
4 Maintaining, Testing, and Troubleshooting

Maintenance

Maintenance of the FR2+ is very simple, but it is a very important factor in its dependability. When in standby mode (with the battery installed), the FR2+ performs many maintenance activities itself. These include daily and weekly selftests to verify readiness for use and more detailed monthly selftests that also verify the shock waveform delivery system. In addition, each time the FR2+ is first turned on, it executes a selftest. Further, a detailed battery insertion selftest is run whenever a battery is installed in the FR2+.

The FR2+ requires no calibration or verification of energy delivery. The FR2+ has no user-serviceable parts.

CAUTION: Improper maintenance may damage the FR2+ or cause it to function improperly. Maintain the FR2+ only as described in these Instructions for Use or as designated by your program's Medical Director.

CAUTION: Electrical shock hazard. Dangerous high voltages and currents are present. Do not open the FR2+, remove its covers, or attempt repair. There are no user-serviceable components in the FR2+. The FR2+ should be returned to Philips for repair.

Suggested maintenance schedule

The following table presents a sample maintenance schedule for the FR2+. Different frequency intervals may be appropriate, depending upon the environment in which the FR2+ is used. The required maintenance frequency is at the discretion of your program's Medical Director.

daily	monthly	maintenance task/response
✓		<p>Check the Status Indicator.</p> <p>If you see the flashing black hourglass: The FR2+ is ready to use. No action required.</p> <p>If you see anything other than a flashing black hourglass, remove and reinstall the battery to run the selftest.</p> <ul style="list-style-type: none"> • If the selftest passes and the Status Indicator shows the flashing black hourglass, the FR2+ is ready to use. • If the selftest fails, install a new battery and run the selftest. If the selftest passes, the FR2+ is ready to use. If the selftest fails, contact Philips Medical Systems. • If the selftest does not run, check to be sure that there is no pads connector installed in the FR2+.
	✓	<p>Check supplies, accessories, and spares for damage and expiration dating.</p> <p>Do not use damaged or expired accessories. Replace them immediately.</p> <p>If a LOW BATTERY or REPLACE BATTERY message is displayed: Replace the battery and run the selftest.</p> <ul style="list-style-type: none"> • Do not attempt to charge the M3863A FR2 standard battery. It is not rechargeable. • The M3848A FR2+ battery is rechargeable. Recharge it, using the M3849A Charger only.
	✓	<p>Check the outside of the FR2+ and the connector socket for cracks or other signs of damage.</p> <p>If you see signs of damage: Contact Philips for technical support.</p>

After using the HeartStart FR2+

After each use of the FR2+, in addition to the maintenance tasks described in the table above, perform the following post-use checks before returning the FR2+ to service:

- Check the operation of the FR2+ by removing and reinstalling the battery and running the battery insertion selftest.
- Check the outside of the FR2+ and the connector socket for signs of dirt or contamination. If the FR2+ is dirty or contaminated, clean it according to the guidelines provided in this manual.

- Check the data card if one has been used. If the data card has been used to record incident data, remove and replace it with a blank data card. Deliver the recorded data card to appropriate personnel according to your local guidelines and medical protocol.
- Check the connector socket to make sure that defibrillator pads are disconnected from the FR2+ when it is not in use.
- Check to make sure the data card tray is installed, even if a data card is not being used.

Cleaning the HeartStart FR2+

The outside of the FR2+, including the defibrillator pads connector socket, can be cleaned with a soft cloth dampened in one of several appropriate cleaning agents (see list below). The following guidelines include some important reminders:

- Do not immerse the FR2+ in fluids.
- Make sure a battery (or the M3864A Training & Administration Pack) and a data card tray are installed when cleaning the FR2+, to keep fluids out of the device.
- Do not use abrasive materials, cleaners, strong solvents such as acetone or acetone-based cleaners, or enzymatic cleaners.
- Clean the FR2+ and the connector socket with a soft cloth dampened with one of the cleaning agents listed below.
 - Isopropyl alcohol (70% solution)
 - Soapy water
 - Chlorine bleach (30 ml/l water)
 - Ammonia-based cleaners
 - Glutaraldehyde-based cleaners
 - Hydrogen peroxide

CAUTION: Do not immerse any portion of the FR2+ in water or other fluids. Do not allow fluids to enter the FR2+. Avoid spilling any fluids on the FR2+ or accessories. Spilling fluids into the FR2+ may damage it or present a fire or shock hazard. Do not sterilize the FR2+ or accessories.

