Automation of Microplate Bar Code Printing and Labeling with the Hudson/Computype Print & Apply Workcell

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INTRODUCTION

Bar code labeling of microplates is becoming an increasingly important aspect of Drug Discovery/High Throughput Screening operations. Automated bar code plate labeling at the front-end of a process ensures positive sample identification and the subsequent tracking of the plate and its contents throughout the various processes that are required during screening and other plate-based processes. This reduces the chance of errors and provides a convenient way to track information within a database as the plate is processed. This is compounded by sharing plates by laboratories at a specific company site and at multiple sites. Barcode labels provide a secure transfer of information both within and across laboratories

The new Print & Apply Workcell is a high-capacity, high-performance bar code printing and application solution that can be installed on the bench in any laboratory. It provides the capability for "walkaway" automation for the printing and application of bar code labels on as many as 420 microplates.

This solution offers an economical, automated alternative to manually applying preprinted labels. It also offers advantages over purchasing pre-labeled microplates. The end user can maintain local control over the labeling process, and confidential data can remain internal to the organization.

COMPONENTS

(1) Computype LAP-4100H Printer Applicator. Performs the thermal-transfer printing onto the bar code labels and the automatic application of the labels onto the microplates. Includes a Zebra Model 96XiIII 600 dpi printer and high performance Computype applicator with positive tamp-on applicator.
(2) Hudson Control Group PlateCrane Pick and Place Robot. Provides walkaway automation for the Workcell by moving microplates between storage stacks and the LAP-4100 Printer Applicator.
(3) Computer with Hudson Total Control for Windows software. (NOT SHOWN) Provides supervisory control of the entire Workcell and a user interface for programming of the system and layout of the bar code labels.

Figure 1: Hudson/Computype Print & Apply Workcell showing the major components.

CONFIGURATION

The Print and Apply Workcell can be configured according to the labeling and capacity requirements of the laboratory. The optimal Workcell is configured by addressing these questions:

- **What is the maximum required walkaway capacity?** A range from **30 to 420** standard microplates can be accommodated. The PlateCrane model and number of installed plate stacks determines the total available capacity of the workcell.
- **What information needs to be bar coded, both in the bar code itself and in human readable text?** This will help to determine the required width of the bar code label. Label widths up to **3.3" wide** can be used with this Workcell.
- **Are multiple labels required?** A rotating gripper can be added to the PlateCrane that will allow application of labels on multiple sides of the microplate, **up to 1 label on all 4 sides**.
- **Is verification of the bar code label required?** A bar code reader can be configured with the system and used to read each label after it is applied to the plate. This will confirm that the label is readable and contains the correct information.
- **Are there different sizes of plates to be labeled?** Deep well plates can also be labeled. The capacity of the system will change due to the larger size of such plates. Also, additional label sizes and applicator nosepieces may be required if multiple size labels are to be used on the same Workcell.
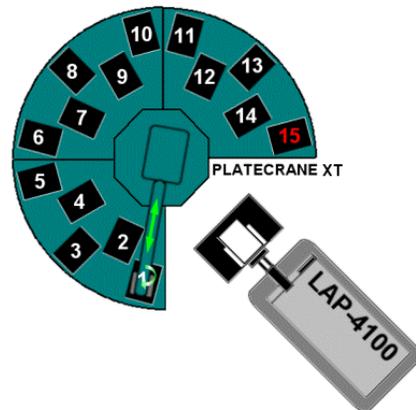

Figure 2: Hudson/Computype Print & Apply Workcell configured with a Hudson PlateCrane XT and a Computype LAP-4100. The PlateCrane XT Pick and Place Robot includes a rotating plate gripper and a telescoping arm. The numbered rectangles represent stacks that hold up to 30 standard microplates each. The red stack #15 is left empty to act as the first "Output Stack". The white stacks #1-14 are used to store microplates for labeling for a maximum capacity of 420 microplates.

The rotating gripper can place the microplates in either the portrait or landscape position. This workcell can apply labels on up to all 4 sides of a microplate.

OPERATION

The operation of the Print and Apply Workcell consists of a few simple steps:
- Load the desired number of microplates into the PlateCrane plate stacks
- Select the method, which includes the label template, and start the system

Operation of the workcell is performed by Hudson's Total Control for Windows (TCW) software, which provides a simple user interface and acts as supervisory control for the PlateCrane and LAP-4100H. The setup up of the bar code label design is performed with a WYSIWYG (What You See Is What You Get) interface from within TCW using an Active X link to Zebra's Bar-One Platinum Label Design Software .

Figure 3: User interface screen from Hudson's Total Control for Windows Software.

The bar code numbering system (or alphanumeric) is typically imported from an externally generated file. The software allows the user to configure the various aspects of the bar code labeling operation.

- Bar code symbology (Code 128, Code 39, etc.)
- Human readable text
- Layout of the label elements
- Number of labels to print for each microplate
- Which side(s) of the microplate to apply the label

MICROPLATE BAR CODE LABELING

There are some important considerations that must be taken into account when developing a plan for the automated bar code labeling of microplates.

- **Label size considerations.** Bar code labels are applied to microplates on the side wall above the flange, or skirt. The width of the label will be limited depending on whether the label is applied to the portrait side (~3") or the landscape side (~4"). More importantly, the label height is limited to ¼". The bar code image should be as tall as possible within the ¼" height in order to prevent misreads due to "skewing" along the narrow code. This means that human readable text should be placed to the side of the bar code, rather than the traditional location underneath the bar code.

MICROPLATE BAR CODE LABELING (CONT.)

- **Bar code image quality:** Image quality is always important in order to minimize misreads. It is even more so in this case because of the short height limitation on the label. Both the black and white vertical bars must be imaged as cleanly as possible to ensure repeatable and accurate reads of the label.
- **Environmental conditions.** Bar code labels on microplates are subjected to environmental conditions that are not found in other applications. These include repetitive freeze/thaw cycles and exposure to solvents such as DMSO that can degrade the bar code image, label, or adhesive.

All of these issues are addressed with the Print and Apply Workcell. The 600 dpi Zebra printer provides the highest resolution available for a bar code printer. This ensures that the bar code image will be of consistent high quality. The Zebra printer can also print high quality human readable text even at very small font sizes.

The LAP-4100 is capable of printing and applying labels up to 3.3" wide. This ability to use a wider label means that more information can be placed in the bar code, and also that more human readable text can be placed on the side of the bar code itself.

Finally, Computype's experience in the design and manufacture of bar code materials has been utilized to produce a combination of label material, liner material, adhesives and thermal transfer ribbon that is best suited to the labeling of microplates and resistant to freeze/thaw cycles and chemical exposure.

Figure 4: Typical bar code for a microplate label. 3 lines of human readable text are placed to the right of the actual Code 128 bar code.

CONCLUSION

The Hudson/Computype Print and Apply Workcell provides a laboratory benchtop solution for the walkaway automation of microplate bar code labeling. The combined expertise of Hudson Control Group in lab automation and Computype in bar code printing and application have been utilized to produce a workcell that has high capacity and flexibility, and addresses the specific needs of labeling microplates for drug discovery and high throughput screening.