

CPR Rate Advisor™ ICG technology

Overview

When CPR treatment is provided to a victim of sudden cardiac arrest, it is vital the chest compressions are of a good quality. If the quality of the CPR provided is good, the chances of successfully resuscitating a patient are greatly increased.¹

Research has demonstrated that non-professional responders regularly provide ineffective CPR due to inexperience.^[2,3]

HeartSine samaritan PAD 450P (SAM 450P) with CPR Rate Advisor provides real-time feedback to the rescuer on the rate and fraction of the CPR they are providing to the victim during a sudden cardiac arrest (SCA) resuscitation. The SAM 450P uses both audible and visual feedback to provide instructions to the rescuer.

CPR Rate Advisor provides feedback to the rescuer on the rate of compressions the rescuer is providing to the victim via the defibrillator electrodes, without the addition of accelerometers (or pucks).

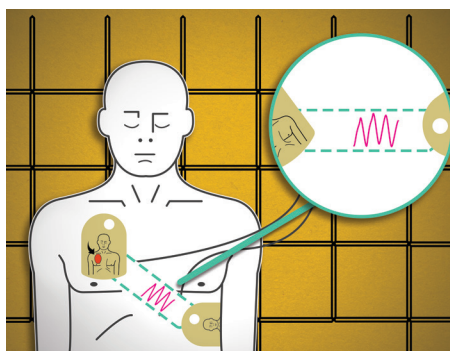


Figure 1. HeartSine's defibrillator detects changes in patient impedance.

How CPR Rate Advisor works

When a patient collapses and a rescuer performs CPR, the compressions applied by the rescuer cause the patient's chest to change shape and result in a change to the patient's ICG (impedance cardiogram) waveform.⁴ CPR Rate Advisor captures the change in the ICG waveform which it uses to count the number of compressions a rescuer administers.

By counting deflections in the ICG waveform, CPR Rate Advisor determines the compression rate and advises the rescuer to "Push faster" if the compression per minute (CPM) rate is below that recommended by the AHA/ERC guidelines (see Figure 2). Likewise, if the rescuer's CPM rate is greater than that recommended by the AHA/ERC guidelines, CPR Rate Advisor will tell the rescuer to "Push slower" (see Figure 3).

The AHA and ERC also recognize the need to keep interruptions to a minimum during CPR. The SAM 450P uses the signals detected through the electrode pads to determine if CPR is being performed when it should be and, if not, will prompt the rescuer to "Begin CPR." The SAM 450P also will detect when compressions have stalled between shock decision cycles and give feedback to the rescuer to ensure that CPR interruptions are minimized to maximize hands-on time (see Figure 4).

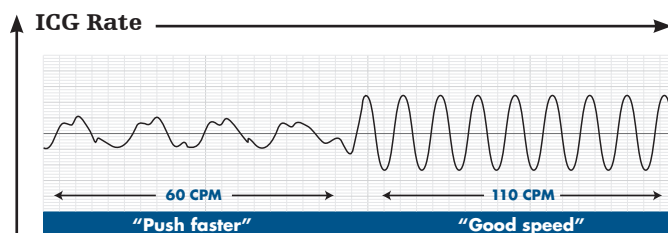


Figure 2. Rescuer's CPR compression rate is too slow, as determined by the low number of deflections detected by the ICG waveform. The SAM 450P will issue the audible prompt "Push faster" until the correct compression rate is achieved.

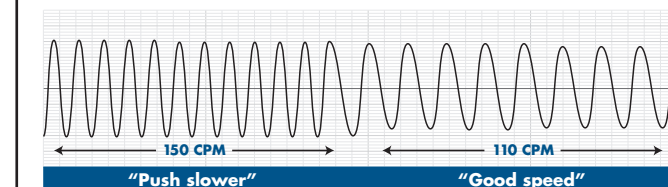


Figure 3. Rescuer's CPR compression rate is too fast, as determined from the high number of deflections detected by the ICG waveform. The SAM 450P issues the audible prompt "Push slower" until the correct compression rate is achieved.

