



**DESCRIPTION**

The Artel Multichannel Verification System (MVS®) consists of equipment, software, aqueous solutions and highly characterized microtiter plates. The system is suitable for liquid volume measurements from 0.1 to 350.0 µL in a 96-well plate format or from 0.01 to 55 µL in a 384-well plate format. A mobile workstation allows for portable, convenient verification of equipment in multiple locations.

Employing a unique, dual-dye photometric method, the Artel MVS conveniently measures the dispensed volume from any 1-, 2-, 4-, 6-, 8-, 12-, 16-, 24-, 96-, and 384-channel liquid delivery device in less than ten minutes. The accuracy and precision performance of each dispensing channel is independently calculated and displayed with summary statistics by well, by row and by column. When using the MVS Verification Plates and an Artel certified Plate Reader, the Artel MVS supports an unbroken chain of traceability to national and international standards.

Results are saved in a secure database on the system's portable computer using the MVS Data Manager software and are available for printout or export to HTML or XML formats.

**SYSTEM PERFORMANCE**

	<b>STANDARD 96-Well Plate</b>	<b>ADVANCED 96- and 384-Well Plate</b>
Volume Range, 96-well plate	0.100 to 350.0 µL	0.100 to 350.0 µL
Volume Range, 384-well plate	N/A	0.0100 to 55.00 µL
Time Requirements	Less than 5 minutes	Less than 10 minutes
Tip Configurations		
96-well	1, 2, 4, 6, 8, 12, 96	1, 2, 4, 6, 8, 12, 96
384-well	N/A	1, 8, 12, 16, 24, 96, 384
Inaccuracy, 96-well Verification Plate*		
<b>Artel ELx 800 Plate Reader</b>		
0.2000 µL to 350.0 µL	± 2%	± 2%
0.1 µL to 0.1999 µL	± 3%	± 3%
<b>Artel PowerWave Plate Reader</b>		
0.2000 µL to 350.0 µL	± 3.5%	± 3.5%
0.1 µL to 0.1999 µL	± 4.5%	± 4.5%
Imprecision, 96-well Verification Plate*		
<b>Artel ELx 800 Plate Reader</b>		
0.2000 µL to 350.0 µL	≤ 0.4% CV	≤ 0.4% CV
0.1 µL to 0.1999 µL	≤ 0.5% CV	≤ 0.5% CV
<b>Artel PowerWave Plate Reader</b>		
0.2000 µL to 350.0 µL	≤ 0.6% CV	≤ 0.6% CV
0.1 µL to 0.1999 µL	≤ 0.7% CV	≤ 0.7% CV
Inaccuracy, 384-well Verification Plate*		
<b>Artel ELx 800 Plate Reader</b>		
0.2 µL to 55.00 µL	N/A	± 2.5%
0.01 µL to 0.1999 µL	N/A	± 3.5%

**Artel PowerWave Plate Reader**

0.2 µL to 55.00 µL	N/A	± 4%
0.01 µL to 0.1999 µL	N/A	± 5%
Imprecision, 384-well Verification Plate*		
<b>Artel ELx 800 Plate Reader</b>		
0.2 µL to 55.00 µL	N/A	≤ 0.8% CV
0.01 µL to 0.1999 µL	N/A	≤ 1.4% CV
<b>Artel PowerWave Plate Reader</b>		
0.2 µL to 55.00 µL	N/A	≤ 0.9% CV
0.01 µL to 0.1999 µL	N/A	≤ 1.6% CV
Operating Temperature	15 to 30 °C	15 to 30 °C
Traceability to national and international standards using Artel Verification Plates	Yes	Yes

\*Stated specifications apply when MVS Plate Readers are used.

