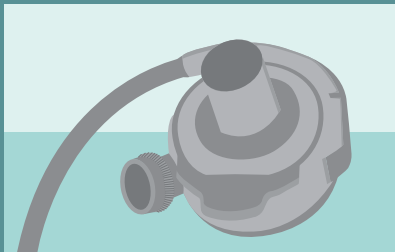


# HeartMate 3™ LVAD

## Algorithms & Care Guide



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# Pump Settings

## **FLOW:** Liters Per Minute (LPM)

Flow is estimated by the power used at a set speed. Increased speed should increase flow.

## **SPEED:** Revolutions per Minute (RPM)

Indicates rotor speed; can only be changed when the patient is connected to the system monitor.



## **POWER:** Watts

Power used to rotate the rotor, pushing blood through the pump.

## **PULSATILITY INDEX (PI):**

As the ventricle contracts during systole and pressure increases, the PI reflects the cardiac pulsatility and the level of support provided by the pump. It is calculated by:

$$\frac{\text{Power}_{MAX} - \text{Power}_{MIN}}{\text{Power}_{AVG}}$$

# Optimizing Pump Function

## Pulsatility Index *Typical Range 3–5*



Low PI	Speed too high, Aortic Insufficiency, Inflow Obstruction, Late Tamponade
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High PI	Hypovolemia, Pneumothorax, Hypertension, Tamponade, Arrhythmia, Right Heart Failure, Speed too low
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## Flow *Typical Range 3–6 LPM*

Low Flow	Hypovolemia, Hypertension, Tamponade, Right Heart Failure
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High Flow	Aortic Insufficiency, Fully offloaded LV, Pump Thrombus ( <i>falsely elevated flow</i> )
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## Power *Typical Range 3–6 W*

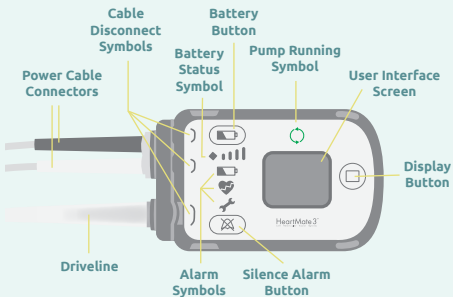


Low Power	Inflow Obstruction (gradual)
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High Power	Pump Thrombus, Thromboembolism, Aortic Insufficiency
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# System Controller

- Constantly monitors and provides power to the device via the driveline
- Pump settings are viewable on the screen using the display button
- Alerts are audio and visual—if an alarm is present, a symbol will illuminate and the alarm type and instructions will appear on the screen



# Controller Change-Out

## Controller Failure

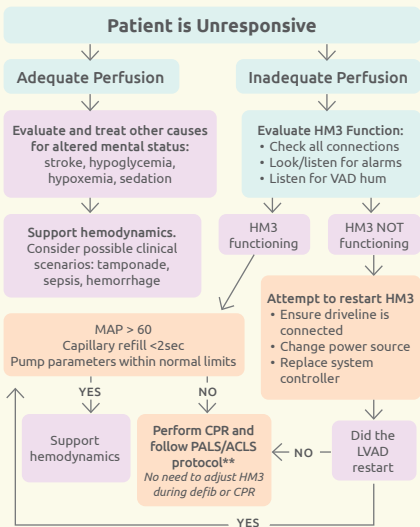
*\*Will require emergent controller exchange*



1. Connect the **back-up controller** to a power source (batteries with clips, power module/monitor, or home mobile power unit)
2. Open the **safety lock** on the malfunctioning controller and press the **red button** to release the driveline—while pressing the red button, pull the driveline out of the malfunctioning controller
3. On the new backup controller, line up the **driveline arrow** to the controller arrow, (ensure modular connector intact) and insert driveline into new controller until you hear a “click”—check that the **pumping running symbol is green** indicating the pump is turned on (pump settings will transfer to new controller automatically)
4. Remember to **close safety lock** once the driveline is engaged



