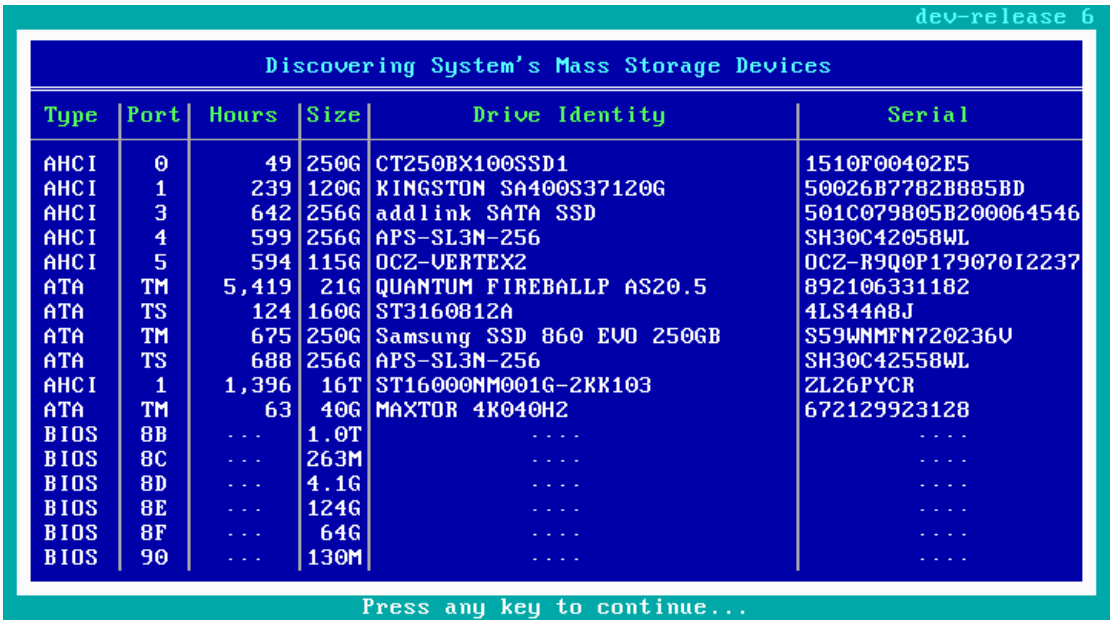
SpinRite's New Benchmarking

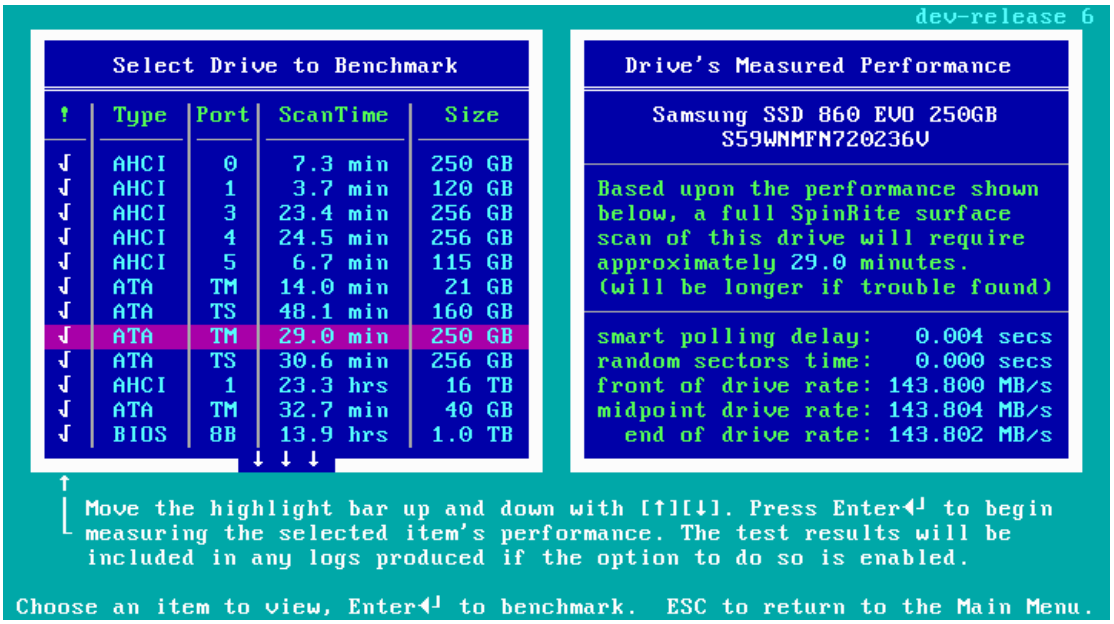
As Implemented in Development Pre-Release #6

SpinRite has always incorporated drive benchmarking, but it has mostly been presented as a curiosity. It only took us 34 years to figure out that what most SpinRite users want to know is how long SpinRite will take to perform a maintenance scan of any given drive. Although no short sample can be precise, the performance of the front and back of a spinning (spinner) or solid state drive can provide a useful first approximation. And we've learned that non-uniform performance of solid state drives can give some sense for the drive's health. (A future SpinRite will offer some surprising benefits for solid state (non-spinning!) mass storage.)

