

# Case Study

## Seiko Instruments and Terumo Cardiovascular Systems

Precision Printing Aids New Cardiac Surgical Practice



### Challenge

Cardiac surgery, with cardiopulmonary bypass, is an extremely delicate yet potentially life-saving procedure. During the process, the patient's blood flow must bypass the heart and lungs, giving the cardiothoracic surgeon a bloodless, motionless field in which to work. To maintain a normal physiologic state, reoxygenated blood is supplied to the patient's body via a heart-lung machine, while the heart is perfused with cardioplegia solution. Throughout this procedure, one of the major risks is intraoperative myocardial ischemia, or lack of oxygen supplied to the heart. Research by Dr. Shukri Khuri suggests that myocardial acidosis is reflective of regional myocardial ischemia, and "reversing or avoiding myocardial acidosis during cardiac surgery improves long-term patient survival."<sup>1</sup> The Terumo Cardiovascular Khuri™ Myocardial pH Monitoring System provides the cardiac surgical team with an accurate on-line tool for the practice of pH-guided myocardial management. With two probes inserted into the left ventricle, the system provides a continuous assessment of myocardial pH, presenting the data via a high resolution touchscreen display.

<sup>1</sup> Khuri SF, Healey NA, Hossain M, Birjiniuk V, Crittenden MD, Josa M, Treanor PR, Najjar SF, Kumbhani DJ, Henderson WG. "Intraoperative regional myocardial acidosis and reduction in long-term survival after cardiac surgery," *The Journal of Thoracic and Cardiovascular Surgery*, 2004.



### Solution

After careful review, Lopez and team selected Seiko Instruments SAM-1245 printer subassembly, determining that it clearly satisfied each design requirement. Based on an advanced 5-volt direct thermal printing design, the printer offered a highly dependable embedded printing solution. Because it required relatively little mechanical real estate, and connected via four screws and a single electrical interface, the SAM-1245 was deemed very easy to integrate. The Khuri Myocardial pH Monitoring System, with its integral SAM-1245 printer, is now successfully being employed by cardiac surgical teams to help prevent or correct intraoperative myocardial ischemia.



In the early design stages, Michael Lopez, Terumo Cardiovascular R&D Manager and the design team determined it was critical to offer printouts of intraoperative data for further analysis and patient records, as well as hardcopies of self-diagnostics and calibration values. The situation called for an embedded printer meeting the following design criteria:

- Capability to generate a 2-inch wide continuous printout with exceptional reliability.
- An embedded solution with minimal footprint, based on a market demand for increasingly smaller devices in the operating room.
- A 5-volt device with a standard electrical interface, for easier integration.
- A printer manufactured by a reputable and stable vendor, able to provide long-term support (up to 15 years).
- General ease of use. According to Lopez, "When there is a patient on the operating table, the last thing people want to worry about is feeding paper into the printer."

**"The Seiko Instruments printer has worked out very well. Reliability has met our high expectations and our customers seem very happy with it."**

**Michael Lopez**  
R & D manager for Terumo Cardiovascular Systems