**PERFORMANCE SPECIFICATION DEFINITIONS**

- When each well in an MVS Verification Plate is uniformly<sup>1</sup> filled with a known<sup>2</sup> volume of MVS sample solution and measured with an approved reader, each individual well measurement will be within the stated MVS inaccuracy specification at a statistical confidence of 95% or better<sup>3</sup>.
- The CV across the full plate (96 or 384 individual results) will also be within the stated imprecision specification at a statistical confidence of 95% or better.<sup>4</sup>

- 1 The liquid handler used to dispense into the verification plates must be capable of repeatable volume delivery with a CV and tip to tip variability at least 3 times smaller than the MVS imprecision specification.
- 2 The liquid handler used to dispense into the verification plates must have a demonstrated accuracy (expanded uncertainty at k=2) at least 3 times smaller than the MVS accuracy specification.
- 3 The number of wells in a single plate, or in a collection of multiple plates, showing results outside of the MVS inaccuracy specification will be less than 5% of the total wells measured.
- 4 The probability that a plate dispensed in this way will show a CV greater than the imprecision specification is less than 5%, or one plate in 20.

**ARTEL ELx 800 PLATE READER**

Size	Depth 42 cm, Width 38 cm, Height 18 cm
Weight	8 kg
Keypad	25 keys
Display	2 x 24 alphanumeric
Light source	Tungsten gas filled bulb
Wavelength selection	Metal oxide interference filters Center wavelengths: 520.2 nm (bandwidth at half-max = 6.2 nm) 730.5 nm (bandwidth at half-max = 10 nm)
Additional filters	405 nm, 450 nm, 490 nm

Printer output	Parallel
COM port	USB

**ARTEL POWERWAVE PLATE READER**

Size	Depth 41 cm, Width 22 cm, Height 22 cm
Weight	11 kg
Light source	Xenon flash lamp
Wavelength selection	Monochromator, selectable 1 nm or greater increments
COM port	RS232

**MVS TITER PLATE SHAKER**

The Q-Instruments Bioshake 3000 is interfaced with the MVS Portable Computer to ensure consistent mixing of the MVS Sample Solutions.

Dimensions	Length 144 cm, width 99 mm, height 48.2 cm
Amplitude	2.0 mm orbital
Shaking Speed Range	60 to 5000 rpm

**MVS CALIBRATOR PLATE**

The MVS Calibrator Plate is a unique, highly sensitive device used to account for local drift in the daily performance of each MVS Plate Reader. Drift is removed from the MVS calculations by correlating the absorbance measurements from a Plate Reader with those made by the reference spectrophotometer at the Artel Laboratory, which is traceable to national and international standards. The MVS Data Manager software obtains critical information from the plate bar code concerning the absorbance of each standard as read in the reference spectrophotometer. The Calibrator Plate therefore allows any MVS Plate Reader in the field to generate standardized, traceable results at any location in the world.

The plate is composed of an aluminum frame with alignment apertures and a set of five sealed, custom-manufactured, precision cuvette absorbance standards. These solution-filled standards are manufactured to strict specifications which cover the working absorbance range of the system. This allows for more accurate wavelength specific corrections of the plate reader for performing MVS calculations. Additionally, temperature dependencies of the Sample Solutions are accounted for by the Calibrator Plate. A pane of neutral density glass is included to monitor any unlikely change in absorbance of the solution-filled standards.

Storage	15 to 30 °C in protective case, out of direct light
Recertification	Periodic factory recertification required
Shelf life	1 year

---

## MVS BAR CODE READER

The HONEYWELL Xenon 1900 is a high-performance hand-held 2D bar code scanner. It allows for easy recall of liquid handler devices and ease of use to enter required MVS bar code data into the Data Manager software.

## MVS PORTABLE COMPUTER

Processor	1.0 GHz, minimum
Memory	128 MB, minimum
I/O Ports	2 USB Connectors, minimum
Network	10/100 Ethernet and 802.11b Wireless
Storage	24x CD-ROM, minimum 20 GB Hard Drive, minimum
Operating System	Microsoft Windows® XP Professional or Windows® 7 (32- or 64-bit)

## MVS MOBILE WORKSTATION

The mobile workstation allows for convenient verification of equipment in multiple locations throughout your facility. The mobile workstation is equipped with two easy to clean shelves and an enclosed bottom shelf with locking door to secure supplies.

Approximate dimensions	Depth 51 cm, width 104 cm, height 97 cm
Accessories	Surge protector with 12 ft. cord

## MVS DATA MANAGER SYSTEM SOFTWARE

The MVS Data Manager software guides the user through the verification procedure and retrieves the data from the MVS Plate Reader and Bar Code Reader. The data are used to determine liquid handler performance relative to set targets and pass/fail tolerance limits. Out-of-tolerance values are automatically flagged. The data output is automatically stored in a database and can be easily exported for further use in other commercially available software programs via HTML or XML formats.

