

Reduce costs and boost productivity with the Advanced Valve System (AVS 4) four port switching valve

Technical Overview



The Advanced Valve System (AVS 4) is an optional accessory for Agilent's MP-AES instruments, which is designed to increase sample throughput and reduce matrix loads on the sample introduction system.

The AVS 4 consists of a four port switching valve that is positioned between the peristaltic pump and the sample introduction components of the spectrometer. It is fully integrated within the instrument hardware and software. Agilent's MP Expert software provides easy set-up and control of the AVS 4 and, used in conjunction with Agilent's fastest ever autosampler, the SPS 4, can be used to increase sample throughput. The AVS 4, however, can be used with any autosampler supported by Agilent's MP Expert software and with both self-aspirating and pumped nebulizers. The AVS 4 is also compatible with the 5100/5110 ICP-OES instruments.

The advantages of analysis with the Agilent AVS 4 include:

- Higher productivity—the AVS 4 rinses the sample introduction system during uptake of the next sample, reducing the rinse time to shorten the analysis time and increase sample throughput. The AVS 4 can improve sample throughput by reducing the rinse time for certain elements.
- Reduced operating costs—shorter analysis times means reduced cost. Also, by diverting the sample away from the spray chamber both before and immediately after measurement, the sample load on the sample introduction system is significantly reduced. This minimizes the exposure of the sample introduction system to aggressive and harsh samples, increasing the life of the consumables which reduces ongoing cost of ownership.
- Reduced carry-over—diverting the sample away from the spray chamber, both before and immediately after measurement, improves washout efficiency and greatly reduces carry-over.
- Ease-of-use—control of the AVS 4 is simple, as it is fully integrated into the MP-AES (and ICP-OES) hardware, and controlled through the instrument software, eliminating the need for stand-alone software to be installed. This means the AVS 4 setup is included in the method, requiring only one parameter to be set, ensuring optimal timing of the switching valve. The robust AVS 4 is designed for easy assembly and re-assembly, making routine maintenance quick and easy and maximizing instrument uptime.

How does it work?

The AVS 4 consists of a four-port switching valve that is automatically triggered during analysis by the instrument control software.

The AVS 4 increases productivity by utilizing the non-measurement time (uptake time) while the sample is being pumped from the sample container to the sample introduction system. During this time (Figure 1), the AVS 4 will direct rinse solution to the spray chamber for washout.

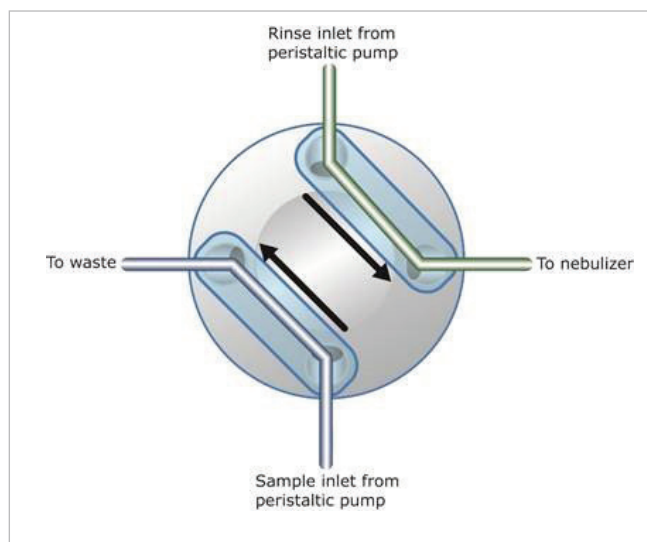


Figure 1. AVS 4 directs rinse solution to the sample introduction system during sample uptake time.

Once the sample has reached the AVS 4, the valve switches, rinsing of the spray chamber stops and the sample is directed into the spray chamber for measurement (Figure 2).

