saved as a .sdx data file, the name of the file will appear in the program title bar with the .sdx extension (Figure 3).

Opening an .sdx File

To open a previously saved .sdx file in Spartan Graphing & Analysis software, use one of the following options:

- A) Select **File** then **Open** from the toolbar menu
- B) Click on the Open icon  on the toolbar
- C) Use the Hotkey <Ctrl + O>

Operating Instructions

End-Point/Real Time and Melt Curve Operational Modes

The Spartan DX-12™ is shipped in “End-Point” operational mode. In order to operate the unit in “Real Time” or “Melt Curve” modes, these functions must be activated.

To activate “Real Time” or “Melt Curve” modes:

1. Using the keypad, select the “Options” menu on the instrument.
2. Move to “System Settings” using the outside buttons and select using the center button.
3. Once within the “System Settings” menu, “Melt Curve” or “Real Time” modes can be turned Off/On by moving to and selecting the appropriate field using the outside buttons and the center button, then toggling up and down with the outside arrow keys, pressing the center key again to register your selection.

N.B.: The first time you change the “Real Time” or “Melt Curve” operational setting, you will be prompted to “AGREE” or “DISAGREE” to a disclaimer. If you do not “AGREE” to the disclaimer, the “Real Time” or “Melt Curve” modes will remain “OFF”, and will be inaccessible. Only once the disclaimers are “AGREED” to can you access these operational modes.

Reaction Set-up

A. Thermal cycling

The Spartan DX-12™ is designed to run two- or three-temperature thermal cycling programs. A three-temperature program has three steps: denaturation, annealing, and extension. A two-temperature program combines the annealing and extension steps into a single step. Although three-temperature programs are more traditional, two-temperature programs usually provide the same performance while significantly shortening run times.

Isothermal programs may also be performed on the Spartan DX-12™ by setting the denaturation, annealing, and extension steps to the same temperature.

Note that the dwell time at each temperature begins once the reaction tube reaches the specified temperature. For example, if the denaturation temperature is set at 95°C, and the denaturation dwell time is set at 10 s, the 10 s countdown begins once the reaction tube reaches 95°C. For most applications, only a few seconds of denaturation time are sufficient to denature the amplicon during thermal cycling.

Designing a Program

Each gene target is unique and may require optimization of the cycling program. Here are some general guidelines for determining the appropriate temperatures and dwell times for your program:

1. Design primers with matching melting temperatures (T_m), preferably between 60-68°C, and amplicon size of < 300 base pairs (bp). For faster cycling speeds, the primers should have T_m s of 65-68°C, and amplicon size of < 150 bp.
2. Set the annealing temperature to the calculated T_m .
3. For three-temperature programs, set the extension temperature to 72°C for 10 s. For two-temperature programs, the extension temperature is combined with the annealing temperature and no separate extension time is used.
4. Set the annealing and/or extension time to 30 seconds.
5. For denaturation temperatures and times, we recommend starting with the following settings:

DNA Source	Denaturation Temp	Initial Time	Cycling Time
Human/Mammalian	95°C	2.5 min	10 s
Bacterial/Viral	95°C	1 min	10 s

Operating Instructions (continued)

B. Detection chemistries

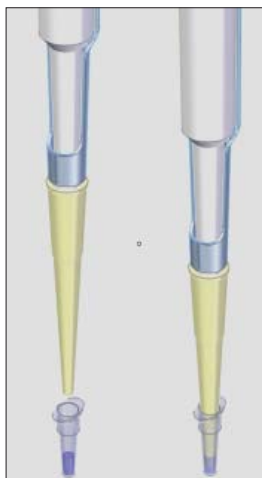
The Spartan DX-12™ is a 2-channel instrument. The first channel detects green wavelengths (520-532 nm), and the second channel detects red wavelengths (620-800 nm). The detection system is compatible with standard probe chemistries such as TaqMan® probes, Scorpion probes and molecular beacons. It is also compatible with DNA intercalating dyes such as SYBR Green (Life Technologies). For probe technologies, Spartan recommends the use of non-fluorescent quenchers such as BHQ-1 and BHQ-2 (Black Hole Quencher®, Biosearch Technologies). For further details, see Spartan Application Notes 005 and 012 at <http://www.spartanbio.com/support/application-notes/>.

For SYBR Green I dye (Invitrogen, Cat. No. S7563), we recommend a concentration of 0.4X. However concentrations in the range of 0.2-1.0X are acceptable. For further details, see Spartan Application Note 0XX at <http://www.spartanbio.com/support/application-notes/>.