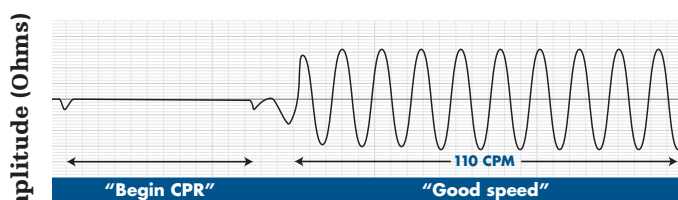


Figure 4. No movement detected in the ICG waveform. In an effort to maximize CPR compression time by the rescuer, the SAM 450P will issue the audible prompt "Begin CPR" repeatedly until CPR is started.

This real-time feedback is important as even though most trained rescuers understand the need to push hard and push fast, rescuer fatigue may set in after as little as one minute, resulting in slower compression rates.^{5,6} The SAM 450P provides compression rate feedback to the rescuer via both visual indicators on the SAM 450P user interface and audible voice prompts (see Figure 5).

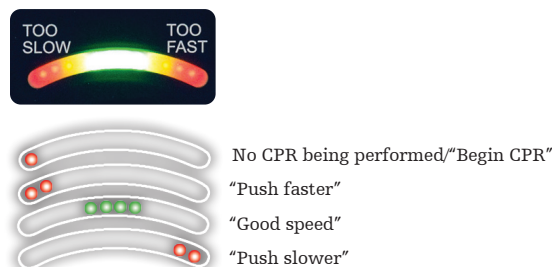


Figure 5. Visual indicators and audible feedback tell the rescuer if the rate of CPR is in line with the AHA/ERC guidelines.

Improved CPR rate efficacy

Usability study results showed that, without compromising compression depth, the percentage of users achieving good compression speed was higher with CPR Rate Advisor when compared to a device without CPR feedback.⁷

Studies have shown that effectiveness of CPR is most likely limited by poor performance in any of its components and that inadequate rate, even in the presence of sufficient depth and technique, likely reduces the effectiveness of CPR compressions.⁸ Evidence suggests that even healthcare professionals do not always achieve the correct CPR compression rates according to AHA/ERC guidelines^{8,9} and that chest compression rate is associated with the return of spontaneous circulation (ROSC).¹⁰

Effective CPR, provided alone or together with a lifesaving shock, can increase the chance of survival.¹¹ CPR Rate Advisor, in conjunction with the metronome, is intended to help rescuers perform CPR in line with the AHA/ERC guidelines by monitoring their real-time CPR performance and helping to guide them toward the correct rate of compressions.

Integrated CPR Rate Advisor helps improve compliance with CPR rate and CPR fraction guidelines. And because CPR Rate Advisor is integrated within HeartSine SAM 450P, a lifesaving shock can be delivered if needed.

References

1. Christenson J, Andrusiek D, Everson-Stewart S, et al. Chest compression fraction determines survival in patients with out-of-hospital ventricular fibrillation. *Circulation*. 2009;120:1241-1247.
2. Gyllenborg T, Granfeldt A, Lippert F, et al. Quality of bystander cardiopulmonary resuscitation during real-life out-of-hospital cardiac arrest. *Resuscitation*. 2017;120:63-70.
3. White AE, Ng H, Ng W, et al. Measuring the effectiveness of a novel CPRcard feedback device during simulated chest compressions by non-healthcare workers. *Singapore Med J*. 2017;58:438-445.
4. Howe A, O'Hare P, Crawford P, et al. An investigation of thrust, depth and the impedance cardiogram as measures of cardiopulmonary resuscitation efficacy in a porcine model of cardiac arrest. *Resuscitation*. 2015;96:114-120.
5. Heidenreich JW, Berg RA, Higdon TA, et al. Rescuer fatigue: standard versus continuous chest-compression cardiopulmonary resuscitation. *Academic Emergency Medicine*. 2006;13(10):1020-1026.
6. Ochoa FJ, Ramalle-Gómara E, Lisa V, Saralegui I. The effect of rescuer fatigue on the quality of chest compressions. *Resuscitation*. 1998;37:149-152.
7. Torney H et al. A Usability Study of a Critical Man-Machine Interface: Can layperson responders perform optimal compression rates when using a public access defibrillator with automated real-time feedback during cardiopulmonary resuscitation. *IEEE Transactions on Human-Machine Systems*. 2016;vol.PP:no.99:1-6.
8. Abella B et al. Chest compression rates during cardiopulmonary resuscitation are suboptimal. *Circulation*. 2005;111:428-434.
9. Milander MM, Hiscok PS, Sanders AB, et al. Chest compression and ventilation rates during cardiopulmonary resuscitation: the effects of audible tone guidance. *Acad Emerg Med*. 1995;2:708-713.
10. Idris A et al. Relationship between chest compression rates and outcomes from cardiac arrest. *Circulation*. 2012;125:3004-3012.
11. Meaney PA, Bobrow BJ, Mancini ME, et al. Written on behalf of the CPR Quality Summit Investigators, the American Heart Association Emergency Cardiovascular Care Committee, and the Council on Cardiopulmonary, Critical Care, Perioperative and Resuscitation. CPR quality: improving cardiac resuscitation outcomes both inside and outside the hospital: a consensus statement from the American Heart Association. *Circulation*. 2013;128:1-19.

