### GE Healthcare

# Marquette 12SL ECG analysis program

Offering exceptional value throughout the continuum of care



# Setting the mark for clinical validity and excellence in ECG analysis

Since the introduction of the Marquette\* 12SL ECG analysis program in 1980, GE Healthcare has consistently expanded its electrocardiograph-based suite of ECG analysis programs and capabilities. Today, we continue to lead developments in computerized ECG analysis, setting even higher levels of clinical accuracy, validity, and performance. Through extensive clinical evaluation and the use of classic and newly developed ECG interpretation criteria and measurement technologies, we steadily refine and improve our comprehensive suite of ECG analysis programs.

Our commitment to improving the science of ECG interpretation has led to the use of our analysis programs across GE diagnostic ECG and monitoring systems, as well as implementation into other industry-leading products. This implementation makes our programs a preferred choice in a variety of care settings and industries including emergency medicine, inpatient, outpatient, and clinical research organizations (CROs).



#### **Clinically validated improvements**

Any change to an analysis program requires a great deal of research and validation. The Marquette 12SL ECG analysis program is continually refined through the following processes:

- **Regular clinical input** Continuous input is gathered from some of the world's top consulting cardiologists and physicians. This input helps to focus our research and development efforts.
- Clinically correlated "Gold-Standard" databases GE utilizes different databases during the development and validation processes to enhance program accuracy. This precludes us from developing an analysis program that works well on a training set of ECGs, but cannot be applied with the same success to other populations.
- Beyond Gold-Standard databases Clinically-correlated databases help to improve program accuracy, but they also have limitations. Analysis programs must work with a wider spectrum of ECG data. To accomplish this task, GE measures its analysis program performance on a large database of ECGs (>50,000). This process challenges the program with multiple diseases and varying degrees of abnormality. ECGs with changed analysis results due to program modification can be further investigated with expert confirmation.

The result of all this work is improved program accuracy, which in turn helps clinicians to improve patient care.

#### A complete suite of state-of-the-art ECG analysis

With the Marquette 12SL's arrhythmia and chest pain assessment capabilities, gender-specific criteria and risk stratification tools, a wider range of disease management needs can be addressed. This means physicians are assisted in making more efficient and informed clinical decisions. Ongoing development by one of the industry's leading advanced development staff provides the latest in capabilities. Validation against global, clinically-verified databases offers verified accuracy with multiple patient populations.

- Serial ECG comparison<sup>†</sup> The Marquette 12SL ECG Analysis Program and the Marquette Serial Comparison Program provide a consistent analysis and comparison of waveforms across each and every ECG, helping to ensure reproducibility and objectivity through all phases of patient care.
  - Provides department supervisors with a means to run efficient operations.
  - Utilizes interpretive statements, ECG measurements and waveform comparison techniques to maximize performance and accuracy in the detection of clinically-significant changes.
  - Emulates the techniques used by trained electrocardiographers when comparing serial ECGs.

- **Gender-Specific criteria** Marquette 12SL with Gender-Specific interpretation applies criteria for evaluating the ST segment and T wave of the ECG waveform, improving sensitivity to acute myocardial infarction in women and enhancing diagnostic confidence.
  - Improved the sensitivity for detection of acute anterior MI from 42% to 48% in women under 60 years of age.<sup>1</sup>
  - 25% relative improvement in detection of acute inferior MI in women under 60 years of age without sacrificing the high specificity already maintained by the program.<sup>2</sup>
- Experience in QT measurement accuracy Identifying prolonged QT is important as the condition can result in serious arrhythmia and Sudden Cardiac Death. However, it can be difficult to measure QT accurately due to factors like ECG noise, difficulty defining the end of the T wave, and requiring corrections for heart rate. GE has concentrated its efforts in helping to minimize these challenges through the 12SL program:
  - 12SL measures QT from a median complex, resulting in a cleaner representative complex for measurement
  - Uses global fiducial points from all 12 simultaneous leads for consistency, reproducibility, and accuracy
  - When the Marquette Hookup Advisor\* program is used prior to acquiring the ECG to determine a quality signal, QT interval measurement accuracy has been shown to improve<sup>3</sup>
  - Offers multiple QT correction factors including Bazett, Framingham<sup>††</sup>, and Fridericia<sup>††</sup>





By using all leads of the median complex to define the end of ventricular repolarization, 12SL offers accuracy and consistency in QT measurement

• Analysis of Artificially–Paced Rhythms – When an artificial pacemaker stimulus is detected, the Marquette 12SL program will identify the underlying rhythm. And in conjunction with the CAM HD, GE's high-definition ECG acquisition module, the 12SL program is able to identify a biventricular paced rhythm.