C. Reaction tubes

The Spartan DX-12™ is designed to work with Spartan reaction tubes (20µl PCR Tube Assembly, Tubes - Cat. No. 01004153 and Caps - Cat. No. 01004155). These tubes have been optimized for fast heating and cooling kinetics, and must be used to perform PCR on the Spartan DX-12..

Spartan reaction tubes are designed to be loaded directly with a pipette tip.. To load tubes, insert loaded pipette tip to the bottom of the tube, and slowly release the liquid while raising the pipette, ensuring the tip of the pipette is kept at the surface of the liquid.. This should release the liquid evenly into the tube without creating any bubbles.



D. Reaction volumes

Spartan reaction tubes have a maximum void volume of 25 µl. The minimum reaction volume is 10 µl. Spartan recommends standard reaction volumes of 10-20 µl.

Run Program

A. Warming Up and Turning Off

1. Plug in the Spartan DX-12™.
2. There is no power switch on the Spartan DX-12™. Turn on the instrument by pressing any key on the keypad.
3. Once the instrument is turned on, and you enter into the setup window, it will take about 10 minutes to warm up and equilibrate to room temperature.

Run Program (continued)

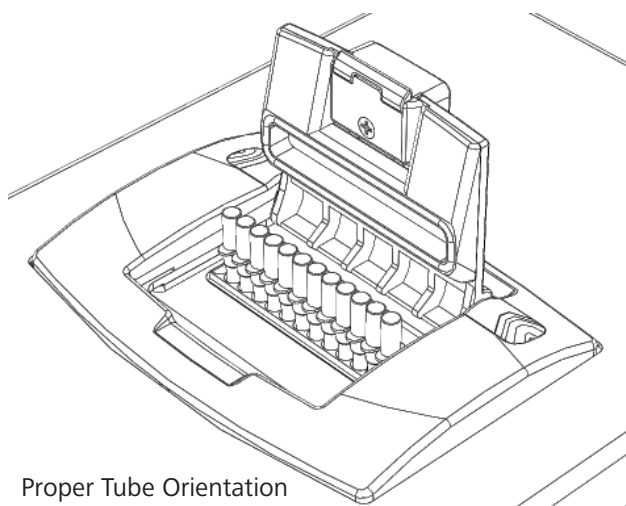
4. To manually turn off the instrument, select "Off" from the Main Menu. When the instrument is turned "Off" all features of the instrument including fans and heaters are turned off. However, the instrument is effectively in "sleep mode" and can be turned back on by pressing any button.
5. After 30 min of inactivity, the display screen will turn off. After a default time of 4 hours of inactivity, the instrument will turn "Off". This auto-shut off time can be changed through the "Options" menu, under "System settings"
6. To ensure that there is no power going to the instrument, unplug the power cord.

B. Selecting a Program

1. Use the left and right outside keypad buttons on the keypad to move to the "File" menu. Press the center button to select this menu.
2. To create a New Program, use the outside keypad buttons to navigate down to the "New" menu and select it. In the program setup screen, edit the name of your new program by pressing the center button. Use the up and down outside keypad buttons to adjust the characters, and use the left and right outside keypad buttons to move from one character to the next. When you are finished, press the center keypad button to accept the new program name.
3. To open an Existing Program, use the outside keypad buttons to navigate down to the "Open" menu and select it. Use the up and down arrows to move between programs in the program list. Programs will be displayed in numeric, then alphabetical order. Select a program by pressing the center button. Open the program by selecting "Open" from the options on the bottom of the screen. At any time, you may select a program using the center button, and use the outside keypad buttons to move between the "Open", "Delete", and "Cancel" options at the bottom of the screen.

C. Setting Up a Program

1. After you have created a New Program, or have opened an Existing Program, the Program Setup Screen allows you to specify settings for the Reverse Transcription, Thermal Cycling, and Melt Curve steps in your program.
2. Use the outside keypad buttons to navigate between the program steps. Select "On" or "Off" to toggle the appropriate steps. Note that the instrument will perform the steps in the following order: Reverse Transcription → Thermal Cycling → Melt Curve. Steps set to "Off" will not be performed.
3. To save modifications to your program, select the "Save" option at the bottom of the screen. If you modify any of the three components of a program and run it without saving, the program will run as entered, but the the changes will be lost at the end of the run.



Run Program (continued)

4. Alternately a PCR program can be created on a PC (See the Spartan DX-12 User's Manual for instructions on "Editing Standard Process Files from your PC")

For more involved programs, see the Spartan DX-12 Operator's Manual for instructions on how to setup and run "Custom Process Files".

