



*Sutter Transplant & Advanced  
Heart Therapy Service*

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# *Ventricular Assist Device*

## EMS Provider Role

Renee Santos, RN and Sherry Martin, RN, BSN  
Sutter Memorial VAD Coordinator's

# Why Are We Doing This?

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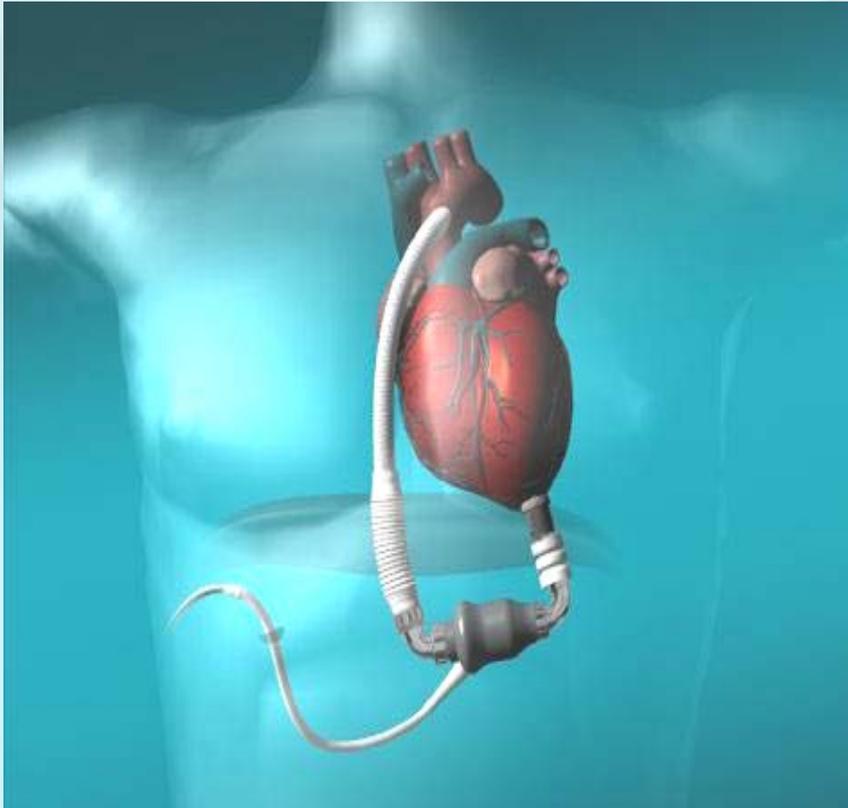
- HeartMate II is used to treat end stage heart failure
- HeartMate II is used as a Bridge to Transplant Device (BTT) or a Destination Therapy Device (DT)
- Bridge to Transplant (BTT) - Patient's goal is to receive VAD therapy as a step to cardiac transplantation
- Destination Therapy (DT) - VAD used as pt's only treatment for heart failure. Typically these pt's are not transplant candidates.

