

Checkit[®] Go

Instant Evaluation for Automated Liquid Handlers



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Synopsis

The Checkit® Go is an accurate, easy to use cartridge for measuring the volume of liquid dispensed by automated liquid handling systems (robots). With better than 2% accuracy, this innovative cartridge measures up to 8 channels at a time, in just a few seconds.

The sample liquids enter precision glass capillaries via capillary action. After a few seconds, the user simply reads the volume of liquid in each capillary by comparing the location of the meniscus with respect to graduations alongside each capillary, in the same manner as reading a bulb thermometer. The Checkit Go has the footprint of standard microwell plates, so it fits in robots that use 96 or 384 well plates.

Accurate: Accuracy is typically within 1%, guaranteed within 2%.

Use your sample liquid: The Checkit Go works with most sample liquids, so viscosity and surface tension effects are included in the measurement, whereas they are not in other methods limited to distilled water or dye solutions.

Fast and Easy: Testing is completed in under 10 seconds, on the bed of the robot, and does not require training.

Documentation: Our Checkit Recorder captures the Checkit Go results and generates a report documenting the test results.

Cost effective: The Checkit Go does not need instrumentation, maintenance, or personnel training.

Reliable: The technology offers consistent and quality performance and is used in many research institutions around the world since 2017.

Basics

The Checkit® Go, shown in Figures 1 and 2, is a well plate size cartridge for measuring eight dispensed liquid volumes simultaneously, on the bed of an automated liquid handling system. Operation consists of three simple steps, as illustrated in Figure 1, which

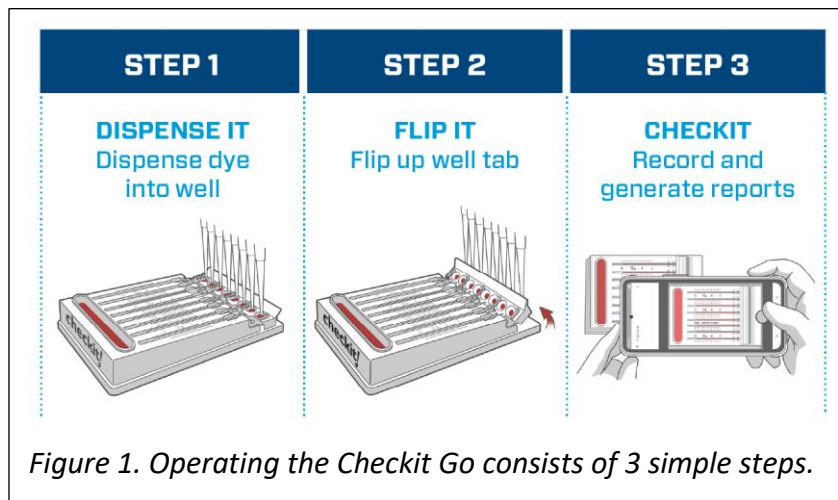


Figure 1. Operating the Checkit Go consists of 3 simple steps.

can be performed in several seconds. Our Checkit Recorder can document the test results, as shown in Step 3 and explained in more detail later.

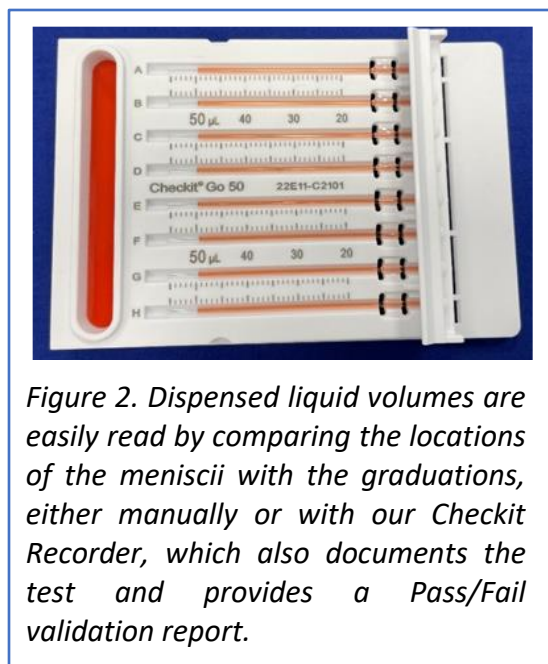


Figure 2. Dispensed liquid volumes are easily read by comparing the locations of the meniscii with the graduations, either manually or with our Checkit Recorder, which also documents the test and provides a Pass/Fail validation report.

This technology has several major benefits.

1. It is very accurate because it is based upon precision glass capillaries.
2. It works with most of the typical sample liquids because it measures volume, not weight or color. You do not need to use specific liquids.
3. It is quick and easy to use. No training is required.
4. No capital investment is required, because it uses stand-alone cartridges.
5. Evaporation is limited to minimal levels because the sample liquid is almost entirely encapsulated in the glass capillaries.

