Introducing New Technology for Liquid Handling Quality Assurance

Bill Gigante and John Bradshaw Ph.D.
Tutorial Topics

- Product overview
- Real world example – Compound Management
- Technology
- Operation
- Maintenance
- General topics
- Typical questions
- Your questions
PRODUCT OVERVIEW
Product Overview

- Using a novel pressure based technology, the Artel VMS™ measures volumes of liquids or solids in 96- and 384-well plates
- Technology developed with Compound Management and Screening in mind
- Measurement is independent of shape of well, type of plastic, and color of material
- Can measure volumes between 5-500 µL
- CV < 2% (plate dependent)
- Accuracy <5 µL (plate dependent)
- Automation friendly
Has anyone experienced any of these issues?

- Empty wells
- Low volumes in wells
- Clogged pipette tips
- Bad tip or plate lots
- Database discrepancies
- Liquid loss from plate seal
- Liquid loss from tip carryover
- Poor liquid class definitions
- Mechanical failures over time

These are issues that can be resolved with real-time volume detection.
Real World Example

Compound Management
Real World Example

Compound Management

- Most big pharma and biotech companies have a Compound Management group
- Compound Management groups store and maintain…
  - Chemical libraries
  - Biologics
  - Reagents
- Compound Management groups support…
  - Drug screening
  - Clinic trials
  - Chemistry

Oversimplification Alert!!!
- Compound Management stores the shotgun BBs
- Screeners shoot the gun at the target!
Typical Workflow

- **External Samples**
- **In-house Samples**
- **Storage**
- **Request Placed**
- **Samples put in plates**
- **Distributed to Requestor**
- **Screened**

 Hits are re-ordered (i.e. IC50 Plates)

★ = Where Artel VMS can be used
Artel VMS Saves Money

- Real time sensing of volume discrepancies
- Early detection of liquid handler malfunctions
- Early detection of clogged tips
- Detection of database errors
- Corrects for errant data in LIMS
- Enables fine tuning of pipetting steps for sensitive assays
- Enables pre- and post- checking of volume additions
- Enables process verification
Technology
Measuring Volume with Pressure

- Ideal gas law: $PV=nRT$
- If you know the pressure and the temperature, you can solve for a volume.
- The Artel VMS adds a known volume of air to each well.
- A strain gauge pressure sensor provides feedback which can be calibrated to a volume.
- An internal set of wells are used to normalize temperature and barometric changes.
- Not subject to issues normally seen by optical or acoustic methods of measurement.
Measurement Details

- A bank of 8 syringes pressurize a column of wells on a plate
- The pressure is measured with a sensor
- The measurement is compared to the stored calibration curve for the specific plate
- A result is generated
Pressure Curve of individual sensors at 80 Hz

Pressure Sampling Rate:  
~ 80 Hz per sensor
Sensor Data converted to Volumes
Artel VMS Operation
Artel VMS Operation

- Calibrate Plate
- Select plate and wells to measure
- Press “Run Plate” and enter or scan plate name
- 30 (96 well) or 120 (384 well) seconds later, results appear on screen
- Results are also saved as a .csv file in a preselected folder
- Apply appropriate Pass/Fail criteria to results
- Occasionally run maintenance program
Plate Calibration

- Most 96 and 384 well SBS plates <20mm high can be calibrated on the VMS
- A pressure-to-volume curve can be generated by measuring full wells and empty wells
- High precision volume simulators are used during the calibration procedure
Plate Calibration Procedure

- Volume simulator values are entered into appropriate columns
Volume Simulators

- Appropriate Volume simulator is added to the plate

242 µL  67 µL  43 µL
Calibration Curves

- After plate is run, calibration data is presented on the screen
Running a plate

- Select from dropdown list of calibrated plates
- If needed, add a shim
- Enter or scan plate name
- Press “OK”
Results are displayed
Apply Pass/Fail Criteria

- Visualization Choices:
  1. ± X Percent of Y Volume
  2. ± X uL of Y Volume
  3. ± X Percent of Well Average

- If the 3rd option is selected, a Stdev and CV are displayed.
Maintenance
Maintenance

- Cleaning pad is provided for occasional cleaning
- Seal bar can be removed for thorough cleaning
General Topics
Automation Friendly

- Plate tray was designed with robotics in mind
- Fully document API available
- 2 integration demo applications with source code are provided
Typical Customer Use Cases

- Real time process verification
- Process optimization
- Automated pipette verification
- Liquid class optimization
- Liquid class optimization during design of novel instrumentation
- QC of reagent addition during PCR
- QC of incoming collections of materials

Where does volume matter in your lab?
Places Where Volume = Quality

- Pharma/Biotech Compound Management & HTS
- Automated Pipette Manufacturers
- Pharma/Biotech Preclinical/ Clinical Development Groups
- Contract Labs
- Forensic Labs
- Pharma/Biotech R & D
- Public Health Labs
- Pharma/Biotech QC Groups
- Regulatory Agencies that create standards

© 2015 Artel
Typical Questions
Questions Before the Q&A

- How do you deal with cross-contamination?
- Can the Artel VMS be integrated?
- What is the tallest/shortest plate it can read?
- Can the Artel VMS read tube racks?
- Can the Artel VMS read barcodes?
- How fast can it read a plate (96/384)?
- What do the results look like and are they configurable?
- What if the liquid has bubbles?
- What if the liquid is stuck to the side of the well?
- What CV and accuracy should I expect?
Questions?