
## Welcome

As always, we thank you for your interest in the upcoming Rimage Maestro system. This is the Fourth Maestro update, but if you missed the earlier updates, they are available on the Maestro website at https://www.rimage.com/future/maestro/. You can also reach out to us at TeamRimage@rimage.com for copies, or with any other questions you have. Feel free to invite anyone else who may be interested to sign-up for these updates as well.

First, you might be asking where is Maestro? While the Rimage Maestro is manufactured in California, some of the component parts were originally planned to be sourced from China. Due to the Corona virus, there have been supply chain disruptions for many companies, Rimage included. We've rapidly pivoted to other sources, but it will cause a few weeks of delay launching Early Access. The next Maestro update will include all the details around Early Access, and should be hitting your inbox in about 2 weeks.

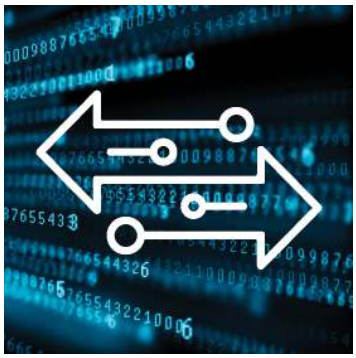
Within each Rimage USB device is the component we refer to as the Data Module. The data module consists of some unique-to-Rimage components, and then the NAND flash memory. NAND is not an acronym, it's actually a combination of "not and". In flash memory technology, this represents a boolean operator and logic gate, referring to how the memory operates. There are many types of NAND available for USB, but we'll cover the major categories and how they apply to the Rimage Data Modules.

## SLC vs MLC vs TLC

One of the main differences in NAND flash memory is SLC, MLC and TLC memory. SLC is "Single-level Cell", meaning each cell contains 1 bit of information. MLC, or "Multi-level Cell" contains 2 bits of information, while TLC, "Triple-level Cell" contains 3 bits of information. There is even QLC, "Quad-level Cell" that has 4 bits of information, and research continues to look for ways to add more.

The difference between these is a direct relationship to performance and cost. The more information each cell holds, the more data can be stored in the same physical space, allowing for larger sizes and/or lower costs. However, there is a trade-off in terms of performance. The more bits in a cell results in lower write speeds and lower numbers of write-cycles.

## Lifespan

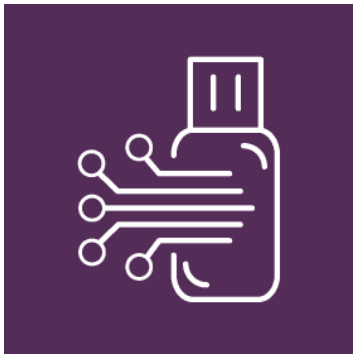


The number of write-cycles is essentially a lifespan limitation of flash memory technology. The cells in the flash memory have a limited number of times they can be written to before they potentially start failing and losing data. Modern devices have a lot of error-correction in them to help reduce the impact of these errors, but it puts boundaries on how many times the cells can be written to and erased. Typically SLC has more than 50,000 or more write-cycles, MLC 1,000 to 10,000 write-cycles and TLC in the hundreds of write-cycles.

One important thing to point out is that these limits are per cell. Modern flash memory has controllers that try to divvy up usage to cells evenly. For a simplified example, if you have an 8 GB TLC device with 300 write-cycles per cell, and you only write 4 GB of data to the device at any time, you could actually get 600 write-cycles before any cell was hitting the limit. With only 2 GB of data, you could get 1200 write-cycles before any single cell was at the limit.

## 3D What?

Technology never stands still, and in flash memory that has resulted in 3D NAND. Rather than having the cells in a 2D plane, 3D NAND has the cells stacked vertically as well. The advantage of doing this is that it negates some of the disadvantages of the higher bit's per cell. 3D NAND is cheaper, more reliable and has increased write performance. As a result, it makes straight forward comparisons between SLC, MLC and TLC a bit more complicated. 3D TLC can perform as well, or better than, standard MLC, while still having advantages in cost and capacity.



## How does this apply to Maestro?

Now that we have some of the technology background, we can get talk about how this applies to Maestro. In Early Access, Rimage will launch with 3D TLC data modules. This gives the best possible price for high capacity and high performance storage. In most environments, 3D TLC memory will be the ideal solution for Maestro. However, the Maestro data-module form factor is not limited to 3D TLC, and we want to hear from end-users that have other requirements. The Rimage data modules are rated for 300 write-cycles, with the longevity of the device depending on the number of times it has been written to. If each device is written to only once, such as if it was locked with our WORM option, the data can last 10 years. This is about the limit of what NAND Flash memory technology can do for longevity with current technology, but if you have requirements for higher number of write-cycles, please let us know.

### Final Thoughts

If you have any further questions about NAND flash memory, the Rimage data modules or anything else about the Maestro system, please let us know. Any feedback you have is greatly appreciated. Remember, the next update is all about Early Access and will have more details around getting a Maestro system, so make sure all interested parties are signed up!