

2DCYPHER™ Code System



The 2DCYPHER™ sample tracking and identification system uses a 2D Data Matrix™ format in a 14 x 14 array, providing up to 3.6 quadrillion (3.6 x 10¹⁵)

unique code combinations to assure a virtually endless code supply. As the code format is also unique, there is no risk of duplication or overlap with other currently available systems. The 2DCYPHER™ range now comprises a choice of tube formats, a variety of lockable racks (also available bar-coded) and a range of sealing options.

A number of dedicated code readers have been developed for high-speed reading of individual tubes and complete racks. The 2DCYPHER™ Cluster Rack Reader in particular has been designed with integration in mind. There are several features that make it straightforward to integrate with robotic laboratory automation systems:

Reader Integration Features



The physical design of the reader is compact (207mm x 184mm x 84mm), so it can fit on the bed of most robotic workstations. The open

design provides accessibility to robotic systems and the tapered rack holder guides the rack to the precise location for reading. Sensors located in the rack holder automatically recognise rack orientation and initiate a reading, which takes approximately 3 seconds.

Data output and reader control commands can be exchanged with the host system in a number of ways. The reading process may be started via the serial port, TCP/IP network connection or switches on top of the reader.

Results of the reading operation are stored in a text file. The format and name of the file can be customised to suit almost any downstream data requirement. The file can be used via OLE (Object Linking and Embedding) to place data directly into another application, or it can be read over a network connection for remote operation. Results can also be output directly to a database system using the ODBC (Open Database Connectivity) standard. This means that results can be linked directly to a LIMS system or other custom information system.

The following case study, using a Hamilton liquid handling robot, demonstrates the ease with which the 2DCYPHER™ Cluster Rack Reader can be integrated to become a powerful, fully automated laboratory tool.

Automated Tube Reformatting using the Hamilton MICROLAB® 4000 and the 2DCYPHER™ Cluster Rack Reader



Mark Rollins¹ and
Colin Reynolds²

When dealing with large sample libraries, there is often a need to extract groups of interesting samples from the larger body of the library. The samples of interest will have been identified by previous experiments and tagged for further testing. The reformatting process for extracting these samples can be achieved either by physically moving individual sample tubes to new empty racks, or by pipetting some of the samples into a new tubes.

This case study illustrates how a Hamilton MICROLAB® 4000 robotic workstation and an ABgene® 2DCYPHER™ Cluster Rack Reader can be used to perform the reformatting operation. Samples of interest are listed in a text file or spreadsheet and, from this data, either reformatting method can be implemented: the MICROLAB® 4000 can pipette through MULTISIP™ Septum Plugs and can also physically move tubes from rack to rack. As samples may be damaged by repeated freezing and thawing, only the tubes of interest should be thawed out for pipetting; for this reason, tubes to be thawed are moved individually to a heater block. Hamilton has validated this solution as a standard application.

The system is built from the following: MICROLAB® 4000, Hamilton Basic Vacuum System (BVS), Inheco C-Pac Thermo Electric Multipurpose Micro Plate Heating & Cooling Unit, and ABgene® 2DCYPHER™ Cluster Rack Reader.

The MICROLAB® deck is loaded with an empty 2DCYPHER™ tube rack (on the Inheco Block) and a 2DCYPHER™ rack containing frozen DNA is placed on the 2DCYPHER™ Reader. The loading process can be manual or automated using a MICROLAB® SWAP. Tube settings exist for a variety of tube manufacturers, including ABgene®, with and without septum plugs. The



Tube transport mechanism



Reading of 2DCYPHER™ cluster rack to identify tubes to be picked

method for application was programmed on Hamilton Vector standard software incorporating the BVS Library. The 2D codes on the bottom of the frozen rack are automatically read by the 2DCYPHER™ Reader and the codes are matched with a user-supplied list of samples to be picked. The tubes of interest are extracted from the frozen rack using a vacuum gripper, and they are then transferred to the empty rack positioned over the heater block. Once the samples have been thawed, they are pipetted into a target vessel of the user's choice (e.g. another tube or a microplate). The MICROLAB® can pipette through septum seals: a tube restraint plate holds the tube in place while the pipette tip is withdrawn. After pipetting is completed, the tubes are moved either back to their original position or into a new rack, as required. The whole process takes approximately 20 seconds per tube to complete but can be customised to accommodate different thaw times. The powerful combination of the MICROLAB® 4000 and the 2DCYPHER™ Reader enables easy reformatting of 2DCYPHER™ tubes with secure data tracking, ensuring error free library maintenance.

Features and Benefits

- Validated method procedure available
- Flexible file handling
- Hands-free processing
- Eliminates human error
- Thaws only the required tubes, eliminating unnecessary freeze-thaw cycles
- Retains septum seal integrity

This application highlights the ease with which the two systems can be integrated and represents just one of many possible integrated applications for 2DCYPHER™.

¹ Hamilton Great Britain Ltd., Unit 2, Enterprise Way, Aston Science Park, Birmingham, B7 4BH, info.gb@hamiltonrobotics.com, www.hamiltoncompany.com

² ABgene®, ABgene House, Blenheim Road, Epsom, Surrey KT19 9AP