

MVS[®]

MULTICHANNEL VERIFICATION SYSTEM

MVS Traceability Document

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1.0 MVS TRACEABILITY DOCUMENT

1.1 Introduction

The Artel Multichannel Verification System (MVS[®]) consists of a set of components that are used to measure liquid volumes dispensed into 96-well microtiter plates. The various MVS components not only allow for measurement of the accuracy and precision of liquid volumes dispensed by a multi-channel liquid handler, but also provide for traceability of these measurements to widely recognized NIST (National Institute of Standards and Technology) standards. This path of NIST traceability allows for standardization of calibration results within a facility, thus ensuring that all liquid handling equipment is calibrated against the same standard.

1.2 NIST Traceability

Standardization of MVS results occurs through an unbroken chain of comparisons that lead back to NIST-recognized primary standards. The path of traceability for MVS occurs through three main measurement types: 1) photometric measurements, 2) gravimetric measurements, and 3) dimensional measurements. Every volume tested with the MVS produces a final result that is calculated based upon all three traceable measurement types.

The path of traceability is best described by following through the steps of a typical MVS volume test:

1.2.1 Step I: Plate Reader Calibration

The MVS Calibrator Plate provides the first traceable step for any MVS analysis. The solution filled cuvettes in the plate provide optical standards which are used to correlate the daily performance of the MVS Plate Reader to the performance of the Varian Cary spectrophotometer in the Artel laboratory. In this way, all photometric measurements performed in the field by *any* MVS Plate Reader are traceable back to NIST through the Artel reference Varian spectrophotometer, which is regularly compared to neutral density glass standards with NIST-traceable optical densities (Starna, UKAS 0659).

1.2.2 Step II: Measurement of Dispensed Volumes

For test volumes dispensed into the wells of an MVS Verification Plate, there are three components to the traceability path: 1) the physical dimensions of the wells in

the MVS Verification Plate, 2) the absorbance per unit pathlength of the MVS Sample Solutions, and 3) the photometric measurements made by the MVS Plate Reader. The well dimensions, the absorbance per unit pathlength, and the measured photometric responses for the dispensed solutions are all necessary components for calculating the volume of solution dispensed into the plate.

When a lot of plates is manufactured, a statistical sampling plan is used to pull plates from the beginning, middle and end of the manufacturing run. Every well in each of these plates is dimensionally characterized by a contracted facility using a Coordinate Measuring Machine (CMM). All CMM measurements produced by this facility are traceable to NIST through primary calibration artifacts with NIST-certified dimensions (B89Ball, ASME B89.4.1). Although dimensional measurements are not performed for every well in every plate, the mean values determined from the statistical sampling plan provide measurements representative of the population mean values for that particular plate lot.

The absorbance per unit pathlength is a bar coded quantity that is determined for every lot of manufactured solution by measuring the photometric response in a known pathlength cuvette. This photometric measurement is made using the reference Varian spectrophotometer, whose traceability is described above (Section 1.2.1). The cuvette pathlength is determined using a CMM, whose traceability is also described above (this section).

Finally, the photometric measurements made by the MVS Plate Reader for the solutions dispensed into the verification plate are traceable through the daily calibration with the MVS Calibrator Plate.

1.2.3 Step III: Release Testing

Although all components described to this point add to the NIST traceability of the MVS results, a primary traceability path is also established by the Artel laboratory through careful release testing protocols. These release testing protocols are used to validate each new lot of MVS Sample Solutions and each new lot of MVS Verification Plates. The MVS performance is measured against a NIST-traceable gravimetric method in the carefully controlled environment of the Artel laboratory. The MVS measurements are traceable as previously described (sections 1.2.1 and 1.2.2), while the

traceability of the gravimetric measurements occurs through a set of reference weights with values traceable to NIST, which are used to maintain balance calibration (W 1g, Class E1).

1.3 Summary

The components of the Artel Multichannel Verification System work together to provide performance metrics about the liquid delivery capabilities of various types of multichannel dispensers. The accuracy and precision results generated by MVS are traceable to NIST, thus allowing standardization between various equipment types and various laboratories within a user facility.