### Software Features

- 21 CFR Part 11 compliance ready.
- Immediate display of pass/fail, dispense patterns via heat map, and volumetric results for each channel.
- Automatic flagging of all deliveries exceeding tolerance limits.
- Compatible with Microsoft Windows® XP Professional or Windows® 7 (32- or 64-bit).
- Easy exporting of data for analysis or viewing with other programs.
- Ability to re-evaluate data visually by modifying the pass/fail criteria after analysis.
- Test the performance of multiple liquid delivery devices using a single plate.
- Ability to use popular conventional microtiter plates when traceability is not a factor.
- Ability to verify and optimize a volume dispensing instrument using specific test solutions such as Dimethyl sulfoxide (DMSO).

---

## MVS SOLUTIONS AND VERIFICATION PLATES

MVS Solutions and Verification Plates are provided as individual components to satisfy the volume measurement requirements of the user. Each individual component is encoded with a bar code containing required performance information to permit all components, whether purchased separately or together, to be interchanged for added flexibility and convenience.

---

## MVS SOLUTIONS

	Working volume for 96 well standard profile plate	Working volume for 384 well standard profile plate	Working volume for 384 round well low volume plate	Working volume for 384 low profile plate
Baseline Solution	200 µL	55 µL	28 µL	20 µL
Diluent Solution	200 µL	55 µL	28 µL	20 µL
Range HV Sample Solution	200.1 to 350.0 µL	N/A	N/A	N/A
Range A Sample Solution	50.00 to 200.0 µL	10.00 to 55.00 µL	4.00 to 28.00 µL	4.00 to 20.00 µL
Range B Sample Solution	10.00 to 49.99 µL	2.500 to 9.999 µL	0.9500 to 3.999 µL	0.9500 to 3.999 µL
Range C Sample Solution	2.000 to 9.999 µL	0.500 to 2.499 µL	0.1900 to 0.9499 µL	0.1900 to 0.9499 µL
Range D Sample Solution				
Data Mgr 3.0 & higher	1.000 to 1.999 µL	0.3000 to 0.4999 µL	0.1500 to 0.1899 µL	0.1500 to 0.1899 µL
Data Mgr 2.4 & lower	0.500 to 1.999 µL	0.1500 to 0.4999 µL	0.0800 to 0.1899 µL	0.0800 to 0.1899 µL
Range E Sample Solution				
Data Mgr 3.0 & higher	0.1000 to 0.9999 µL	0.0300 to 0.2999 µL	0.0190 to 0.1499 µL	0.0100 to 0.1499 µL
Data Mgr 2.4 & lower	0.1000 to 0.4999 µL	0.0300 to 0.1499 µL	0.0190 to 0.0799 µL	0.0100 to 0.0799 µL
Stock Solution 1	0.4 to 10 µL	0.1 to 2.5 µL	0.05 to 1.5 µL	0.04 to 1.5 µL
Stock Solution 2	10 to 50 µL	2.5 to 10 µL	1.5 to 4 µL	1.5 to 4 µL
Shelf Life	All MVS Solutions are stable for 15 months from date of manufacture.			
Storage	15 to 30 °C in closed box, out of direct light.			

## MVS VERIFICATION PLATES

- MVS Verification Plates are optical quality, flat bottom plates which are dimensionally characterized.
- Each Verification Plate comes with a bar code containing the lot number and a unique identifier.
- Verification Plates are statistically sampled and characterized using methods traceable to national and international standards to minimize the variability from lot to lot as well as within each plate. These values describing the characterization are embedded in the bar code and are used in the calculations to determine the dispensed volume.
- Plates are supplied in packages of 25.

## PATENTS

The MVS and its components are covered by patents: US 6,741,365; US 7,187,455; US 7,791,716; US 7,998,747; US 8,003,405; US 7,061,608; EP 1 454 125; DE 602 37 167.8; JP 4303594; JP 4578486; and other US and Foreign Patents Pending.