Operator's checklist

The following checklist is for your reference. You may want to photocopy it or use it as the basis for creating your own checklist.

OPERATOR'S CHECKLIST

HeartStart FR2+ Model No.: _____ Serial No.: _____

HeartStart FR2+ Location or Vehicle ID: _____

Date							
Scheduled frequency							
HeartStart FR2+ Clean, no dirt or contamination; no signs of damage							
Supplies available <ul style="list-style-type: none"> • Two sets defibrillator pads, sealed, undamaged, within expiration date • Ancillary supplies (hand towel, scissors, razor, pocket mask, gloves) • Spare M3863A battery, within "Install Before" date • Data cards, undamaged, and spare data card tray 							
Status indicator Shows alternating hourglass/square; selftest passed.							
Inspected by Signature or initials of operator completing the maintenance inspection							
Remarks, problems, corrective actions							

Testing

The HeartStart FR2+ Defibrillator has several ways of testing itself and alerting you if it finds a problem. In addition to the selftest performed each time it is turned on and each time a battery is installed, the FR2+ also automatically performs periodic selftests daily.

NOTE: The FR2+ selftests are designed to check that the FR2+ is ready for use. However, in the event that the FR2+ has been dropped or mishandled, it is recommended that the battery be removed and reinstalled to initiate a selftest. If the FR2+ has visible signs of damage, contact Philips for technical support.

Battery insertion selftest

Before running the battery insertion selftest, be sure that neither the defibrillator pads nor the FR2+ ECG assessment module are connected to the device. When you insert the battery, the main menu is displayed and a two-part selftest will run unless you make another selection from the menu* within 10 seconds. The selftest includes an automatic part and an interactive part.

NOTE: The menu screen *will not* appear when a battery is inserted if:

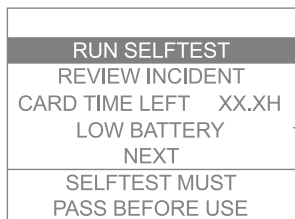
- the defibrillator pads are attached to a patient, indicating that the FR2+ is in use,
- the FR2+ ECG assessment module is connected to the FR2+, or
- the battery is completely depleted.

If less than five minutes have passed since the FR2+ was last used, the menu screen *will* be displayed, but after 10 seconds the FR2+ will go to standby mode if you make no selection.

RUN SELFTEST
REVIEW INCIDENT
CARD TIME LEFT XX.XH
GOOD BATTERY
NEXT
IN EMERGENCY
PRESS OFF TO QUIT

To run the battery insertion selftest, remove and reinstall the battery. The screen tells you whether or not a data card is installed. If it is, a screen message displays how much recording time is left until the data card is full.

- * To move around the menus displayed, use the Option buttons as follows:
- Press the lower Option button to move the highlight bar from one item to another on the menu.
 - Press the upper Option button to select the highlighted item or to scroll through the settings for that item.



NOTE: The data card is typically capable of storing a number of incidents. However, it is recommended that it be cleared or replaced after every use. In the unlikely event that the card fills up during an incident, no further data can be recorded, so it is important for you to monitor the CARD TIME LEFT information on this screen.

Text prompts tell you if the battery power is low. If so, replace the battery. If a previous selftest has failed, the screen displays a message that the FR2+ must pass a selftest before being used.

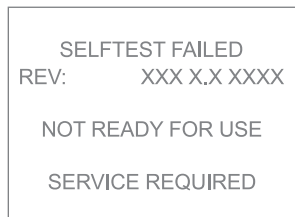
It is a best practice to always have a spare battery available. However, if you do not have a spare battery when a screen display prompts you to replace the battery or the Status Indicator shows a flashing red **X**, you can continue to use the FR2+ until the battery is completely depleted. This may be necessary in an emergency.



NOTE: The M3848A FR2+ rechargeable battery should not be used as a spare or backup battery.

NOTE: If you connect defibrillator pads (that are applied to the patient) or the FR2+ ECG assessment module to the FR2+ during a battery insertion selftest, the selftest will stop and the FR2+ will go to its standby mode to be ready for use.

