

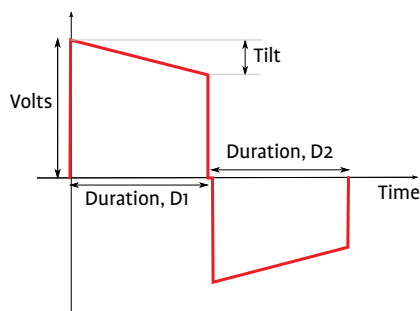
# HeartSine SCOPE™ Biphasic Escalating Waveform

## History

Early external defibrillators used monophasic waveforms and were not designed to compensate for patient impedance. Instead, the devices used selectable energy levels that were set by the attending physician. The physician not only needed to estimate impedance based on a specific patient, but also needed to increase the energy level if defibrillation was not initially successful. In addition, the monophasic waveforms used energy levels up to 360 Joules to defibrillate effectively.

## Biphasic Waveforms

Biphasic waveforms, which were initially developed for use in implantable defibrillators, have become the standard in public access defibrillators. Importantly, many studies have shown that biphasic waveforms defibrillate successfully at lower energies because biphasic waveform technology allows the waveform to be adapted for different patient impedances. For any particular energy level there are three primary variables for the wave shape: voltage, tilt, and the duration of each phase.



Manufacturers of public access defibrillators have adopted different strategies for biphasic waveforms, adjusting one or more of the main variables to compensate for patient impedance. The various approaches are shown in the following table.

Waveform	D1	D2	Voltage	Slope
HeartSine SCOPE	Variable	Variable	Variable	Variable
Cardiac Science STAR	Variable	Fixed	Variable	Variable
Philips SMART	Variable	Variable	Fixed	Variable
Physio-Control	Variable	Variable	Fixed	Variable
Zoll RBW	Fixed	Fixed	Variable	n/a

## SCOPE Waveform

SCOPE (Self Compensating Output Pulse Envelope) is HeartSine's proprietary biphasic waveform. Unlike the technology used by other manufacturers, the HeartSine SCOPE waveform adjusts all three variables for all impedances in the operating range and uses an escalating energy protocol to optimize the efficacy of the samaritan® PAD. The HeartSine SCOPE waveform also is a low energy waveform.

Because biphasic waveforms are adapted for varying patient impedance, the range of patient impedance over which the device operates is significant. As shown in the table below, the SCOPE waveform can deliver a shock over a wide impedance range (20-230 ohms) without a significant loss of energy—another advantage of the HeartSine SCOPE technology.

Waveform	Min. Impedance	Max. Impedance
HeartSine SCOPE	20 ohms	230 ohms
Cardiac Science STAR	25 ohms	180 ohms
Philips SMART	25 ohms	180 ohms
Physio-Control	25 ohms	200 ohms
Zoll RBW	25 ohms	300 ohms*

\* Delivered energy reduces after 175 ohms.

Please note that if the patient impedance is below 20 ohms or in excess of the maximum 230 ohms, the device will NOT deliver a shock.

## References

- Walsh S, McClelland J, Owens CG, Allen J, McCanderson J, Turner C, Adgey J. Efficacy of distinct energy delivery protocols comparing two biphasic defibrillators for cardiac arrest. *Am J Cardiol.* 2004;94:378–380.

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