

Automated production of microfluidic test devices with the Freedom EVO/REMP SSS Factory

Akonni Biosystems is the latest company in the USA to acquire a Freedom EVO®/REMP Small-Size Store™ Factory, relying on the platform for fully automated liquid handling and sample management during manufacturing of its revolutionary TruArray™ microfluidic card-based diagnostic arrays.

Akonni Biosystems Inc, based in Maryland, USA, specializes in providing genetic-based diagnostic and disease surveillance tools for human diseases. The company has developed the TruArray™ product line, a microfluidic-based diagnostic microarray for fast genetic testing in a single portable device that is suitable for use by health practitioners.

Prof Andrei Mirzabekov at the Engelhardt Institute in Moscow, Russia, originally invented the underlying gel-drop microarray technology in 1988 and it was further developed and optimized at the Argonne National Laboratory in Chicago, Illinois. The technology was licensed to Akonni Biosystems, founded in 2003, for use in medical applications and the company has since developed its microfluidic devices, which automate the processing of every gel-drop (from 10 to 4,200) on the array. Each gel-drop behaves as a microscopic test tube that can be tailored to carry out a specific diagnostic biochemical test and, by packing hundreds or thousands of gel-drops onto the array, a small volume from a single clinical sample can be analyzed for hundreds or thousands of disease markers simultaneously, yet independently. The microfluidic device performs on-chip PCR within each gel-drop and is inserted into a portable instrument for processing, allowing accurate, on-the-spot testing to be performed for a variety of diseases.

Manufacturing these tiny devices requires precision robotics, as Dr Charles (Chuck) Daitch, founder of Akonni Biosystems,

explained: “The TruArray™ products are disposable in vitro diagnostic tests that contain a lot of different parts and require careful assembly. The injection-molded plastic that contains the microfluidics components has to be sterilized initially, and then the various reagents are assembled for printing the biomolecular centers of the array using automated liquid handling.”

“The Freedom EVO/REMP SSS platform is ideal for the set-up and support tasks required to produce our array products at a suitably high volume with appropriate quality control,” Chuck continued. “All our samples and reagents can be kept at low temperatures in the REMF SSS using the REMF Tube Technology™ consumables, and the components that couple the REMF SSS to the Freedom EVO will automatically retrieve the required reagents for our printing robots to assemble and print the TruArray™ tests. For example, if we have an order for one million tests for a particular marker, the platform will simply pull out the



The Freedom EVO/REMP SSS platform



Opening of the laboratory at Akonni Biosystems



The team at Akonni Biosystems

necessary reagents from the REMF SSS using barcode recognition and prepare them for printing the tests as and when required. The Freedom EVO/REMP SSS is a great help to the printing robots because it can automatically organize and prepare source plates for printing, as well as automatically handle our sample inventory and organizational needs. We are also working with engineers at Tecan to incorporate a number of additional features into the platform, including an analytical system to quantify and normalize the biomolecular centers we produce, prior to storage in the REMF SSS and preparation of the printing source plates on the Freedom EVO platform.”

“We chose Tecan because we were confident of the quality of the products,” Chuck said. “Our colleagues at the Argonne National Laboratory use many instruments from Tecan, including automated hybridization systems and liquid handling platforms.”

The REMF SSS is a fully automated storage and retrieval system that can handle samples in a variety of formats, including microplates and REMF Tube

Technology consumables. Integration of the REMF SSS with the Freedom EVO and Freedom EVOware® software allows walkaway operation for sample retrieval and processing steps. Chosen samples are identified by barcode and cherry-picked from within the store’s controlled environment and transferred to the Freedom EVO workstation using an integrated plate shuttle. Tubes can be decapped using an automated capper/decapper (REMF ACDg6™) device and processed as required and, after processing, the samples are recapped and returned to storage. This combination of automated sample

storage and processing minimizes the time that samples are exposed to the environment and increases process security. Sample volumes, concentrations and identification numbers can be fully tracked within the software, and data handling is perfectly integrated, making this platform ideal for compound dissolution and reformatting factories, or genomic sample factories.

Akonni has recently moved to new facilities designed to accommodate its scaled-up production facilities, which include a clean room with four robots for printing and producing the arrays, as well as the integrated Freedom EVO/REMF SSS platform. The grand opening of the laboratory was held in November 2007 and sponsored in part by Tecan.

Scientific instrumentation. Not for use in human clinical or diagnostic procedures. TruArray is a trademark of Akonni Biosystems Inc.



Akonni's TruArray microfluidic device

Akonni
Biosystems

Akonni's portable array reader