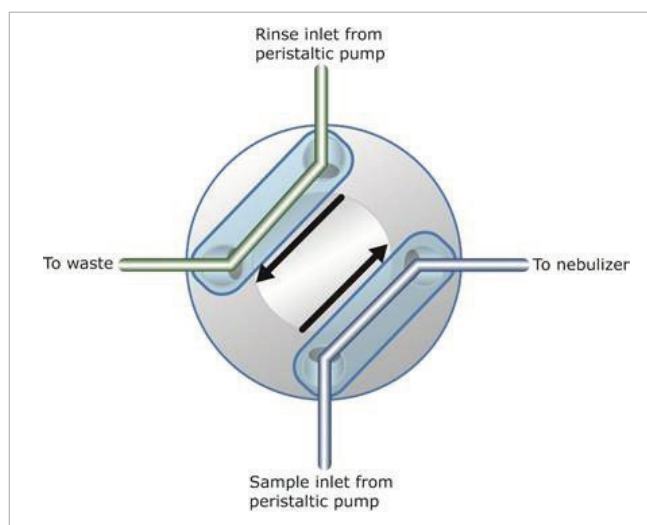


Figure 2. AVS 4 directs the sample to the spray chamber during sample measurement time.

Immediately after the measurement is completed, the valve switches back to the position shown in Figure 1, diverting any remaining sample away from the plasma. The rinse solution is automatically introduced, ensuring thorough washout and reducing carry-over.

The amount of sample that is introduced into the plasma is only that which is necessary for the analysis. This reduces both wear and sample build up in the torch, which is particularly an issue when measuring samples containing high levels of dissolved solids. The end result is a longer torch lifetime and improved long term stability.

The AVS 4 improves the efficiency of sample delivery and removal from the spray chamber, reducing analysis times. The portion of the total sample analysis time that is dedicated to rinsing the system is maximized when compared with typical sample introduction systems, reducing carry-over, which in turn improves accuracy.

Analytical results

Reduced carry-over and increased sample throughput for “sticky” elements

Diverting the sample away from the spray chamber both before and immediately after measurement, greatly reduces carry-over of “sticky” elements such as boron and mercury. These elements have much higher absorptivity onto the sample introduction components and require longer rinse times to washout.

The example in Figure 3 displays the washout performance of boron using the 4210 MP-AES. Various rinse times were used, both with and without the AVS 4, measuring a blank solution after measurement of a 200 mg/L B solution. It can be seen that washout from 200 mg/L to less than 100 µg/L was 3 times faster with the valve installed than with no valve.

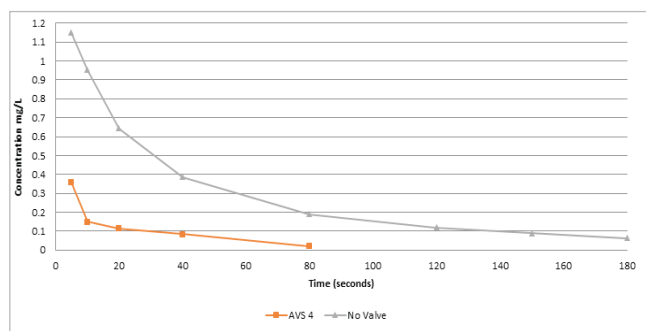


Figure 3. Washout performance of boron for various rinse times, with and without the AVS 4.

Table 1 displays a comparison of rinse times for the washout performance of 200 mg/L boron solution with and without the AVS 4. The reduction in rinse time with the AVS 4 significantly improves sample throughput in comparison to no valve.

Table 1. Comparison of rinse times for washout performance of 200 mg/L boron solution with and without the AVS 4.

	With AVS 4	No valve
Rinse time	40 s	150 s

The reduction of analysis time using the AVS 4, also reduces sample load on the sample introduction system.

Improved stability

Used in conjunction with Agilent’s humidifier accessory, the AVS 4 can significantly improve signal stability. Figure 4 displays long term stability of elements in 3% NaCl, spiked at 2 ppm, measured over an 8-hour period. It can be seen that the precision (%RSD) for 3% NaCl significantly improved for all elements with addition of the AVS 4.

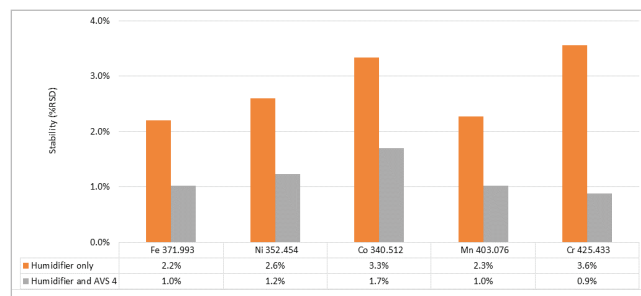


Figure 4. %RSD of elements measured in 3% NaCl over 8 hours with the humidifier and with humidifier and AVS 4.

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