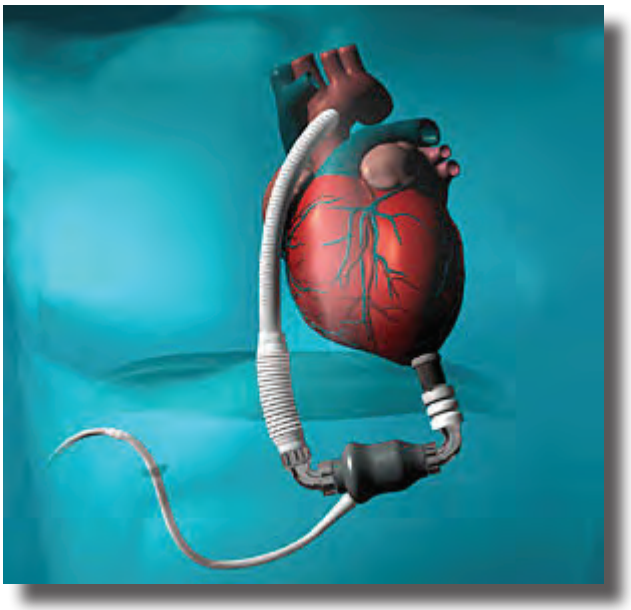
EMS Guide

HeartMate II®

This guide is produced by ICCAC – The International Consortium of Circulatory Assist Clinicians. The ICCAC is the professional society for MCS Clinicians throughout the world. It has been vetted by experts in MCS, Air Medical Transport, and Emergency Services. It should not replace the device operating manual as a primary source of information.

Questions and Answers
Ventricular Assist Device



What is a Ventricular Assist Device (VAD)?

A ventricular assist device (VAD) is a mechanical pump that's used to support heart function and blood flow in people who have weakened hearts.

How does a VAD work?

The device takes blood from a lower chamber of the heart and helps pump it to the body and vital organs, just as a healthy heart would.

What are the parts of a VAD?

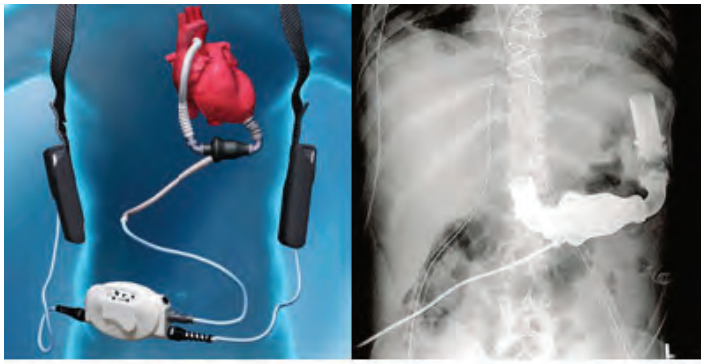
The basic parts of a VAD include: a small tube that carries blood out of your heart into a pump; another tube that carries blood from the pump to your blood vessels, which deliver the blood to your body; and a power source.

What is the power source?

The power source is either batteries or AC power. The power source is connected to a control unit that monitors the VAD's functions. The batteries are carried in a case usually located in a holster in a vest wrapped around the patients shoulders.

What does the control unit or controller do?

The control unit gives warnings, or alarms, if the power is low or if it senses that the device isn't working right. It is a computer.



The portability of the HeartMate II enables patients to resume many of their normal daily activities.

Color Coding System

MOST patients have a tag located on the controller around their waist that says what type of device it is, what institution put it in and a number to call. Most importantly is the color of the tag – it matches this EMS Field Guide and allows you to quickly locate the device you are caring for.

HEARTMATE III

HEARTMATE II

HEARTWARE

JARVIK 2000

FREEDOM DRIVER
Total Artificial Heart

Patient Management For VADs

1. Assess the patients airway and intervene per your protocol.

2. Auscultate Heart Sounds to determine if the device is functioning and what type of device it is. If it is continuous flow device, you should hear a “whirling sound”.

3. Assess the device for any alarms.

4. Look on controller usually found around the waist of the patient and to see what color tag and device it is.

5. Match the color on the device tag to the EMS Guide.

6. Intervene appropriately based on the type of alarm, tag (device) and EMS Guide.

7. Start Large Bore IV.

8. Assess vital signs – Use Mean BP with Doppler – with the first sound you hear is the Mean Arterial Pressure (MAP).

9. If no Doppler, use the Mean on the non invasive blood pressure machine.

10. Transport to closest VAD center. Call the number on the device to get advice.

11. Bring all of the patients equipment.

12. Bring the significant other if possible to act as a expert on the device in the absence of consciousness in the patient.