BRIEF SUMMARY OF INDICATIONS AND IMPORTANT SAFETY INFORMATION

INDICATIONS FOR USE: The HeartSine samaritan PAD 360P (SAM 360P) and HeartSine samaritan PAD 450P (SAM 450P) are indicated for use on victims of cardiac arrest who are exhibiting the following signs: unconscious, not breathing, without circulation (without a pulse).

The AEDs are intended for use by personnel who have been trained in their operation. Users should have received training in basic life support/AED, advanced life support or a physician-authorized emergency medical response training program. The AEDs are indicated for use on patients greater than 8 years old or over 55 lb (25 kg) when used with the adult Pad-Pak (PAD-PAK-01 or PAD-PAK-07). They are indicated for use on children between 1 and 8 years of age or up to 55 lb (25 kg) when used with the Pediatric-Pak (PAD-PAK-02).

CONTRAINDICATION: If the patient is responsive or conscious, do not use the HeartSine samaritan PAD to provide treatment.

WARNINGS: AEDs:

- The HeartSine samaritan PAD (AED) delivers therapeutic electrical shocks that can cause serious harm to either users or bystanders. Take care to ensure that no one touches the patient when a shock is to be delivered.
- Touching the patient during the analysis phase of treatment can cause interference with the diagnostic process. Avoid contact with the patient while the AED is analyzing the patient. The AED will instruct you when it is safe to touch the patient.
- Do not delay treatment trying to find out the patient's exact age and weight. If a Pediatric-Pak or an alternative suitable defibrillator is not available, you may use an adult Pad-Pak.
- Disconnect non-defibrillation protected electronic devices or medical equipment from the patient before using the AED.
- Do not use the AED in the vicinity of explosive gases, including flammable anesthetics or concentrated oxygen.
- Do not use portable RF communications equipment closer than 12 in (30 cm) to any part of the AED.
- Place pads at least 3.1 in (8 cm) away from a pacemaker.
- The SAM 360P is a fully automatic defibrillator. When required, it will deliver a shock to the patient WITHOUT user intervention.
- The SAM 450P CPR Rate Advisor is only intended to provide feedback on adult patients. If you treat a pediatric patient with the SAM 450P and an adult Pad-Pak, ignore any voice prompts regarding the rate of CPR.
- Do not open or repair the AED under any circumstances as there could be danger of electric shock. If damage is suspected, immediately replace the AED.
- Do not use any accessories other than those specified or provided by HeartSine Technologies as the AED may malfunction.

Pad-Pak and Pediatric-Pak:

- Do not use if the gel is dry.
- Not for use on patients under 1 year old.
- Pediatric-Pak is for use with children up to the age of 8 years or up to 55 lb (25 kg). DO NOT DELAY THERAPY IF YOU ARE NOT SURE OF EXACT AGE OR WEIGHT.
- Pediatric-Pak is suitable for use only with HeartSine samaritan PADs with the adult/child symbol*.
- If the AED you are using does not have this label, use the adult Pad-Pak if no alternatives are available.
- The use of the Pediatric-Pak will enable delivery of 50 J shocks to the pediatric patient.
- It is advised that the Pediatric-Pak is stored separately when not in use.
- Never charge, short circuit, puncture, deform, incinerate, heat above 85°C or expose contents of TSO (Aviation) Pad-Pak to water. Remove when discharged.