Importance of pipette accuracy

Why is pipette accuracy so important in liquid handlers? Establishing a routine standard operating procedure (SOP) to validate the accuracy of liquid handlers between calibrations prevents incohesive data generation and wasted resources. When you consider that manual pipettes and robotic liquid handlers are an innate part of research, diagnostic and clinical labs, and manufacturers around the world, the importance of pipette accuracy is even more apparent.

The accuracy of the liquids dispensed by the liquid handlers determines the quality of the data or the products that come from respective institutions. For example, in a research facility, a pipetting error of 5% can lead to hard-to-interpret data in quantitative RT-PCR or in dosage-dependent studies. In a manufacturing facility, wrong volumes of reagents dispensed into the diagnostic kits results in recalls and wasted resources. In a clinical laboratory, pipetting inaccuracies can cause quantitative errors of results leading to misinterpretation of patient diagnosis. A validation SOP enables the users to have confidence in their results/products and to know if their liquid handlers need calibration.

Limitations of other methods

Two common ways to check manual or robotic pipette's accuracy are gravimetric and colorimetric/photometric methods:

The gravimetric method measures the accuracy of a pipette by weighing the water dispensed by the pipette using a high precision balance. This is an indirect measurement, whereby the dispensed volume is calculated from the measured weight, and thus requires using distilled water or other liquid with precisely known density. Usually, a weighing pan must be moved in and out of the measurement chamber. Additionally, a humid environment is required because measurements require the time for the balance to stabilize, allowing evaporation to affect the results, particularly with smaller volumes. Overall, this method is tedious and requires personnel training for accuracy and reliability and a capital investment of a high precision balance.

The colorimetric method measures the accuracy of a pipette by measuring the light absorption from a single dye or from dual dyes using a spectrophotometer. This is also an indirect measurement, requiring expensive precision dye concentrations, personnel training, an expensive spectrophotometer that must be periodically calibrated. In addition, the spectrophotometer must be transported and the high viscosity of some dyes makes it difficult to obtain precision pipetting at low volumes.

In addition, neither of these methods can use the sample solutions the robot will use in its daily operation, thus introducing errors caused by differences in viscosity and surface tension.

The Checkit Go bypasses the above limitations by using capillary technology for volumetric measurements.

Benefits of the Checkit Go

There are several benefits to using the Checkit Go for your routine verification:

- Accurate
- Use your own sample liquid
- Fast and easy
- Cost-effective
- Reliable

Accurate

The Checkit Go provides very accurate measurements for several reasons.

- The capillary technology is a mature, decades old proven technology.
- The capillaries are very precise and the graduations are positioned very accurately on every cartridge. Therefore, every cartridge is guaranteed to be accurate to $\pm 2\%$ and is typically accurate to $\pm 1\%$
- Evaporation is largely eliminated, since the liquid is almost entirely encased in glass.
- The measurements are direct measurements of volume. There is no compounding of errors such as from temperature measurement or liquid purity for liquid density values or from dye concentration for absorbance.
- The measurements are conducted on the actual sample liquid, ruling out potential errors from using special measurement liquids with differences in viscosity or surface tension. This effect can be extreme when measuring small volumes using viscous colored dyes for spectrophotometers.

Use your own sample liquid

Just as tips matter to ensure accuracy in liquid dispensing by liquid handlers, so does using the right liquid type. Liquids used by liquid handlers, such as water, glycerol, ethanol, or plasma have different physical properties, e.g. density, surface tension, and viscosity. It is therefore important to validate the liquid handlers with the liquid classes they handle.

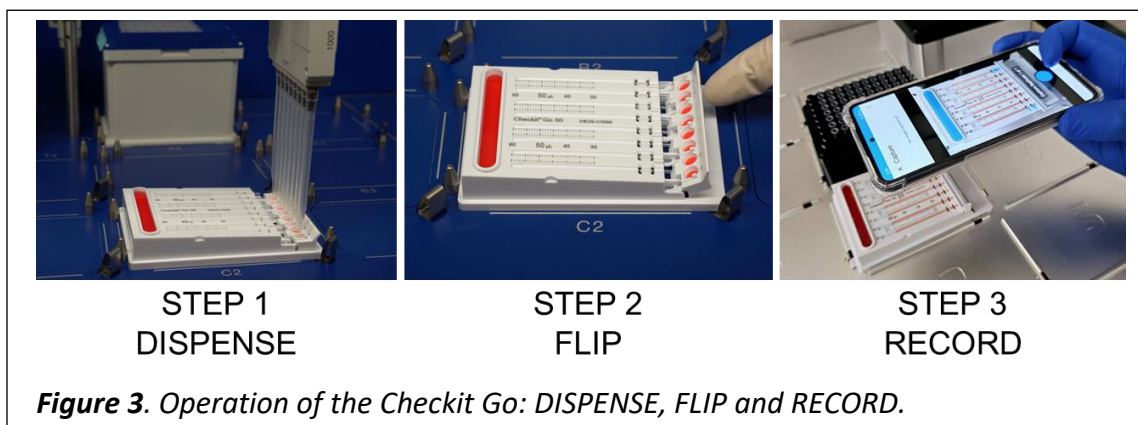
We have tested the compatibility of the Checkit Go with various liquid classes and the results are in the chart below. Solutions most commonly used with the liquid handlers – glycerol, ethanol, DMSO ranging in concentrations from 10 to 80%, and biological fluids were dissolved in a red dye pellet (SKU: DYLY0510-6 & DYLY2050-6) available through Next Advance. The reconstituted test solutions were used with liquid handlers to verify their accuracy by dispensing them into Checkit Go 5, 10, 20 & 50 cartridges and confirmed to be compatible. The results, shown in Table 1, demonstrate that the Checkit Go can be used with many typical sample liquids.