# How It Works

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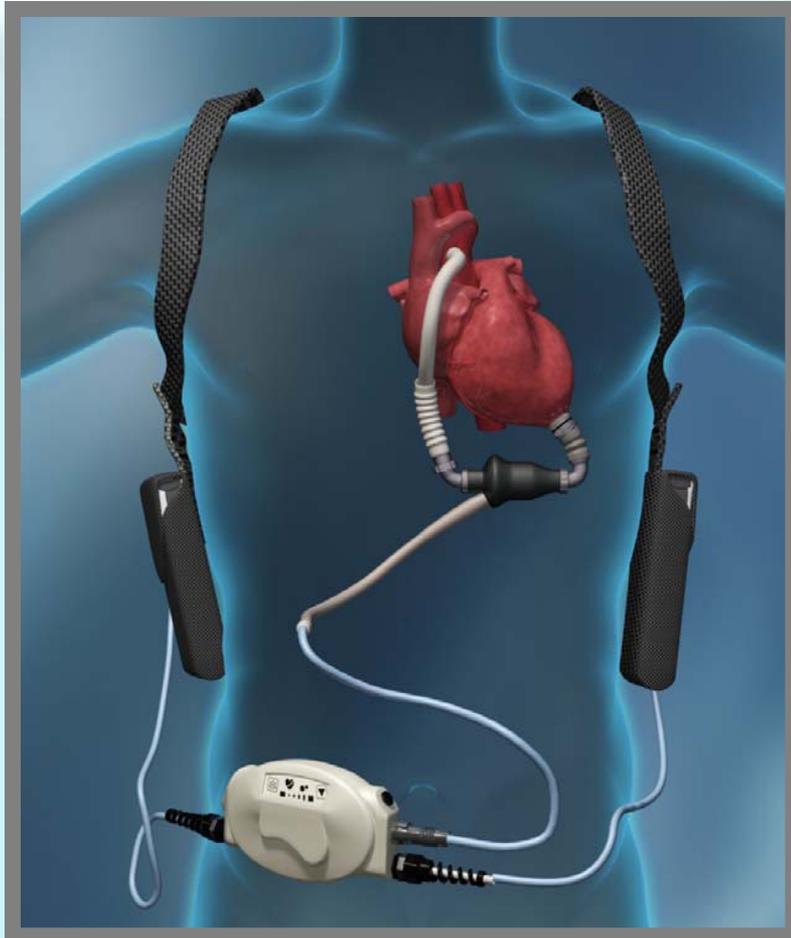


- The HeartMate II pumps blood from the weakened left ventricle to the aorta.
- The inflow graft is connected to the apex of the left ventricle.
- The outflow graft is stitched to the ascending aorta.
- This pump is designed to last for up to ten years.

# HeartMate II LVAD



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- HM II Components:
  - Implantable titanium blood pump
  - System Controller
  - Display Module
  - Power Sources
    - Power Module
    - UBC (charges batteries)
    - Batteries & Clips
    - Emergency Power Pack



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*How do you care for patient with  
a VAD?*

# Forget Everything You Know

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- Non-pulsatile VAD pt's go against everything you have ever been taught.
  - No pulse
  - No systolic and diastolic blood pressure - they have one number which is typically obtained via doppler
  - O2 sats may or may not be accurate
  - VAD can maintain perfusion even in the presence of V-fib (pt could be walking and talking)



# *Important Clinical Information*

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- Pt's are typically pulseless as this is a continuous flow device.
- Automatic blood pressures are not accurate and usually can't be obtained as pt's do not have systolic or diastolic function d/t the continuous flow provided by the VAD.
- May be difficult to obtain an O<sub>2</sub> saturation d/t lack of pulsatility.

# *Important Clinical Information*

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- **NO CHEST COMPRESSIONS**
  - These patient's should not have chest compressions performed as it may dislodge their grafts and cause sudden death.



# *Important Clinical Information*

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- Pump flow is not intuitive like the native heart and cannot adjust for patient activity. Many pt's experience orthostatic hypotension.
- The pump is very fluid sensitive as it must have volume to flow through the pump or ventricular "suck down" may occur. Hypovolemia can cause pump malfunctioning and pt's can become symptomatic even in the presence of mild hypovolemia.
- Pt is anticoagulated on Coumadin.





# *Assessment*

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- Vital signs done **per protocol**
  - Blood pressure via auscultation (more likely) or in very few cases, palpation if able to obtain - automatic blood pressures are not accurate and should not be used as an indication to treat. Pt's will only have one number which can represent a "mean" blood pressure. This number typically ranges 65-100, but can vary depending on pt's needs.
  - Heart rate may be obtained by ECG and often by auscultation. Palpation will not be accurate.
  - O2 saturation - also difficult to obtain as pt is pulseless. May also be inaccurate. Please use clinical judgment - if pt appears adequately perfused, no SOB and good cap refill, but sats read 60% do not trust the number.

**\*\*Must use rudimentary forms of assessment such as checking capillary refill to check for extremity perfusion\*\***





# *What You Can Do*

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- Administer ACLS medications - no medication is contraindicated in relation to the VAD
- Cardiovert and Defibrillate without any risk to the device
- Access the on-call VAD Coordinator 24/7 whether the emergency is pump related or not.