#### Advanced Interpretation of Paced Rhythms

Marquette 12SL provides analysis for detecting bi-ventricular pacemakers, identifying the underlying rhythm, in addition to the chamber(s) being paced

- Acute Coronary Syndrome Tool The 12SL ACS tool<sup>†††</sup> provides higher-sensitivity analysis for ST-Elevated MI or Acute Ischemia for patients suspected of having an acute cardiac event. The tool heavily weighs the finding of ST elevation with reciprocal ST depression. This is a very important and highly-specific indicator of STEMI and ACS that has been found to "identify patients who stand to benefit most from early interventional strategies."<sup>4</sup> A study evaluated on over 1,900 clinically correlated ECGs from patients suspected of having ACS showed that the ACS tool:
  - Improved the sensitivity of emergency physicians' interpretation of acute myocardial infarction by 50% and cardiologists' interpretations by 26%, with no loss of specificity<sup>5</sup>
  - Improved the sensitivity of emergency physicians' acute ischemic syndrome interpretation by 53% while maintaining a specificity of 91%<sup>5</sup>

## Why use the GE Marquette 12SL ECG analysis program?

- Meets all applicable standards for computerized resting ECG analysis<sup>6</sup>, including 15 lead analysis for pediatric patients.<sup>7</sup>
- Automated decision support that has clinical "gold standard" verified accuracy and is tested against a large database of ECGs with multiple diseases and varying degrees of abnormality.
- Suggests additional findings not initially detected and encourages careful, targeted review of the ECG tracing.
- Computerized analysis including atrial arrhythmias, pace detection, and QT measurement.
- Minimizes the time spent over-reading ECGs.8
- Provides measurements of heart rate, axis, intervals and durations.
- Pediatric age-driven interpretation criteria.
- Adult gender and age driven interpretation criteria for acute MI. Utilized in pre-hospital defibrillators to identify clinically-significant changes and expedite patient care in time-critical environments.
- Assists with ECG interpretation training assistance.

#### A pioneer in technology innovation

GE has pioneered the technology and expertise by making the Marquette 12SL program available throughout a patient's entire cardiac experience, from pre-hospital through follow-up. The Marquette 12SL program operates on a variety of platforms and currently exists in these areas:

- Pre-hospital environment
- Emergency department
- General hospital departments
- CCU/ICU
- Exercise testing labs
- Clinics
- Physician offices

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GE Medical Systems Information Technologies, a General Electric company, going to market as GE Healthcare.

Computerized analysis is not a substitute for physician interpretation. The ECG, therefore, must always be reviewed in light of the surrounding clinical circumstances.

- <sup>1</sup>Wright, R.S., et.al. "Women with Acute Anterior Myocardial Infarction Have Less Precordial ST Elevation Than Men Independent of Age of Presentation." J Am Coll Cardiol. 37(2001): 361A.
- <sup>2</sup>Xue, J., et.al. "A New Method to Incorporate Age and Gender Into the Criteria for the Detection of Acute Inferior Myocardial Infarction." J Electrocardiol. 34(4) (Part 2) (Oct 2001): 229-234.
- <sup>3</sup> Farrell, R.M. and Rowlandson G.I., The effects of noise on computerized electrocardiogram measurements. J Electrocardiol, 2006. 39(4 Suppl): p. S165-73.
- <sup>4</sup> Otto, L.A. and T.P. Aufderheide, Evaluation of ST segment elevation criteria for the prehospital electrocardiographic diagnosis fo acute myocardial infarction. Ann Emerg Med, 1994. 23(1): p. 17-24.
- <sup>5</sup> Xue, J., et al., Added value of new acute coronary syndrome computer algorithm for interpretation of prehospital electrocardiograms. J Electrocardiol, 2004. 37 Suppl: p. 233-9.
- <sup>6</sup> International Standard IEC 60601-2-51:2003 Medical electrical equipment. Particular requirements for safety, including essential performance, of recording and analyzing single channel and multichannel electrocardiographs, I.E.C. (IEC), Editor. 2003, International Electrotechnical Commission (IEC).

- <sup>7</sup>Schwartz PJ, Garson A Jr, Paul T, Stramba-Badiale M, Vetter VL, Wren C. "Guidelines for the interpretation of the neonatal electrocardiogram. A task force of the European Society of Cardiology." Eur Heart J 2002 Sep;23(17):1329-44.
- <sup>8</sup> Brailer DJ, Kroch E, Pauly MV. "The Impact of Computer-assisted Test Interpretation on Physician Decision Making: The Case of Electrocardiograms" Med Decis Making. 1997 Jan-Mar;17(1):80-6
- <sup>†</sup>Serial comparison is available only in conjunction with the MUSE ECG management system
- <sup>11</sup> Framingham and Fridericia not available in all GE Healthcare ECG devices. Contact your GE Healthcare Representative for more details.
- <sup>+++</sup> The 12SL ACS algorithm is not available in all GE Healthcare ECG devices. Contact your GE Healthcare Representative for more details.

#### About GE Healthcare

GE Healthcare provides transformational medical technologies and services that are shaping a new age of patient care. Our broad expertise in medical imaging and information technologies, medical diagnostics, patient monitoring systems, drug discovery, biopharmaceutical manufacturing technologies, performance improvement and performance solutions services helps our customers to deliver better care to more people around the world at a lower cost. In addition, we partner with healthcare leaders, striving to leverage the global policy change necessary to implement a successful shift to sustainable healthcare systems.

Our "healthymagination" vision for the future invites the world to join us on our journey as we continuously develop innovations focused on reducing costs, increasing access, and improving quality around the world. Headquartered in the United Kingdom, GE Healthcare is a unit of General Electric Company (NYSE: GE). Worldwide, GE Healthcare employees are committed to serving healthcare professionals and their patients in more than 100 countries. For more information about GE Healthcare, visit our website at www.gehealthcare.com

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