HeartMate II®

1. **Can I do external CPR?**
   Only if absolutely necessary
2. **If not, is there a "hand pump" or external device to use?**
   No.
3. **If the device slows down (low flow state), what alarms will go off?**
   A red heart alarm light indicator and steady audio alarm will sound if less than 2.5 lmp. Can give a bolus of normal saline and transport to an LVAD center.
4. **How can I speed up the rate of the device?**
   No, it is a fixed speed.
5. **Do I need to heparinize the patient if it slows down?**
   Usually no, but you will need to check with implanting center.
6. **Can the patient be defibrillated while connected to the device?**
   Yes.
7. **If the patient can be defibrillated, is there anything I have to disconnect before defibrillating?**
   No.
8. **Does the patient have a pulse with this device?**
   May have weak pulse or lack of palpable pulse.
9. **What are acceptable vital sign parameters?**
   MAP 70 - 90 mm Hg with a narrow pulse pressure
10. **Can this patient be externally paced?**
    Yes.

FAQs

- May not be able to obtain cuff pressure (continuos flow pump).
- Pump connected to electric line exiting patient's abdominal area and is attached to computer which runs the pump.
- Pump does not affect EKG
- All ACLS drugs may be given.
- No hand pump is available.
- A set of black batteries last approximately 3 hours, gray batteries last 8-10 hours.
- Any emergency mode of transportation is ok. These patients are permitted to fly.
- Be sure to bring **ALL** of the patient's equipment with them.

Adapted from Sweet, L. and Wolfe, Jr., A. Mechanical Circulatory Devices in Transport in ASTNA: Patient Transport Principles and Practice, 4th ed., Mosby, 2010 in press.

Trouble Shooting HeartMate II®

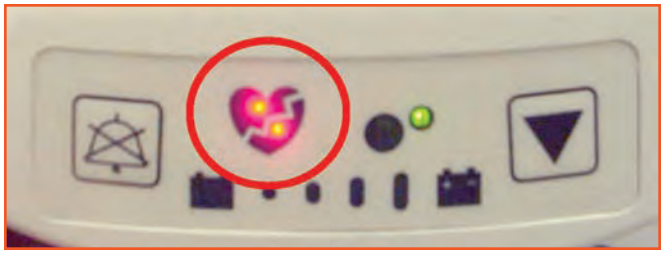
When the Pump Has Stopped

- Be sure to bring ALL of the patient's equipment with them.
- Fix any loose connection(s) to restart the pump.
- If the pump does not restart and the patient is connected to batteries replace the current batteries with a new, fully-charged pair. *(see changing batteries section on next page)*
- If pump does not restart, change controllers. *(see changing controllers section on next page)*

Alarms: Emergency Procedures

Yellow or Red Battery Alarm: Need to Change Batteries. See changing batteries section on next page.

Red Heart Flashing Alarm: This may indicate a Low Flow Hazard. Check patient--the flow may be too low. If patient is hypovolemic, give volume. If patient is in right heart failure-- treat per protocol. If the pump has stopped check connections, batteries and controllers as instructed in the section above.



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Trouble Shooting HeartMate II®

Changing Batteries

WARNING: At least one power lead must be connected to a power source AT ALL TIMES. Do not remove both batteries at the same time or the pump will stop.

- Obtain two charged batteries from patient's accessory bag or battery charger. The charge level of each gray battery can be assessed by pressing the battery button on the battery. (Figures 3 and 4)
- Remove only **ONE** battery from the clip by pressing the button on the grey clip to unlock the battery. (Figure 1)
- Controller will start beeping and flashing green signals.
- Replace with new battery by lining up **RED** arrows on battery and clip. (Figure 2)
- Slide a new, fully-charged battery (Figure 4) into the empty battery clip by aligning the **RED** arrows. The battery will click into the clip. Gently tug at battery to ensure connection. If battery is properly secured, the beeping and green flashing will stop.
- Repeat previous steps with the second battery and battery clip.