# *Where Do the VAD Patient's Transport to*

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- Typically, if able, the VAD pt's should be routed to the nearest VAD center. Currently Sutter Memorial is the only VAD Center in the Sacramento area.
- Reasons not to transport a VAD pt to Sutter Memorial:
  - Unable to establish an airway
  - Trauma's (transport to the nearest trauma center and notify SMH on-call VAD Coordinator immediately)
  - Burn's (transport to the nearest burn center and notify the SMH on-call VAD Coordinator immediately)

# *The Little Black Bag*

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- VAD pt's are required to carry an emergency bag with them at all times.
- It contains
  - back-up equipment
  - extra batteries
  - ID card
  - EMS instructions with VAD Coordinator pager numbers
  - Alarm Guide



# General Safety

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- Patient must wear abdominal binder or driveline anchor at all times with the System Controller properly attached to the binder or other peripheral equipment.
- Must avoid any activities that cause a jarring motion of the driveline.
- Patient must have emergency pack with them at all times (contains back-up controller, extra batteries, emergency card with contact info for VAD Team, medication list, alarm guide)

# System Controller

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The Brains of the  
Operation:

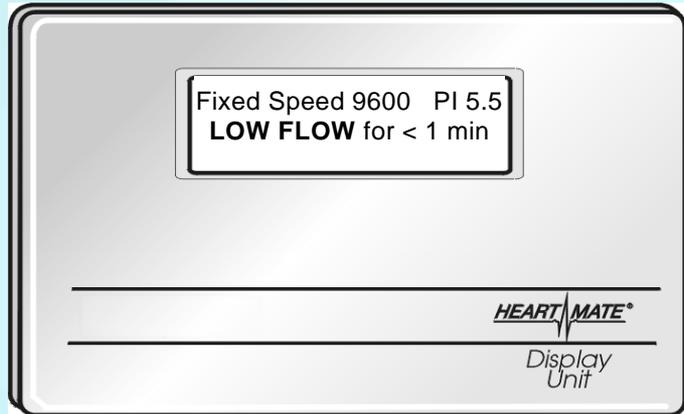
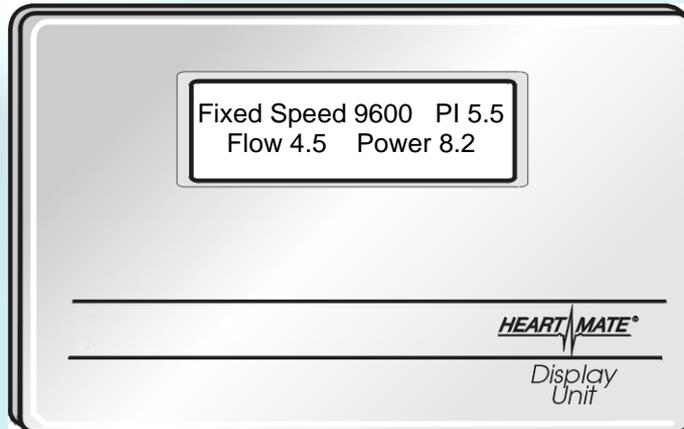
- Controls pump speed and power
- Provides hazard and advisory alarms
- Provides complete backup system

**\*\* This must be connected to  
pt at all times\*\***





# Display Monitor



- The home Display Monitor displays all VAD data.
- It can also display alarms as they occur.

**This only displays numbers when pt is connect to the PM – you won't get a reading if the pt is on battery power.**

# Power Module



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- Supplies power to the LVAD
- Repeats alarm conditions



**\*\*Note – if transporting a VAD pt this piece of equipment must go with them. It is there power source.**

# Universal Battery Charger

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- Tests and charges batteries
- Calibrates batteries



# Li-Ion Batteries

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- Provide 10 hours of battery operated power



**\*\*Note – if transporting a pt please take all extra batteries with the pt**

# Power Base Unit (PBU)

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- Supplies power to LVAD
- Test and charge up to six batteries (8 hours)
- Repeats alarms generated by the System Controller

**\*\*Note – this is the old unit. The Power Module and Battery Charger replace this unit– there are still a few pt’s with this machine.**



