Restoring a Classic the BioRaptr 2

slas 2022

Presentation
by Sam G. Michael
NIH/NCATS

Presented Wed Feb 9 11:00 AM
Location: 210B

The dream upgrade

NEW Software and embedded computer

NEW motion system controller

NEW features for on-the-fly adjustments

NEW support for 21 CFR Part 11

Compatibility with historical dispense files

"A key component of High-Throughput Screening (HTS) at NCATS, and in general, is accurate, reliable, and fast low-volume liquid dispensing into microtiter plates. Options for flexible and high-quality dispensers that are both user and automation friendly have historically been limited, and we have relied heavily on the BioRAPTR dispensers that were initially supported through Aurora Discovery followed by Beckman Coulter, until their eventual removal from the market.

Given our heavy investment in these dispensers and their ubiquitous adoption across multiple laboratories, the NCATS automation team has maintained over 20 BioRAPTR dispensers in-house down to the component level for the majority of the last decade. These dispensers are integrated onto multiple robotic platforms and used for benchtop assay optimization and validation by our biologists daily. The ability to calibrate the 4-valve/tip dispense heads quickly and create custom multi-tip protocols on a well-level as well as dispense a 1536-well microtiter plate in less than a few minutes is essential to our HTS operations. We have also integrated custom features such as droplet detection, designed and built in-house to add further dependability. Due to limited options for dispenser replacements that are equivalent to the BioRAPTR, NCATS invested time into upgrading the existing dispensers from Windows XP to Windows 10 to improve security as well as improve functionality by moving away from an unsupported operating system.

We also formed a collaboration with Let's Go Robotics (LGR) to update and refurbish the existing BioRAPTR models, ensuring that we maintain the features that have made them our primary dispensers for over a decade, while also adding new capabilities to enhance their already outstanding performance. This work will help to ensure that the daily bench and automated system operations using these dispensers will continue uninterrupted while also making improvements for future integrations." - *Sam Michael presentation abstract*

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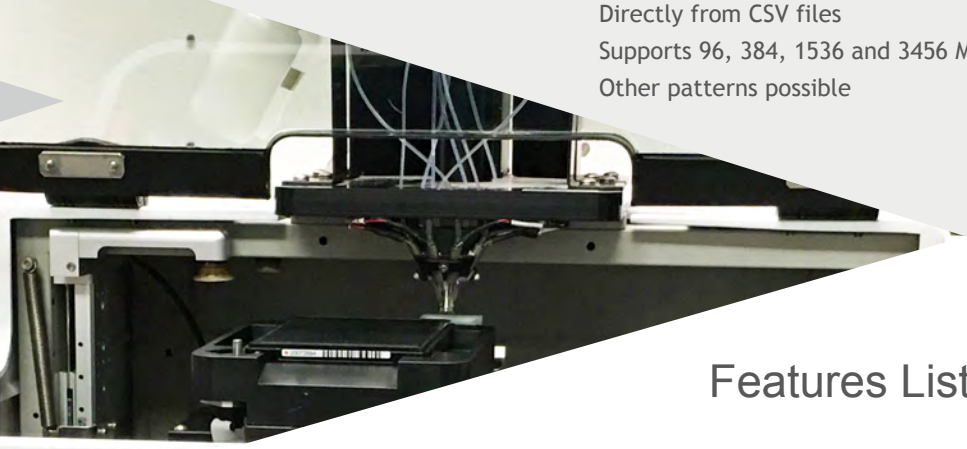

Precision Micro Fluid Dispensing
50 nL to 100 uL volumes
Full calibration curves

On-the-fly Dispensing
8 channels standard
Directly from CSV files
Supports 96, 384, 1536 and 3456 MTPs
Other patterns possible

Innovative Calibration Station
Uses precision scale to calibrate each valve

Modern Software
Friendly web interface
Developed by LGR
Runs on an embedded Linux computer

Modern Controllers
New motion controller
New valve dispense controller

Features List

- New software developed in Python and runs on a Linux computer within the system, no stand alone computer is required. The calibration scale connects directly to the BioRaptr 2.0 for calibration, and improved features for valve calibration. One does not have to run a complete calibration for all eight ch's. You can select the valve and volume range to calibrate within minutes, and not have to wait for ½ hour or more for calibration. The new system removes air pressure on the source bottle when not dispensing to eliminate "splash downs" and leaky valves containing the XY stages. LGR developed the new valve controller computer and PCB. This design is faster than the original system at 1 micro sec clock timing, and includes all new components.
- New software features to enable on-the-fly dispense gradient adjustment, along with row or column pattern dispensing. The new systems runs all the current FRD BioRaptr "Excel" dispense files.
- The new system uses a Galil motion controller that will be supported for 10 years or more. This is using 1 micro meter linear encoders, and the current linear motors for accurate XYZ locations. This accuracy allows for 3456 plate types if needed
- New calibrations can be added easily on the system to dispense at different air bottle pressure or for different reagent densities.
- The new system allows for control of the system over a network, this also allows for easy automation interfacing with current robotics.
- Log files are stored for traceability, along with backup and restore capabilities of all the software settings. Long run could be 21 CFR Part 11 compliant for record-keeping.
- Email notification for errors can be setup, provide the system has a network connection.
- Walk up USB flash stick file loading for dispense files. One can work at a remote desk computer and then go to the system to setup a custom dispense. Alternatively, if on a network, then just transfer the file over. Naturally, one can use the easy to use built-in software tools on the system to setup dispenses.
- Current Lee Valves for the BioRaptr can be purchased new from the The Lee Company directly. These are 40 VDC valves to lower the current and keep the cells from getting hot. They work well and took years to develop by Aurora.
- One can use other valves from other manufactures if required. Sapphire valve seats help with DMSO. Mechanical modifications to the valve head manifold would need to be done to use these other valves, but the LGR valve controller has no problem controlling these.

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