During the automatic part of the selftest, the screen displays a bar that fills in as the test continues. When that part of the test is finished, the FR2+ beeps. If a data card was inserted in the FR2+ prior to installing the battery, the results of the selftest are automatically recorded on the data card.



If the automatic part of the selftest detects a problem:

- The screen displays a message that the selftest has failed. After a short time, an error code is displayed. Write down the error code and serial number.
- The Status Indicator shows a flashing or solid red **X**.



Replace the battery with a new battery and repeat the test. If the second selftest fails, contact Philips for technical support.

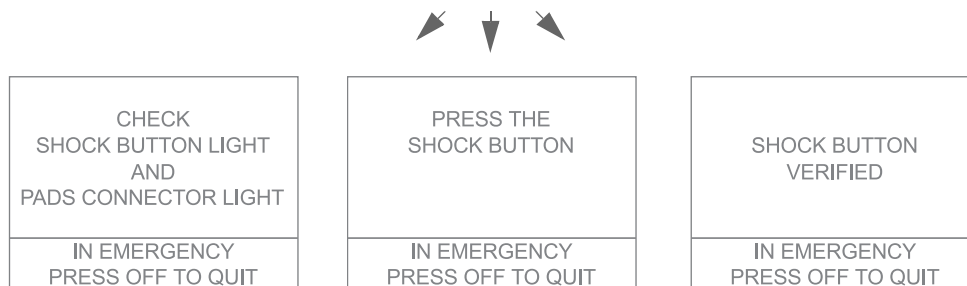
SELFTEST PASSED REV: XXX X.X XXXX NO DATA CARD SN 000000001 IN EMERGENCY PRESS OFF TO QUIT

If the automatic part of the selftest passes:

- The screen displays a message that the selftest passed, then begins the interactive part of the test.

The interactive part of the selftest requires you to respond to prompts in order to make sure the display, buttons, lights, and speaker on the FR2+ are working properly.

Text prompts guide you through a series of steps in the interactive part of the selftest. Some ask you to observe that a feature of the FR2+ works properly. Others ask you to take certain actions — for example, to press a button. The screen then displays a message showing that the button's operation has been verified. If you do not press the button, or if you do but the button is not working, the screen displays a message that the button's function is not verified.



If something does not work correctly — for example, if lights do not come on or you do not hear beeps when expected — make a note of the problem and contact Philips for technical support.

NOTE: Do not use the FR2+ if any parts of the interactive selftest indicate a problem. Be sure to note and report any problems you find.

When the interactive part of the battery insertion selftest is complete, the FR2+ turns off and goes to standby mode to be ready for use.

If it detects a problem during any selftest, the FR2+ beeps and displays a flashing red **X** or a solid red **X** on the Status Indicator.

DEVICE HISTORY
BATTERY HISTORY
SETUP
CLOCK
RETURN
IN EMERGENCY
PRESS OFF TO QUIT

Device history

The FR2+ stores key information about its history in internal memory. To review the history of your FR2+, select NEXT from the main menu screen displayed when you insert the battery, then select DEVICE HISTORY from the next menu displayed.

The device history information includes:

DEVICE HISTORY
RETURN
USES: 12 19
SHOCKS: 17
TRAINING: 25 456
TESTS: 156 22
5 1
REV: 01E 1.6 ABA1

- USES — how many times the FR2+ has been used (shown in the left column of numbers) and the total time in minutes it has been used (shown in the right column of numbers);
- SHOCKS — the total number of shocks it has delivered;
- TRAINING — how many times it has been used with the Training & Administration Pack for training (left column) and the total time in minutes it has been used for training (right column); and
- TESTS — how many tests have been run. Four figures are shown: daily (upper left), weekly (upper right), and monthly (lower left) periodic selftests, and battery insertion selftests (lower right).
- REV — device model, software version and language.

DEVICE HISTORY
BATTERY HISTORY
SETUP
CLOCK
RETURN
IN EMERGENCY
PRESS OFF TO QUIT

Battery History

Information about use of the battery currently installed in your FR2+ is also available. To review the history of the battery, select NEXT from the menu screen displayed when you insert the battery, then select BATTERY HISTORY from the next menu displayed.