# *Batteries*

- 3 - 5 hours of support on a pair of batteries
- Eight hour recharge for fully discharged battery



**\*\*These are the older batteries that will be associated with the older power machine.**



# Alarm Events



System Controller Warning Lights & Sounds				
Warning Lights	Audio Tone	Alarm Message	Meaning	Action
	Steady Audio Tone	LOW FLOW HAZARD (on Display Module) LOW FLOW, PUMP OFF and/or PUMP DISCONNECTED (on System Monitor)	Pump flow < 2.5 lpm, pump has stopped, perc lead is disconnected, or pump is not working properly.	<ol style="list-style-type: none"> <li>1. Make sure System Controller is connected to the pump.</li> <li>2. Make sure System Controller is connected to a power source (batteries, PBU, or EPP).</li> <li>3. If alarm continues, immediately seek additional help.</li> </ol>
NONE: No Warning Lights and No Green Power Symbol	Steady Audio Tone	NONE	System Controller is not receiving power.	<ol style="list-style-type: none"> <li>1. Make sure System Controller is connected to a power source (batteries, PBU, or EPP).</li> <li>2. If connected and alarm continues, switch to alternate power source.</li> <li>3. If alarm continues after switching power source, replace Controller (see other side for instructions).</li> </ol>
	Steady Audio Tone	LOW VOLTAGE	Less than 5 minutes of battery power remain, voltage is too low, or the System Controller is not getting enough power from the PBU.	<p>Immediately replace depleted batteries with new, fully-charged set. Change batteries <b>one at a time</b>. If fully-charged batteries are not available, switch to PBU or EPP.</p> <p><b>WARNING! Do NOT remove power from both power leads at the same time, or the pump will stop.</b></p> <p><b>Note:</b> Pump speed will gradually decrease to save power (i.e., "Power Saver Mode") until the condition is resolved and the alarm clears.</p>
	1 Beep Every 4 seconds	Low Voltage Advisory	Less than 15 minutes of battery power remain, voltage is too low, or the System Controller is not getting enough power from the PBU.	<p>Immediately replace depleted batteries with new, fully-charged set. Change batteries <b>one at a time</b>. If fully-charged batteries are not available, switch to PBU or EPP.</p> <p><b>WARNING! Do NOT remove power from both power leads at the same time, or the pump will stop.</b></p>
NONE: No Warning Light	Broken Audio Tone (repeating cycle: 1 beep per second for 2 seconds, followed by 2 seconds of silence)	REPLACE SYSTEM CONTROLLER (on System Monitor) REPLACE SYSTEM DRIVER (on Display Module)	System Controller is operating in back-up mode.	<ol style="list-style-type: none"> <li>1. Replace the System Controller (see other side for instructions).</li> <li>2. Notify the patient's physician.</li> <li>3. Obtain a new backup System Controller.</li> <li>4. Program the new backup Controller with settings prescribed for this patient.</li> </ol>
	1 Beep Every 4 Seconds	SC CELL MODULE LOW (on System Monitor) REPLACE SYSTEM DRIVER (on Display Module)	The battery module that powers the System Controller audible alarm is depleted.	Replace the System Controller Battery Module.
	1 Beep Every Second	POWER CABLE DISCONNECTED	One of the power leads is damaged or disconnected.	<ol style="list-style-type: none"> <li>1. Reconnect or tighten disconnected/loose power lead.</li> <li>2. If alarm continues, check System Controller power lead and PBU power lead for damage.</li> <li>3. If System Controller power lead or PBU power lead is damaged, replace the Controller (see other side for instructions), and/or replace the PBU cable.</li> <li>4. Obtain a new, backup System Controller for this patient, if necessary.</li> </ol>
NONE: No Warning Light	NONE on PBU w/System Monitor 1 Beep Every 4 Seconds when on Batteries or PBU (w/Display Module)	WARNING: Low Speed Operation	Pump is operating below low speed limit.	Connect System Controller to System Monitor (audio alarm will stop) and increase fixed speed setting or reduce low speed limit.

