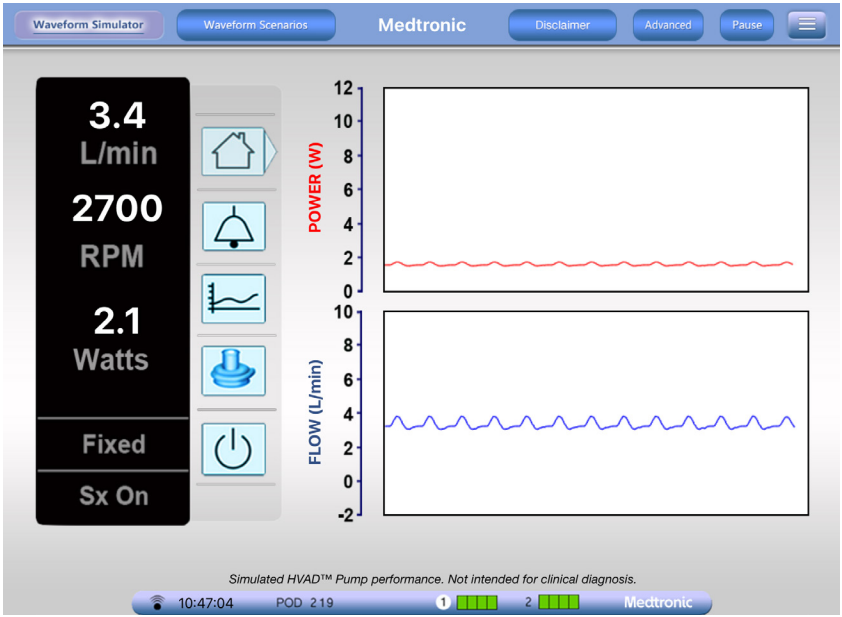
QUICK REFERENCE

HEARTWARE™ HVAD™ PUMP FLOW INDEX

Medtronic

LOW PULSATILITY, LOW FLOW

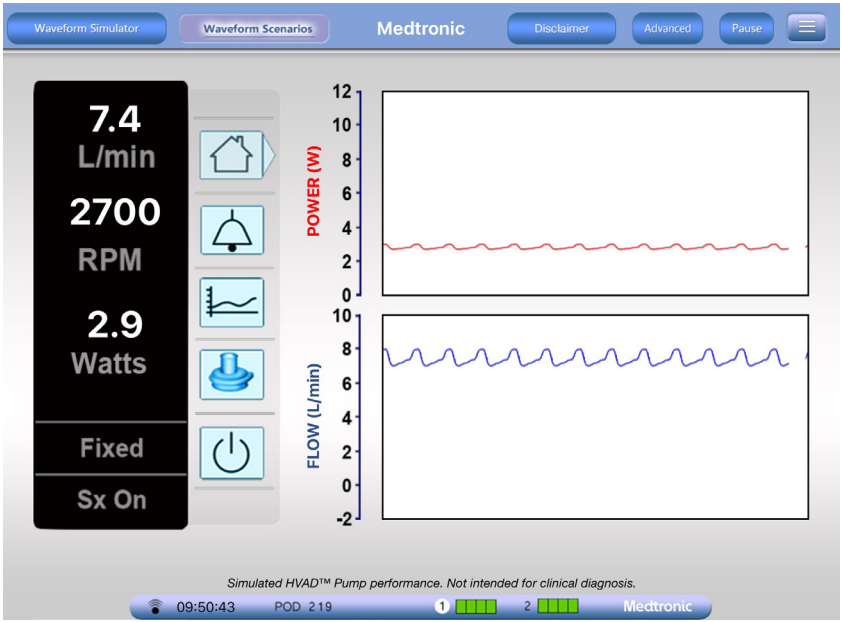


HVAD waveforms do NOT conform to a single, classic appearance, and are not intended for diagnostic purposes. Waveforms represent pump performance.