Reverse Transcription

1. To modify the Reverse Transcription temperatures and dwell times, use the outside keypad buttons to navigate to "Reverse Transcription" and select it using the center button.
2. In the Reverse Transcription Setup Screen, use the outside keypad buttons to navigate between the temperatures and dwell times. After using the center button to select a setting to change, use the up and down outside keypad buttons to change the values. Use the center button to accept the new entry.
3. Step #1 specifies the Reverse Transcription synthesis conditions, and Step #2 specifies the Reverse Transcription denaturation conditions. Step #2 of the Reverse Transcription program, and Step #0 of the Thermal Cycling program are performed sequentially when both programs are selected. This should be kept in mind when setting up a program that involves a Reverse Transcription step.
4. When you are finished adjusting the values, navigate to the bottom of the screen and select "Ok".
5. To cancel your modifications, navigate to the bottom of the screen and select "Cancel".

Thermal Cycling

1. To modify the Thermal Cycling temperatures and dwell times, use the outside keypad buttons to navigate to "Thermal Cycling" and select it using the center button.
2. In the Thermal Cycling Setup Screen, use the outside keypad buttons to navigate between the temperatures, dwell times, and cycle number. After selecting a setting to change, use the up and down outside keypad buttons to change the values. Use the center button to accept the new entry.
3. Step #0 specifies the initial denaturation conditions. During the cycling phase of the program, Steps #1, 2, and 3 specify the denaturation, annealing, and extension conditions, respectively.
4. When you are finished adjusting the values, navigate to the bottom of the screen and select "Ok" by pressing the center button.
5. To cancel your modifications, navigate to the bottom of the screen and select "Cancel".
6. By default Thermal Cycling is set to "3-Temp" thermal cycling conditions. To switch between two-temperature and three-temperature programs, toggle the "2-Temp" or "3-Temp" option at the bottom of the screen by selecting it with the center button.

Melt Curve

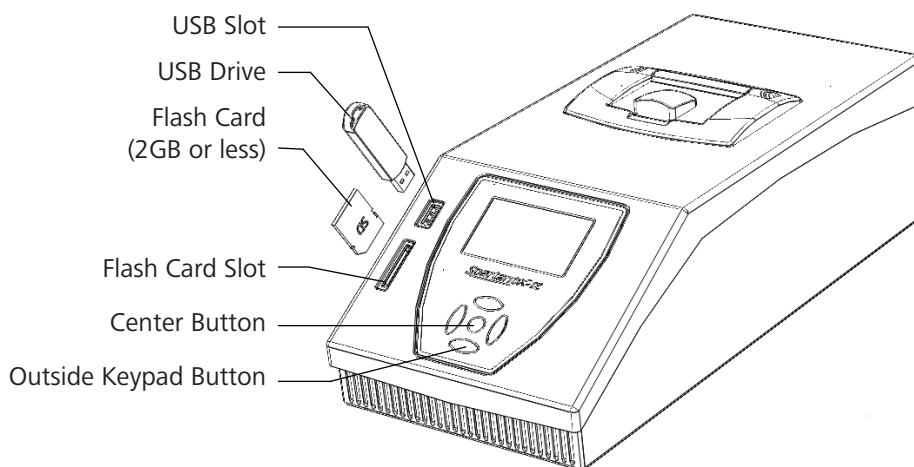
1. To modify the Melt Curve temperatures and dwell times, use the outside keypad buttons to navigate to "Melt Curve" and select it using the center button.
2. In the Melt Curve Setup Screen, use the outside keypad buttons to navigate between the temperatures and dwell times. After selecting a setting to change, use the up and down outside keypad buttons to change the values.
3. Step #1 specifies the initial denaturation conditions. Step #2 specifies the starting temperature for the melt curve. Step #3 specifies the end temperature for a single-step melt curve. Step #4 specifies the end temperature for a multi-step melt curve. "°C/step" specifies the frequency of data acquisition. The minimum and maximum increments are 0.1°C/step and 1.0°C/step, respectively.
4. When you are finished adjusting the values, navigate to the bottom of the screen and select "Ok".
5. To cancel your modifications, navigate to the bottom of the screen and select "Cancel".

Run Program (continued)

- By default, the Melt Curve program is set to "Single-Step". A Single-Step program uses the same temperature increment from the starting to end temperatures. To switch between single-step and multi-step programs, toggle the "Single-Step" to "Multi-Step" option at the bottom of the screen by selecting it. A Multi-Step program allows you to set two different temperature increments between the starting and end temperatures. This feature is useful if you want higher resolution for a specific region of the curve, but want the overall run-time to be short.