Figure 1


Figure 2

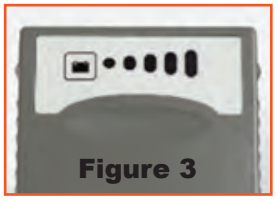
Figure 3


Figure 4

Changing Controllers

- Place the replacement Controller within easy reach, along with the batteries/battery clips. The spare Controller is usually found in the patient's travel case.
- Make sure patient is sitting or lying down since the pump will momentarily stop during this procedure.
- Attach the battery clips to the spare controller by lining up the half moons and gently pushing together and attach the batteries to the spare controller by aligning the **RED** arrows. **ALARMS WILL SOUND-THIS IS OK.**

- Depress the silence alarm button (upside-down bell with circle) until the alarm is silenced on the new, replacement Controller.
- Rotate the perc lock on the replacement controller in the direction of the "unlocked" icon until the perc lock clicks into the fully- unlocked position. Repeat this same step for the original Controller until the perc lock clicks into the unlocked position.

- Disconnect the perc lead/driveline from the original controller by pressing the metal release tab on the connector socket. The pump will stop and an alarm will sound.

Note: The alarm will continue until power is removed from the original Controller. ***Getting the replacement Controller connected and the pump restarted is the first priority.***

- Connect the replacement Controller by aligning the BLACK LINES on the driveline and replacement Controller and gently pushing the driveline into the replacement Controller. The pump should restart, if not complete the following steps:

Step 1. Firmly press the Silence Alarm or Test Select Button to restart the pump.

Step 2. Check the powersource to assure that power is going to the controller.

Step 3. Assure the perc lead is fully inserted into the socket by gently tugging on the metal end. **DO NOT** pull the lead.

- After the pump restarts, rotate the perc lock on the new controller in the direction of the "locked" icon until the perc lock clicks into the fully-locked position. If unable to engage perc lock to the locked position, gently push the driveline into the controller to assure a proper connection. Retry to engage perc lock.
- Disconnect power from the original Controller. The original Controller will stop alarming once power is removed.

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HeartMate II® Controller Comparison Guide

POCKET CONTROLLER™

3 Modes: Run, Charge, Sleep
Run: Driveline + Power source connected.
Charge: Only power source connected.
Sleep: No driveline or power source connected; ready to use.

Backup Battery
An emergency backup battery is built into Pocket Controller, powering the pump for 15 minutes in the absence of an external power source. The backup battery is supplied NONSTERILE.

Event Logger
Pocket Controller includes date/time records in event history. Pocket Controller can store 240 events.

Green Pump Running Symbol
Green "pump running" symbol signifies that the pump is on and running.

Controller Buttons
Display Button: Enables viewing of pump parameters and backup battery charge status.
Silence Alarm Button: Silences hazard alarms for 2 minutes and advisory alarms for 4 hours.
Display Button + Silence Alarm Button Together: Displays previous six alarms.
Battery Button: Displays the battery power gauge when pressed. Activates a self test when held for 5 seconds then released. Enters sleep mode when driveline and external power are disconnected and button is held for 5 seconds then released.

Self Test
Press and hold the Battery Button for 5 seconds.

Low Power
Yellow Diamond Symbol: Displayed when only 15 minutes of external power is remaining.
Red Battery Symbol: Displayed when only 5 minutes of external power is remaining.
Backup Battery Mode: Entered after external power is depleted. Provides 15 minutes of internal emergency backup battery power.
Power Saver Mode: Entered when pump has run on backup battery for 15 minutes. Pump Speed is reduced to the set Low Speed Limit.

Starting the Pump
>8000 RPM: Pump starts automatically.
<8000 RPM with Backup Battery: Start pump by pressing any button on Pocket Controller.
<8000 RPM with no Backup Battery: Pump can only be started via System Monitor.

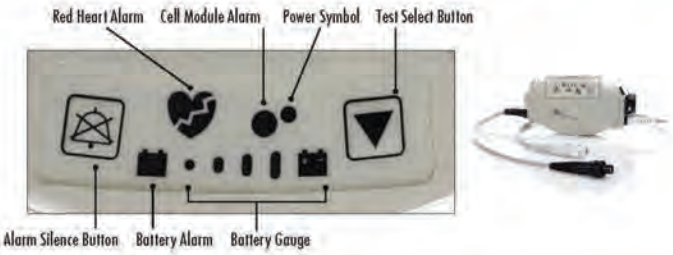
System Monitor Event History Screen

PI Event:	10/04/13 07:20	4.8	9590	5.6	5.4	PI Event
System Information:	10/04/13 01:30	4.8	6900	5.7	6.6	* System Information

Compatibility
System Monitors I and II, Power Module, Power Module Patient Cable (14 Volt), 14 Volt Lithium-Ion Batteries and Battery Clips.