LOW PULSATILITY, LOW FLOW

Differential	Hemodynamic Changes					ECHO	Interventions to Consider[1]
	CVP	PAP	PAOP	MAP	SVO2		
Hypovolemia	↓	↓	↓	↓	↓	Under-filled	**Give volume; Treat bleeding if cause; Decrease HVAD RPM**
Tamponade	↑	↓	↓	↓	↓	RA/RV Compression	**Surgical takeback**
RHF	↑	↑	↓	↓	↓	Dilated RA/RV	**Decrease HVAD RPM; Inotropes; Mechanical support (RVAD)**
Occlusion	↑	↑	↑	↓	↓	Dilated LA/LV, Ao opening	**Surgical takeback**

LOW PULSATILITY, HIGH FLOW



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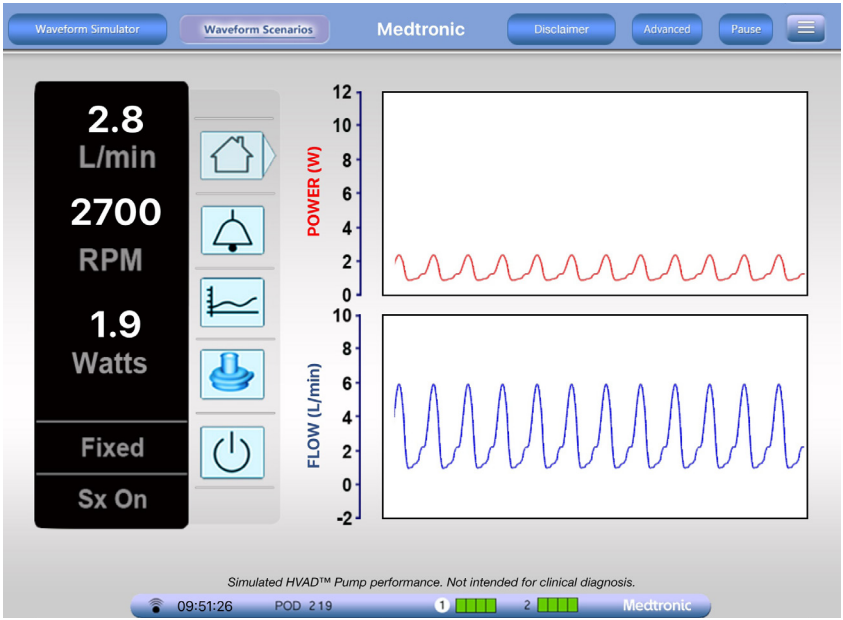
LOW PULSATILITY, HIGH FLOW

Differential	Hemodynamic Changes					ECHO	Interventions to Consider[1]
	CVP	PAP	PAOP	MAP	SVO2		
Vasodilation	↔	↔	↔	↓	↑	Normal Under-filled	**Evaluate for cause (e.g. infection, medications); support with fluid/pressors; Reduce or hold vasodilators**
AI	↔	↑	↑	↓	↓	AI, Increased LVEDD, MR	**Vasodilate; Reduce HVAD RPM; Surgical intervention**
Thrombus*	↑	↑	↑	↓	↓	Dilated LA/LV, Ao opening, MR	**Medical management by increasing antiplatelet and anticoagulation; Thrombolytics; Pump exchange**

*It should be noted that for thrombus the calculated flow will be erroneously high due to increased power consumption.

