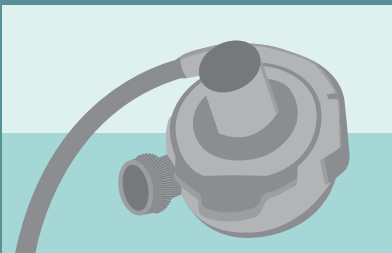


HeartMate 3™ LVAD Algorithms & Care Guide



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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.



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:

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

SPEED: Revolutions per Minute (RPM)

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

Optimizing Pump Function

Pulsatility Index *Typical Range 3–5*



Low PI	Speed too high, Aortic Insufficiency, Inflow Obstruction, Late Tamponade
High PI	Hypovolemia, Pneumothorax, Hypertension, Tamponade, Arrhythmia, Right Heart Failure, Speed too low

Flow *Typical Range 3–6 LPM*

Low Flow	Hypovolemia, Hypertension, Tamponade, Right Heart Failure
High Flow	Aortic Insufficiency, Fully offloaded LV, Pump Thrombus (<i>falsely elevated flow</i>)

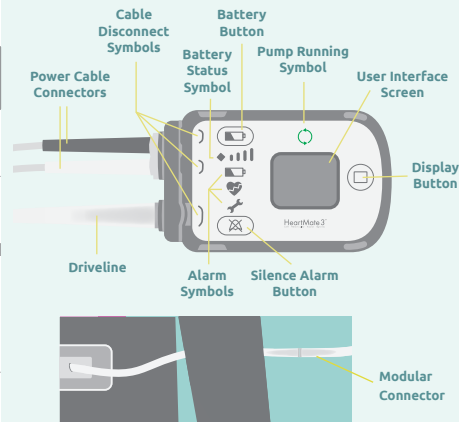
Power *Typical Range 3–6 W*



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

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

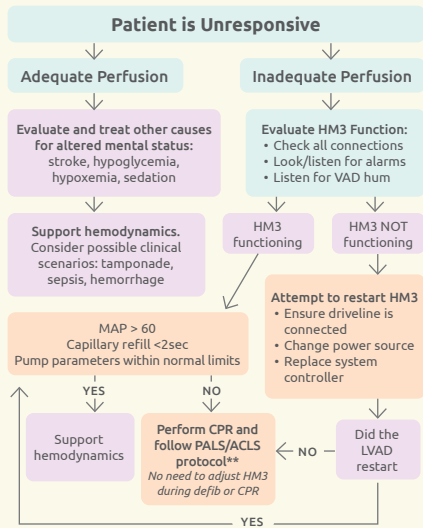
**Will require emergent controller exchange*



- Connect the **back-up controller** to a power source (batteries with clips, power module/monitor, or home mobile power unit)
- 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
- 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)
- 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

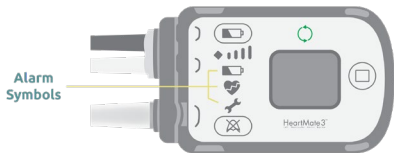
Alarms

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