PRECAUTIONS: AEDs:

- Check the AED periodically in accordance with the service and maintenance instructions provided in the user manual.
- If you hear a warning message when you turn on your AED, consult Troubleshooting in the user manual.
- Proper placement of the electrode pads is critical. Electrode pads must be at least 1 in (2.5 cm) apart and should never touch one another.
- Do not use electrode pads if pouch is not sealed.
- Do not pull green tab on Pad-Pak during set-up.
- If a non-shockable rhythm is detected, the AED will end its ready to shock condition if it previously decided to shock.
- Use of the AED outside the operating and storage ranges specified in the user manual may cause the AED to malfunction or reduce the shelf life of the Pad-Pak.
- Do not immerse any part of the AED in water or any type of fluid.
- Do not clean the AED with abrasive materials, cleaners or solvents.
- Do not turn on the AED unnecessarily as this may reduce the standby life.
- Do not use any unauthorized accessories with the AED as it may malfunction if non-approved accessories are used.
- Dispose of the AED in accordance with national or local regulations.
- Check with the relevant local government health department for information about any requirements associated with ownership and use of a defibrillator in the region where it is to be used.

Pad-Pak and Pediatric-Pak:

- Single use only. Reuse may cause AED to be unable to deliver therapy leading to a failure to resuscitate or lead to cross-infection between patients.
- Do not use if open or damaged.
- Check expiration date.
- It is advised that a spare Pad-Pak be stored with AED in rear section of carry case.

Saver EVO Software:

- Download the complete HeartSine samaritan PAD memory prior to erasing it. This information should be stored safely for future reference. Ensure that only the events you want to delete have been selected prior to deleting. Once deleted from your computer's memory, events cannot be regenerated, and all information will be lost.

POTENTIAL ADVERSE EFFECTS: The potential adverse effects (e.g., complications) associated with the use of an automated external defibrillator include, but are not limited to, the following:

- Failure to identify shockable arrhythmia
- Failure to deliver a defibrillation shock in the presence of VF or pulseless VT, which may result in death or permanent injury
- Inappropriate energy which could cause failed defibrillation or post-shock dysfunction
- Myocardial damage
- Fire hazard in the presence of high oxygen concentration or flammable anesthetic agents
- Incorrectly shocking a pulse-sustaining rhythm and inducing VF or cardiac arrest
- Bystander shock from patient contact during defibrillation shock
- Interaction with pacemakers
- Skin burns around the electrode placement area
- Allergic dermatitis due to sensitivity to materials used in electrode construction
- Minor skin rash

CAUTION: U.S. Federal law restricts the SAM 360P and SAM 450P AEDs to sale by or on the order of a physician.

Please consult the user manuals at heartsine.com for the complete list of indications, contraindications, warnings, precautions, potential adverse events, safety and effectiveness data, instructions for use and other important information.



All claims valid as of 04/2023.

For further information, please contact your Stryker representative or visit our website at strykeremergencycare.com

Emergency Care Public Access

AED users should be trained in CPR and in the use of the AED. Although not everyone can be saved, studies show that early defibrillation can dramatically improve survival rates. AEDs are indicated for use on adults and children. AEDs may be used on children weighing less than 25 kg (55 lb) but some models require separate defibrillation electrodes.

The information presented is intended to demonstrate Stryker's product offerings. Refer to operating instructions for complete directions for use indications, contraindications, warnings, cautions, and potential adverse events, before using any of Stryker's products. Products may not be available in all markets because product availability is subject to the regulatory and/or medical practices in individual markets. Please contact your representative if you have questions about the availability of Stryker's products in your area. Specifications subject to change without notice.

Stryker or its affiliated entities own, use, or have applied for the following trademarks or service marks: CPR Rate Advisor, HeartSine, Pad-Pak, Pediatric-Pak, samaritan, Saver EVO, Stryker. All other trademarks are trademarks of their respective owners or holders.



HeartSine samaritan PAD: UL Classified. See complete marking on product.

Date of Issue: 04/2023

Made in U.K.

H009-020-008-AG EN-US

HeartSine SAM 450P is not available for sale outside of the U.S. or Japan.

Copyright © 2023 Stryker.



Manufactured by:

HeartSine Technologies, Ltd.
207 Airport Road West
Belfast
Northern Ireland
BT3 9ED
United Kingdom
Tel +44 28 9093 9400
Fax +44 28 9093 9401
heartsinesupport@stryker.com
heartsine.com

Distributed in U.S. by:

Stryker Emergency Care
11811 Willows Road NE
Redmond, WA, 98052 U.S.A.
Toll free 800 442 1142
strykeremergencycare.com