HIGH PULSATILITY, LOW FLOW



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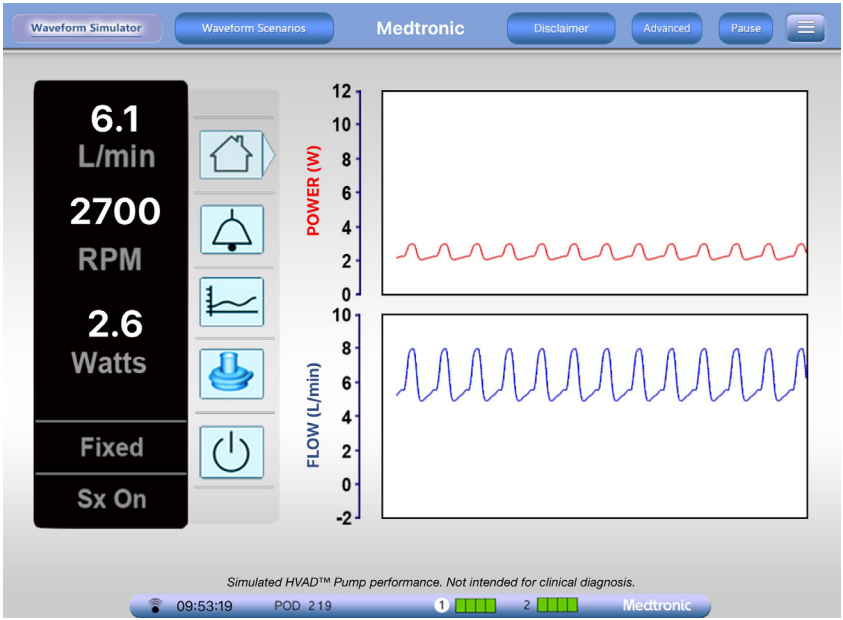
HIGH PULSATILITY, LOW FLOW

Differential	Hemodynamic Changes					ECHO	Interventions to Consider[1]
	CVP	PAP	PAOP	MAP	SVO2		
Hypertension	↔	↑	↑	↑	↔	Dilated LA/LV, Ao opening, MR	**Adjust medications to reduce MAP**
RPM too low	↑	↑	↑	↔	↔	Dilated LA/LV, Ao opening, MR	**Increase RPM**
Continuous Suction*	↓	↓	↓	↓	↓	Under-filled. LV may be collapsed	**Decrease RPM; Give volume; Increase afterload**

*Continuous suction may give the appearance of high pulsatility due to deflections towards zero flow during systole.

HIGH PULSATILITY, HIGH FLOW



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HIGH PULSATILITY, HIGH FLOW

Differential	Hemodynamic Changes					ECHO	Interventions to Consider[1]
	CVP	PAP	PAOP	MAP	SVO2		
Hypervolemia	↑	↑	↑	↑	↑	Normal to dilated	**Fluid removal with diuresis or CRRT**

Brief Statement: HeartWare™ HVAD™ System

Indications
The HeartWare™ Ventricular Assist System is indicated for use as a bridge to cardiac transplantation in patients who are at risk of death from refractory end-stage left ventricular heart failure. The HeartWare System is designed for in-hospital and out-of-hospital settings, including transportation via fixed wing aircraft or helicopter.

Contraindications
The HeartWare System is contraindicated in patients who cannot tolerate anticoagulation therapy.

Warnings/Precautions
Proper usage and maintenance of the HVAD™ System is critical for the functioning of the device. Never disconnect from two power sources at the same time (batteries or power adapters) since this will stop the pump, which could lead to serious injury or death. At least one power source must be connected at all times. Always keep a spare controller and fully charged spare batteries available at all times in case of an emergency. Do not expose batteries to excessive shock or vibration since this may affect battery operation. Do not grasp the driveline cable as this may damage the driveline. Do not pull, kink or twist the driveline or the power cables, as these actions may damage the driveline. Special care should be taken not to twist the driveline including while sitting, getting out of bed, adjusting the controller or power sources, or when using the shower bag. Do not disconnect the driveline from the controller or the pump will stop. If this happens, reconnect the driveline to the controller as soon as possible to restart the pump.

Potential Complications
Implantation of a Ventricular Assist Device (VAD) is an invasive procedure requiring general anesthesia, a median sternotomy, a ventilator and cardiopulmonary bypass. There are numerous risks associated with this surgical procedure and the therapy including but not limited to, death, stroke, device malfunction, peripheral and device-related thromboembolic events, bleeding, infection, hemolysis and sepsis.

Refer to the "Instructions for Use" for detailed information regarding the implant procedure, indications, contraindications, warnings, precautions and potential adverse events prior to using this device. The IFU can be found at www.heartware.com/clinicians/instructions-use.

Caution: Federal law (USA) restricts these devices to sale by or on the order of a physician.

1. Feldman, D, et al. 2013 ISHLT MCS Guidelines. J Heart Lung Transplant, 2013;32:2.

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