Table 1. Checkit Go compatibility with typical sample liquids.

DMSO	✓	Up to 80%
Ethanol	✓	Up to 80%
Glycerol	✓	Up to 80%
Plasma	✓	Up to 100%
Serum	✓	Up to 100%
PEG-8000*	✓	Up to 38%
Toluene	✓	Up to 30%
Tetrahydrofuran	✓	Up to 50%
Acetic Acid	✓	Up to 50%
*Customer contribution: confirmed in Checkit Go 5 model		

Fast and Easy

The operation of the Checkit Go to check the accuracy of your robotic liquid handlers or manual pipettes consists of three steps, as shown in Figure 3, which can be done in 10 seconds or less. No training is required.



Step 1. The robot dispenses the included dye or your sample liquid diluted with our dye pellet (for visualization) into the wells of the cartridge’s flip tab.

Step 2. Flip up the flip tab – with your finger or with the robot. The liquid in the wells will be drawn into the capillaries in the Checkit Go cartridge.

Step 3. Determine the dispensed volumes by comparing the location of the meniscii against the graduations or use the Checkit Recorder to capture and analyze an image.

The Checkit Recorder determines the volumes in each capillary and generates a report with complete statistical analysis for a single test or a series of repetitions, including Pass/Fail results if criteria are provided. The report can be downloaded and printed for record.

The Checkit Go cartridge has the same footprint of a standard microplate, so it fits in all automated liquid handlers that accommodate 96 or 384 well plates. Labware definitions and liquid classes are available for many manufacturers on our website, at, www.nextadvance.com/checkit-go/resources.

Cost-effective

The Checkit Go is a standalone, low-cost disposable cartridge. This avoids the steep capital investment in a 5-digit balance or a spectrophotometer, annual maintenance, and personnel training.

The financial advantages of capillary technology are outlined in Table 2, which compares the entry cost to use the Checkit Go, gravimetric, and colorimetric methods. Note that the gravimetric and colorimetric methods have significant startup costs.

Table 2. Comparison of entry cost for validation methods

	Checkit Go	Gravimetric	Colorimetric
Capital investment	None	\$20K + (5-digit balance)	> \$50K (spectrophotometer)
Training costs	None	\$500- \$1000/person	\$250 - \$500/person

The operating costs, or cost per test, factoring in labor, is approximately the same for the three methods, with colorimetric being slightly higher. See Table 3 below.

Table 3. Comparison of operating costs for validation methods

	Checkit Go	Gravimetric	Colorimetric
Annual maintenance and calibration	None	\$200 - \$500	> \$500
Labor (to test 8 channels)	1 minute (\$2)	15 minutes (~\$30)	10 minutes (~\$20)
Consumable (to test 8 channels)	\$30 (USA, 2023)	\$0	\$20 +

Reliable

The capillary technology in Checkit Go offers consistent and quality performance. It has become a trusted technology to validate the accuracy of pipetting volumes in many research institutions around the world since 2017.

Every cartridge is evaluated for accuracy using instrumentation with NIST-traceable calibration. A Certificate of Accuracy is available for every Checkit Go cartridge, from our website (<https://www.checkitcofa.com/>) by simply providing the serial number of the cartridge.

Customer testimonials

"I was very impressed by how easy it was to use."

- Ramisa Fariha, Brown University

"Once in a while someone comes up with a product that makes you go "A HA!". Checkit Go is one of those products. It's magical in its simplicity and the speed at which you can verify your liquid handler is unlike anything else I've ever seen or used."

- Jeff Kent, Dynamic Devices

"Checkit Go is now my go-to tool to quickly verify my volume. It is fast and intuitive to use. I got results in a few minutes versus one hour from my previous method."

- Jean Courtemanche, Takeda Pharmaceuticals International Co.

In development

We are developing cartridges that can handle smaller and larger volumes and handle 96 pipette heads.

Conclusion

The Checkit system is poised to become the go-to validation solution for liquid handlers and multichannel pipettes. The compatibility of Checkit Go's capillary technology with a range of commonly used sample liquids and biological samples (such as serum and plasma, and the availability of red-dye pellet) enables you to use the sample liquids as test liquids during validation.

Checkit Go – Instant Evaluation for Automated Liquid Handlers



Request a Checkit Go sample kit today.

If you want to see how fast and easy it is to verify the accuracy of your liquid handler or multichannel pipettes – using the same liquids you are dispensing – ask us for a sample Checkit Go kit.

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The Checkit Go is manufactured by Next Advance, Inc., an ISO 9001:2015 registered company, located in New York State, USA.