**\*\*This is the alarm guide that can help you in the event of a VAD alarm. Pt's keep a copy at home (usually on the fridge or by the phone) and a copy in their black emergency bag.**

# VAD Coordinator's



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- Pt's are taught to call 911 in an emergency then page the on-call VAD Coordinator immediately (whether it is pump related or not)
- Typically we will be on the phone waiting to talk to EMS when you arrive
- If pt is not being transferred to Sutter Memorial, the VAD Coordinator needs to know where the pt is going so they can meet the patient in the ED.



# *Transporting*

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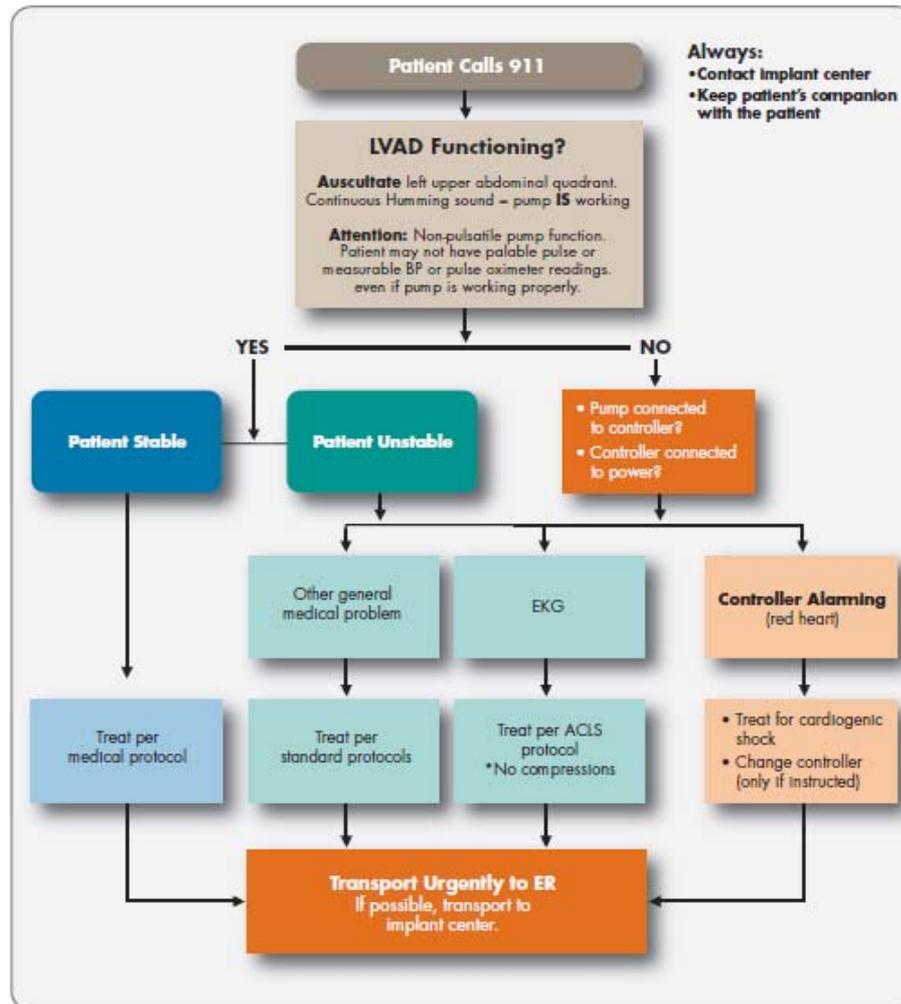


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- The caregiver should transport in the ambulance with the patient. They will be your equipment expert.
- Emergency bag should be with pt at all times.
- Please bring pt's power source and battery charger with the pt.



## HeartMate II® LVAS Patient Assessment Protocol



# VAD Coordinator Contact Info

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*Sutter Transplant & Advanced  
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- Sherry Martin RN, BSN
- 916-396-9402 (cell)
- 916-523-9495 (pager)
- 916-733-8133 (answering service - after hours to reach on-call VAD Coord)
- Renee Santos, RN
- 916-281-8561 (cell)
- 916-762-5840 (pager)
- 916-733-8133 (answering service - after hours to reach on-call VAD Coord)

**\*\* A VAD Coordinator is on-call at all times \*\***