Alarms
For a review of alarms and their meanings, reference HeartMate II Alarms for Clinicians, item 107526. Pocket Controller includes a yellow wrench icon to denote advisory alarms. Note that Pocket Controller includes drivelines fault detection.

EXTERNAL PERIPHERAL CONTROLLER (EPC)



2 Modes: On, Off
On: Driveline + Power source connected.
Off: No driveline or power source connected.

Cell Module Battery
No backup battery. The cell module battery powers an audible tone if EPC is removed from power while the driveline is connected. The cell module battery is supplied STERILE.

Event Logger
EPC does not include date/time records in event history. EPC can store 120 events.

Green Power Symbol
Green light only means that the controller is receiving power. Listen over the pump pocket for confirmation that the pump is running.

Controller Buttons
Alarm Silence Button: Displays the battery fuel gauge. Also silences hazard alarms for 2 minutes and advisory alarms for 4 hours.
Test Select Button: Activates a self test when held for 3 seconds.
Note: EPC does not include a display button or user interface screen. The Display Module is used to view pump parameters and alarm events.

Self Test
Press and hold the Test Select Button for 3 seconds.

Low Power
Yellow Battery Symbol: Displayed when only 15 minutes of external power is remaining.
Red Battery Symbol: Displayed when only 5 minutes of external power is remaining.
Power Saver Mode: Entered when the battery voltage falls to a critically low level. Pump Speed is reduced to 8000 RPM.

Starting the Pump
>8000 RPM: Pump starts automatically.
<8000 RPM: Start pump by pressing Alarm Silence Button or Test Select Button on EPC.

System Monitor Event History Screen

PI Event:	10/04/13 07:20	4.8	9590	5.6	5.4	
System Information:	10/04/13 01:30	4.8	6900	5.7	6.6	*

Compatibility
System Monitors I and II, Power Module, Power Base Unit (PBU), Power Module Patient Cable (12 Volt and 14 Volt), 14 Volt Lithium-Ion Batteries and Battery Clips, 12 Volt SLA and NiMH Batteries and Clips.

Alarms
For a review of alarms and their meanings, reference HeartMate II Alarms for Clinicians, item 103851. Note that EPC does not include driveline fault detection.

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HeartMate II Controller Comparison Guide

DRIVELINE CONNECTION

Pocket Controller:
A safety tab is located on the back of the controller.

Unlocked

Locked

External Peripheral Controller (EPC):
A percutaneous lock is located on the side of the controller.

Unlocked

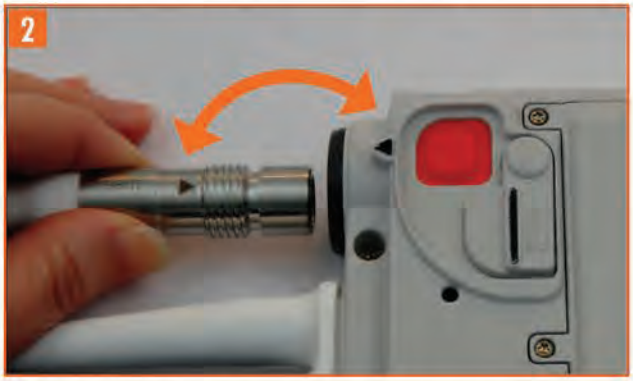
Locked

The Pocket Controller driveline connection and locking mechanism are different from the EPC. To insert and lock the driveline into Pocket Controller:

1

Slide the safety tab back to expose the red button.

2

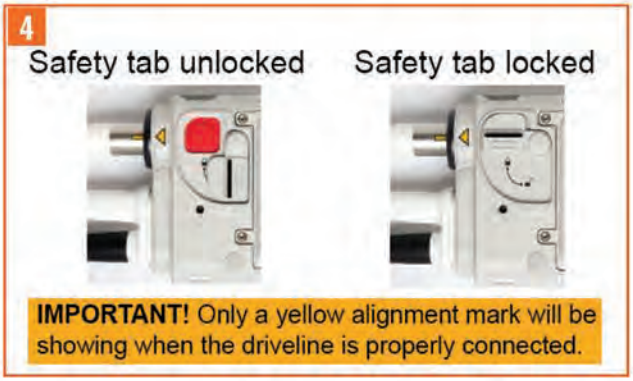


Align the arrow on the driveline to the arrow on the Pocket Controller. Firmly insert the driveline until it snaps into place.

3

Tug gently on the metal portion of the driveline to ensure that it is fully engaged.

4



Slide the safety tab over the red button. Ensure the safety tab completely covers the red button.

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