BATTERY HISTORY
RETURN
USE MINUTES: 519
CHARGES: 40
GOOD BATTERY
STATUS: 29 00000000

The battery history information is read from the internal memory of the battery. It includes:

BATTERY HISTORY
RETURN
USE MINUTES: 519
CHARGES: 40
0% 100%
STATUS: 00000000

- USE MINUTES — the total operating time (in minutes), including selftest time, for this battery;
- CHARGES — the total number of full defibrillation charges that have been provided by this battery, including selftest charges;
- BATTERY READINESS — a GOOD BATTERY message (M3863A) or a fuel gauge display (M3848A) showing 25%, 50%, 75% or 100%, or a LOW BATTERY or REPLACE BATTERY message, as appropriate.

- **STATUS** — the current status of the M3863A battery. Make a note of this code if technical service is needed.

Troubleshooting Guide

Status indicator summary

status indicator	meaning
Flashing black hourglass	The FR2+ passed the battery insertion selftest or the last periodic selftest and is therefore ready for use.
Flashing red X accompanied by a chirping sound.	A selftest error has occurred or the battery power is low.
Solid red X	The battery is completely depleted or a selftest failure occurred.

Recommended action during an emergency

If the status indicator displays the flashing black hourglass, follow all voice and text prompts.

The HeartStart FR2+ Defibrillator is designed to deliver therapy even if the status indicator displays a flashing red **X**, although the device may not perform to all of its specifications. Voice and text prompts should be followed whenever they are given. If for any reason you cannot hear voice prompts during use of the defibrillator, periodically check the device screen for text prompts.

NOTE: After completing emergency use of the FR2+, if you are unable to clear the problem as described in this Troubleshooting section, and the Status Indicator does not show the flashing black hourglass, contact Philips for technical support.

In the unlikely event that the device becomes unresponsive during use:

1. cycle power (press the On/Off button once, wait one second, then press it again), or
2. remove and reinstall the battery (use a new M3863A FR2 standard battery, if available, or a charged M3848A FR2+ rechargeable battery).

If neither of these actions clears the problem, do not use the FR2+. Attend to the patient, providing CPR if needed, until emergency medical personnel arrive.

NOTE: Perform CPR (if needed) any time there is a delay before or an interruption in use of the FR2+.

Troubleshooting during patient use

symptom	possible cause	recommended action
STATUS INDICATOR: FLASHING RED X		
Screen and voice prompts: LOW BATTERY Screen and voice prompts: REPLACE BATTERY NOW	<ul style="list-style-type: none"> The energy remaining in the battery is low but sufficient to deliver a shock. The energy in the battery is nearly depleted. The FR2+ will turn off if a new battery is not installed. 	Replace the battery with a new M3863A FR2 standard or a charged M3848A FR2+ rechargeable battery as soon as possible.
STATUS INDICATOR: FLASHING BLACK HOURGLASS		
Screen and voice prompts: APPLY PADS PRESS PADS FIRMLY or PLUG IN CONNECTOR Or voice prompts: INSERT CONNECTOR FIRMLY or PRESS PADS FIRMLY TO PATIENT'S BARE CHEST or POOR PADS CONTACT Voice and text prompts: REPLACE PADS	<ul style="list-style-type: none"> The defibrillator pads are not properly applied to the patient, or The pads are not making good contact with the patient's bare chest because of moisture or excessive hair, or The pads are touching each other, or The defibrillator pads connector is not firmly inserted in the connector socket. The defibrillator pads, cable, or connector may be damaged. The FR2+ has detected a possible problem with the defibrillator pads or pads cable. 	<ul style="list-style-type: none"> Make sure that the defibrillator pads are sticking completely to the patient's skin. If the pads are not sticking, dry the patient's chest and shave or clip any excessive chest hair. Reposition the pads. Make sure the pads connector is completely inserted in the connector socket. If the prompt continues after you do these things, replace the pads. Replace the defibrillator pads with new defibrillator pads.

