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Serialized Programming Solutions for IoT Secure Elements

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Billions of networked devices are currently reshaping the health care, banking, security and surveillance, transportation, manufacturing, retail, home tech, and consumer electronics industries, comprising what is known as the Internet of Things (IoT). In a world increasingly operated in the cloud, security is essential, which makes the unique internal and external serialization of secure elements necessary to operate these smart devices.

With traditional, large-scale testing and programming methods, it can be difficult and costly to guarantee unique serialization. Exatron, in partnership with NBS technologies has found a way around the challenges of secure element serialization with its Smart Queue technology and associated 901 TRX automated test/program handler, which is designed to deliver 100 percent perfect serialized internal and external order with no missing or duplicated numbers at speeds of greater than 2,000 units per hour.

Exponential IoT Growth

The number of IoT devices grows exponentially every year, with some predicting as many as 50 billion in operation by 2020. Many home security systems, thermostats, and even light bulbs, can be controlled by a smartphone. Blood pressure can be read by a smartwatch and tracked online. Shipping vessels are tracked by handheld devices. EMV chip readers for debit cards are ubiquitous in stores and restaurants around the world. The continued success of, and confidence in, these widespread systems relies on data security. Smart devices must be paired uniquely to consumer phones and tablets. EMV card readers must be paired uniquely with bank software and individual card readers. Unique serialization of secure elements used in these devices increases both data protection and fraud detection.

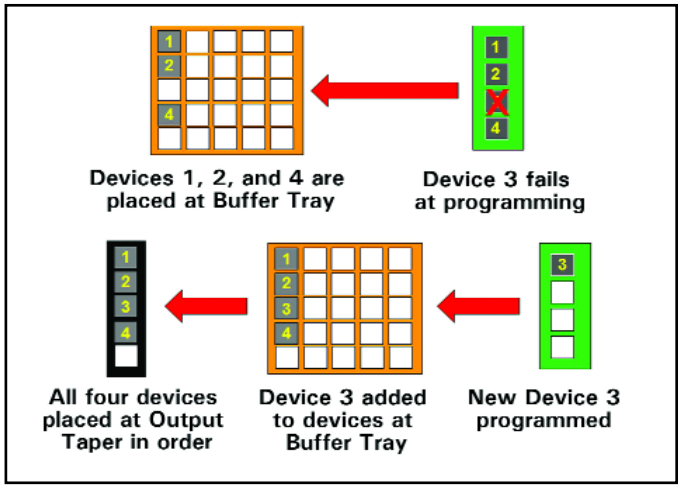

Illustration of Exatron's Smart Queue system.

However, traditional test/program methods can make unique serialization a time-consuming and costly challenge. Serial numbers often need to be both programmed internally and human-readable externally. Often those internal and external serial numbers are not the same. This can make it difficult to keep track

of serial numbers at output. Also, if even one single device out of a lot of thousands is found to be programmed incorrectly after the fact, the entire batch may be wasted, or the entire batch must be retested. In order to guarantee perfect serialized internal and external order, serial numbers must be tracked at every step of production through input, programming, laser marking, and output, so operators have a confirmed database of which serial number is where.

Smart Queue Program Handler

Exatron, in partnership with NBS Technologies, has created the 901 Smart Queue program handler system (901 TRX) to solve these unique serialization challenges. The 901 TRX offers trackable, unique internal and external serialization, automatic verification of programmed secure elements, automatic remake of failed elements, and also guarantees 100 percent perfect serial order at output with no missing numbers, no duplicates and no gaps in output tape.

The key is the company's Smart Queue software, which not only ensures serial order, but also tracks and logs each serial number location at every step. During production, secure elements are placed at a verification site immediately after programming and laser marking.

If one or more elements fail verification, those elements are sorted to the specified reject bin, while passed elements are placed at a buffer tray, leaving empty spaces in serial order. A new element or elements are picked, programmed with the missing serial number or numbers, laser marked, verified and ultimately placed in the empty buffer tray spaces.

All four elements are then picked and output to tape in perfect serialized order. The 901 TRX also offers a topside OCR inspection, which ensures the correct serial number has been legibly marked on each element. If any element fails inspection, passed elements are placed at buffer tray, while a new element is programmed and marked with the missing number before output.

Throughout production, Exatron software tracks and displays serial numbers at every step, and then, at the end of each production lot, creates a log file of serial numbers processed.

The 901 TRX is designed to maximize speed, efficiency and accuracy. It has two quad pickup heads; tape in/out; up to 32 program sites, including one dedicated quad remake station; one dedicated quad verification station; a laser mark and laser buffer tray with pneumatic positioners; one buffer waffle tray; one reject waffle tray; up to six reject buckets; a Rofin laser marker; and two Keyence inspection cameras, one that performs OCR inspection at the laser site and one that ensures correct pin one orientation and pocket seating at the output taper.

901 TRX Smart Queue program handler system.

The gantry is powered by servo motor-driven lead screws, with each pickup head moving four devices at once and reaching speeds of over 2,000 units per hour, including laser marking, inspection, and programming time. Even with a one percent fail rate, there is no dip in UPH. The TRX is also easily adaptable, allowing customers to insert sequence test and quality control test modules into the production flow as needed and quickly evolve along with industry form factors.

Benefits for Smartcard Manufacturers

The 901 TRX already has a presence in the IoT secure elements industry. Top smartcard manufacturers are producing millions of secure elements, mainly in the machine-to-machine (M2M) sector and automotive compliance. More than a dozen TRX systems have been installed throughout Latin America, Europe and Asia

"TRX was the first and most reliable machine in the eSIM and M2M market," says Alfonso Crespo Gonzolez, operations director at Valid, based in Spain. "This definitely helped to enhance our portfolio by creating products tailored to our customer requests."

"Being the first machine for such products is challenging, especially because market needs are not completely defined. TRX provides us with a full set of solutions and has already evolved to make sure market trends are captured and implemented in the machine," adds Francois Maurel, vice president and general manager of NBS Technologies in France. "We believe the TRX is a very good trigger for the serialization of secure elements and, as volumes grow, NBS and Exatron will promote a new generation of equipment running faster and handling smaller devices."

Exatron and NBS combined more than 40 years of experience and expertise to create the 901 TRX Smart Queue Program Handler System. Exatron's building block design method allows the 901 TRX to be customized to suit nearly any application.

It can handle a wide range of device types, can adapt to nearly any third-party programmer and is easily integrated with Exatron's large inventory of assembly options, including input/output options, such as a bowl feeder, tube and tray, 2D and 3D vision and laser marking upgrades, and digital linear motor upgrades for increased speed and handling of devices as small as 0.04 x 0.04 in. (1 x 1 mm).

NBS Technologies in France leads the wafer packaging industry with more than 100 systems installed in most of the world's top semiconductor vendors and has been involved for many years in smartcard manufacturing and personalization.

The future of smart devices and IoT technology depends largely on security. Security depends largely on unique, trackable serial numbers. The 901 TRX with Exatron Smart Queue automation software is designed to guarantee internally and externally serialized output, logged and tracked at each production step. It is an excellent tool for a rapidly expanding market.

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