D. Running a Program

- Insert Spartan reaction tubes into the instrument. Ensure that the tubes are properly nested in each well. **Do not force the tubes down into the wells.** Close the instrument lid.
- From the Program Setup Screen, select the "Run" option from the bottom of the screen.
- While the program is running, you may increase the cycle number at any time by navigating to the cycle number denominator on the screen with the outside keypad, pushing the center button to select it, and the up and down arrow key to make the changes, pressing the center button again to implement the changes.
- While the program is running, you may also select "Stop" at any time. Note that the program is only stopped after you select "Yes" to confirm stopping the program. When a program is stopped, all data accumulated to that point has been saved and is available via the "Save Last Run" feature in the "Options" menu. If a Flash Card (2 GB or less), or USB drive is present in the unit during the run, the data will also be automatically written to the drive(s).



Data Analysis

Thermal Cycling

- During a Thermal Cycling program, the fluorescence intensity of each well is measured after the first and last cycles. You may change from end-point detection to real-time detection in the "Options" menu by turning on "Real-time mode". You must agree to the disclaimer before real-time mode will be turned on.
- At the end of a Thermal Cycling program, you may view the fluorescence results on the instrument's LCD screen. Fluorescence values are displayed on a scale from 1 to 999. Display value = (fluorescence last cycle - (minimum fluorescence+1))/2000 (rounded to the nearest whole number) If the result is <01, display "00"

Data Analysis (continued)

3. When in "Real-Time" mode, data acquisition occurs following the Annealing/Extension step (Step 2) during 2-Temperature PCR, and following the Extension step (Step 3), during 3-Temperature PCR.
4. Selecting "Save" at the bottom of the screen saves the results to either the Flash card (2GB or less) or the USB drives.
5. To graph the results, remove the Flash card or USB drive from the instrument and insert it into the corresponding port of a personal computer (PC).
6. Data is stored as a ".txt" file on the Flash card or USB drive. The file will be saved with the following naming convention: AAAAAAA_UUUU_DDMM_RR.txt, where AAAAAA is the program name, UUUU is the unit ID number, DDMM are day and month, and RR is run of the day. This data is encrypted and can only be graphed using Spartan Analyzer software that is supplied with the instrument.

N.B.: This data can ONLY be graphed using Spartan Analyzer software that is supplied with the instrument.

7. The User Manual for the Spartan Analyzer software is available for download at: <http://www.spartanbio.com/products/manuals/>

Melt Curve

1. During a Melt Curve program, the fluorescence intensity of each well is measured after each temperature increment.
2. At the end of a Melt Curve program, select "Save" at the bottom of the screen to save the results to both the Flash card and USB drives in the instrument.
3. To graph the results, remove the Flash card or USB drive from the instrument, and insert it into the corresponding port of a PC.
4. Melt curve data is stored in the same file as the Thermal Cycling data. This data may also be graphed using Spartan Analyzer software.
5. The User Manual for the Spartan Analyzer software is available for download at: <http://www.spartanbio.com/products/spartan-dx-12/manuals/>

Optional Settings

In the "Options" menu, there are various optional settings and features:

1. Move to the appropriate "Set Date/Time" field using outside buttons and select using center button. Modify the fields using outside buttons and unselect by pressing center button. Select "Save" to save your new date and time settings. Note that it is important to set the correct date and time because a date-and-time stamp is saved with the fluorescence results for each run.
2. To re-save the results from the previous run, select "Save Last Run". Note that the instrument will only store data from the most recent run and that these results will be over-written with every additional run.
3. To troubleshoot any problems you may experience with the instrument, select "Reports". This will save an instrument status report to the Flash card and USB drives. The self tests will take 10-20 minutes for the instrument to perform. The resulting report can be e-mailed to Spartan Bioscience for trouble-shooting or verification purposes..
4. Some DNA amplification assays for the Spartan DX-12™ come with pre-defined programs. These programs may be up-loaded to the instrument by saving them to Flash Card or USB under a folder named "process" and ensuring that they have a 7-digit name. These pre-defined programs can then be loaded onto the instrument by inserting the Flash Card or USB in to the instrument and selecting "Load Process File", choosing the appropriate program, and selecting transfer. Loading a process file with the same name

Optional Settings (continued)

as an existing one will overwrite the pre-existing file. Note that custom process files cannot be edited through the "Open" menu.

5. In the "System Settings" menu, you have the option of turning "On" or "Off" the "Real-Time Mode" and "Melt Curve Mode" features. You may also specify the duration of time before the instrument automatically shuts off after a period of inactivity.