# SPECTRUM

▶ **Case Study**

# Real-time high speed logger for embedded systems

CPU based embedded systems now play an increasing part in the monitoring and control of the mechanical and electrical components in many areas of our technological environment. Within the U.K. one innovative company, Rapita Systems Ltd., recognised the need within the avionics and automotive industries to have a verification tool to help reduce the cost of measuring, optimising and verifying the timing performance of critical real-time embedded systems, so improving test effectiveness. From this idea the RTBx Data Logger and Rapita Verification Suite (RVS) software was developed.
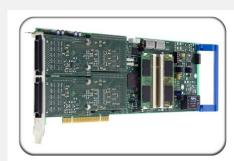
The result is a generic device which provides greater versatility compared to many traditional data loggers and logic analysers, which can be CPU specific as well as complicated to configure. One aspect of its versatility is the ability of the data logger to connect a digital bus network of the embedded systems, which can be 8, 16 or 32 bits wide and sample the logic changes at up to 100MHz. The signals on this bus are the code execution signals involved with monitoring and control of the larger system, be it a vehicle or an aircraft. Being able to easily capture, time-stamp and store signal with the RTBx Data Logger, then analyse with the RVS software, is at the heart of the system.



The RTBx Data Logger logs the data and address bus of an embedded CPU in real time up to 100 MHz

To achieve the performance objectives and to reliably capture over extended time periods, Rapita Systems contacted UK-based DataQuest Solutions distributors of the M2i.7000 series of digital I/O cards from PC instrumentation specialist Spectrum GmbH. This series provides solutions with I/O ports 8, 16 and 32 bits wide, as well as the capability to capture the logic changes with very high data acquisition speeds (up to 125MHz).  The Spectrum M2i card's extended data streaming functionality also answered the need for long period captures by utilising a deep on-board memory in a FIFO operation. This capture operation can be short or extended to periods of several weeks or more. The RTBx Data Logger utilises the M2i card within an industrial 19-inch rack computing platform and integral deep data storage facility. Special programming performed by Rapita Systems employed the card's driver library which gives deep control over the card's functions. It is the combination of all this technology that helps provide the RTBx Data Logger with its ability to be used with a whole range of



M2i.7020 - 32 channel digital data acquisition with PCI/PCI-X interface and a streaming data rate of up to 240 MByte/s

automotive and avionic embedded CPU based systems.

In practical terms connection to the RTBx Data Logger is easily performed from its rear panel via a ribbon cable to the dedicated output port on the embedded system, which is the source of data (instrumentation points) every few CPU machine code cycles. An alternative connection can also be made to the address bus of the system under test, where the user can write a small instrumentation point routine to provide the data at a specific address. The front panel provides a neat LCD display showing logging status, logging data, estimated recording time, network (IP) address and software version. The RTBx Data Logger can be used straight out of the box with the target system, with the further facility of control via an Ethernet connection using a Windows or Linux Host running the Rapita Systems graphical user interface.

The RTBx hardware working hand-in hand with RVS software provides an effective solution which is the basis for products that can evolve to keep pace with the future challenges of more advanced CPU embedded system design, minimising the time and effort in their development, implementation and optimisation.