# Circulation & Function



\* Pulsatility should not be used for assessment of adequate perfusion as patient may not be pulsatile at baseline

\*\* See AHA Guideline for further information at:

[www.ahajournals.org/doi/10.1161/CIR.0000000000000504](http://www.ahajournals.org/doi/10.1161/CIR.0000000000000504)

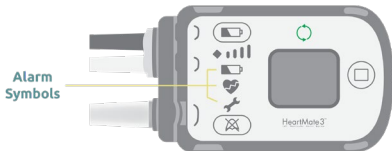
# Alarms

**Hazard:** Red alarms (constant tone) are life-threatening and require immediate intervention—*Potential causes include:*

- ❤️ Pump has stopped running, or controller has failed
- ❤️ Low flow (<2.5LPM, low flow controllers <2.0LPM)
- ❤️ Driveline is disconnected or damaged, causing VAD to stop

**Advisory:** Yellow alarms (fast beeping tone) are important, but non-life-threatening—*Potential causes include:*

- ♦ Low battery (*less than 15 minutes*)
- ) 1 of the 2 power cables is disconnected
- 🛠 Fault with Controller, System, or Pump



*Pressing the mute button will silence alarms for 2 minutes.*

## PUMP OFF

*Pump has stopped running, possibly because power has been disconnected or failed.*

“Call Hospital Contact”

**AND** “Low Flow”

**AND**  *flashing red*

 *solid black*


**ACTION:** Connect to power source. If not resolved, press any button on the Controller to attempt pump start, and immediately call care team.

## NO EXTERNAL POWER

*Controller is not receiving power from either power cable. The pump is being powered by the Controller’s backup battery.*

“Connect Power Immediately” and Backup Battery graphic

**AND**  *flashing red*

 *flashing yellow*  
*(next to power cables)*

**ACTION:** Connect to a working power source (Mobile Power Unit or two charged batteries) to ensure pump does not stop.

## LOW BATTERY *(less than 5 min)*

*Less than 5 minutes of battery power remains.*

“Low Battery”

**AND** “Replace Power Immediately”

**AND**  *flashing red*

**ACTION:** Connect to working power source (Mobile Power Unit or two charged batteries).



## CONTROLLER HARDWARE FAULT

*Controller is not functioning. Pump will operate as long as power is applied to the Controller and no other malfunction occurs. All alarms are not functional.*

“Call Hospital Contact;  
Controller Fault”

**AND**

All Symbols are black

**AND**

All Controller buttons are  
non-functional


**ACTION:** Call care team immediately for diagnosis and instructions. Switch to backup Controller if instructed.

## DRIVELINE DISCONNECTED

*Driveline is disconnected from the Controller or the connector is broken.*

“Connect Driveline”

 *flashing red*

 *flashing red  
next to driveline  
connector*

 *solid black*

**ACTION:** Reconnect the Driveline to Controller. Move Driveline Safety Lock on the Controller to the locked position. Make sure Modular inline Connector is intact and secure.

- If alarm persists after reconnect, press any button on Controller to attempt pump start
- If alarm still persists, replace Controller with backup
- If alarm still persists, call care team

## PUMP STOP & NO EXTERNAL POWER


*Pump has stopped running and mobile power unit has failed, possibly due to static electricity.*

“Connect Power Immediately”

**AND** “Backup Battery”

**AND**  *flashing red*

 *solid black*

 *flashing yellow*  
*(next to power cables)*

 *flashing red*

### **ACTION:**

Connect to charged batteries. If restoring power does not resolve, press any button on the Controller to attempt pump start.

## LOW FLOW

*Pump flow is <2.5 LPM (for low flow controllers: <2.0 LPM)*

“Call Hospital Contact”

**AND**

“Low Flow” alternate

**AND**

 *flashing red*

**ACTION:** Ensure Driveline is connected to the Controller and a power source is connected to the Controller. Call care team for diagnosis.

## Emergency Care

- Defibrillation or cardioversion should be performed if necessary
- Chest compressions should be performed if needed