symptom	possible cause	recommended action
Voice prompts: ANALYZING INTERRUPTED or STOP ALL MOTION or CANNOT ANALYZE	<ul style="list-style-type: none"> • The patient is being moved or jostled. • Radio or electrical sources are interfering with ECG analysis. • The environment is dry and movement around the patient is causing static electricity to interfere with ECG analysis. 	<ul style="list-style-type: none"> • Stop CPR; do not touch the patient. Minimize patient motion. If the patient is being transported, stop the vehicle if needed. • Check for possible causes of radio and electrical interference and remove them from the area. • Responders and bystanders should minimize motion, particularly in dry environments that can generate static electricity.
Voice and text prompts: NO SHOCK DELIVERED	The patient impedance is not within the specifications for the FR2+ to deliver a shock.	<ul style="list-style-type: none"> • Make sure the defibrillator pads are correctly positioned on the patient according to the diagram on the back of the pads. • Make sure the defibrillator pads connector is completely inserted in the connector socket. • Press the defibrillator pads firmly to the patient's chest. • Replace the defibrillator pads if necessary.
Voice prompt: SHOCK BUTTON NOT PRESSED	Shock has been advised but not delivered within 30 seconds. (FR2+ has been disarmed.)	When next prompted, press the Shock button to deliver shock.

General troubleshooting

symptom	possible cause	recommended action
<p>Status Indicator: FLASHING RED X Audio signal: CHIRPING</p>	<ul style="list-style-type: none"> • The energy remaining in the battery is low. (Nine shocks remain when the flashing red X first appears.) • The FR2+ has been stored outside the recommended temperature range. • An error has been detected as part of the selftest. • The FR2+ has been unable to perform its daily selftests. 	<ul style="list-style-type: none"> • Replace battery with a new M3863A FR2 standard or a charged M3848A FR2+ rechargeable battery as soon as possible. • Remove and reinstall the battery and run a battery insertion selftest. A text prompt will tell you if the FR2+ has been stored outside the recommended temperature range. (See Appendix B for recommended range.) • Remove and reinstall the battery and perform the battery insertion selftest. If it fails, install a new battery and repeat the test. If it fails again, do not use the FR2+. • Make sure defibrillator pads are not attached to the FR2+.
<p>Status Indicator: FLASHING OR SOLID RED X Audio signal: CHIRPING Text prompt (displayed for 10 seconds at the end of a BIT, before FR2+ turns off): NOT READY FOR USE or SELFTTEST FAILED</p>	<p>A test revealed a failure or error. The FR2+ performs selftests every time it is turned on, when a battery is inserted, and periodically while it is in standby mode.</p>	<ul style="list-style-type: none"> • Unplug the pads connector from the FR2+, if connected. • Remove and reinstall the battery and check the results of the battery insertion selftest. If it fails, install a new M3863A FR2 standard battery or a charged M3848A FR2+ rechargeable battery and repeat the test. If it fails again, do not use the FR2+. <p><i>NOTE: You can stop the tests and use the FR2+ as soon as you see the Status Indicator change to the flashing black hourglass. Simply press the On/Off button to stop the test and put the FR2+ into standby mode. The FR2+ is then ready for use.</i></p>

symptom	possible cause	recommended action
Status Indicator: SOLID RED X Audio signal: NONE	<ul style="list-style-type: none"> • The battery is missing or completely depleted. • The Training & Administration Pack is being used in the administration function (the solid red X is normal in this case) or has been left in the FR2+ by mistake. • A selftest detected a failure. 	<ul style="list-style-type: none"> • Install a new M3863A FR2 standard battery or a charged M3848A FR2+ rechargeable battery in the FR2+ and perform the battery insertion test (BIT). • Remove the Training & Administration Pack and install a battery. • Remove and reinstall the battery and perform the battery insertion selftest. If it fails, install a new M3863A FR2 standard battery or a charged M3848A FR2+ rechargeable battery and repeat the test. If it fails again, do not use the FR2+.
Status Indicator: SOLID RED X Audio signal: CHIRPING	<ul style="list-style-type: none"> • The Training & Administration Pack is being used in the ADMINISTRATION function and more than 10 minutes have passed without user interaction (button press or pads change). • The Training & Administration Pack is being used in the TRAINING function and more than 30 minutes have passed without user interaction (button press or pads change). 	<ul style="list-style-type: none"> • To continue using the Training & Administration Pack, press any button (except On/Off). • To return the FR2+ to standby mode, remove the Pack and install a battery.
Status Indicator: NONE	The FR2+ has been physically damaged.	<ul style="list-style-type: none"> • Check for visible damage. Do not use the FR2+ if it appears to be damaged. • Remove and reinstall the battery to perform the battery insertion selftest. If it fails, install a new M3863A FR2 standard battery or a charged M3848A FR2+ rechargeable battery and repeat the test. If it fails again, do not use the FR2+.