This screen snapshot shows SpinRite v6.1's drive enumeration of various spinning and solid-state mass storage SSD's and "thumb drives" with AHCI, ATA and USB/BIOS connections:

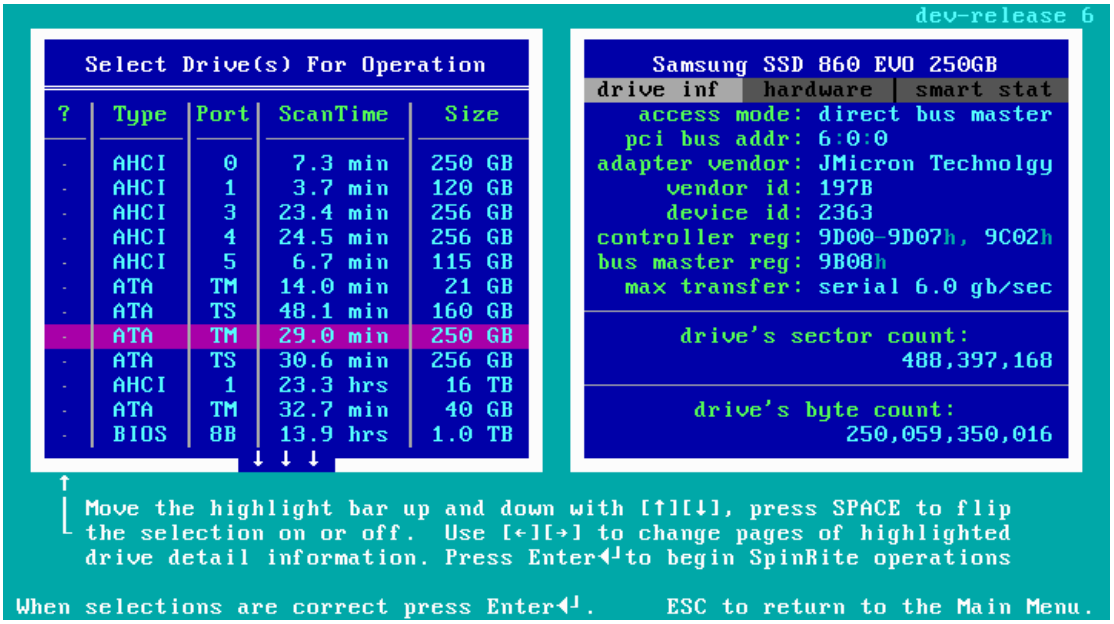


Below, the left pane shows each drive's "ScanTime" determined by the new benchmarking:



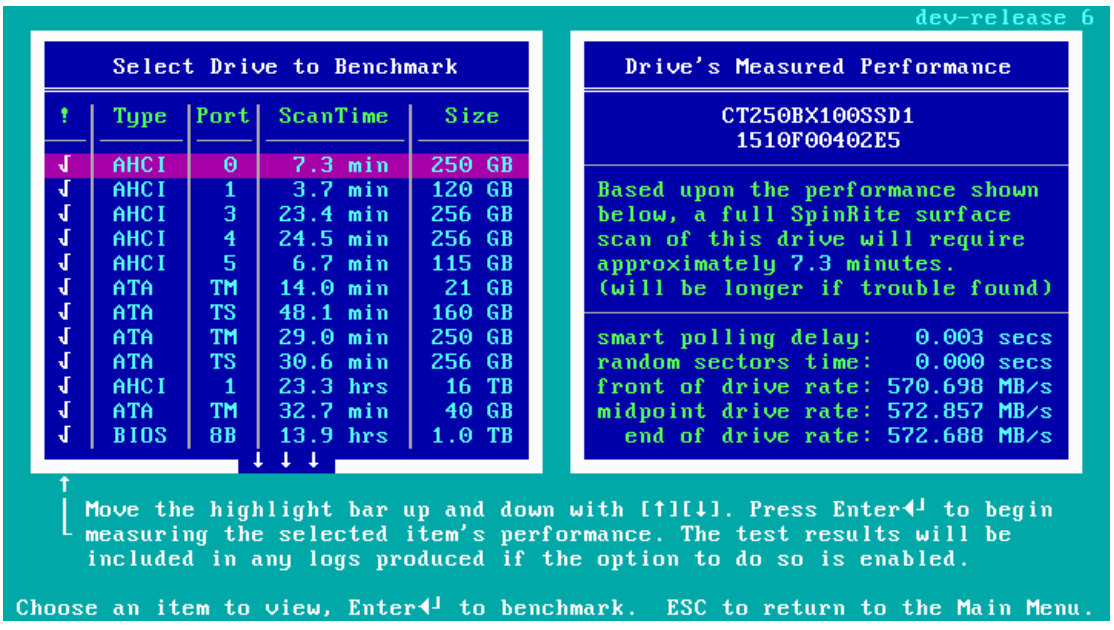
The righthand pane above illustrates the high quality of this benchmark's measurements. Given a rock-solid performing SSD (in this case, as shown, a 256GB Samsung 860 EVO), the three separate regional measurements taken at the front, middle and end of the drive show sustained transfer rates of: 143.800, 143.804, 143.802 megabytes per second. Assuming flat and uniform performance, this benchmark's measurements demonstrate an accuracy of **five** significant digits. It's easy to say, but it's much more difficult to pull off.

However, 143.8 megabytes per second is not super fast and doesn't seem right for a high-performance SATA 3 Samsung 860 EVO SSD. SpinRite's drive information page for this drive reveals why:



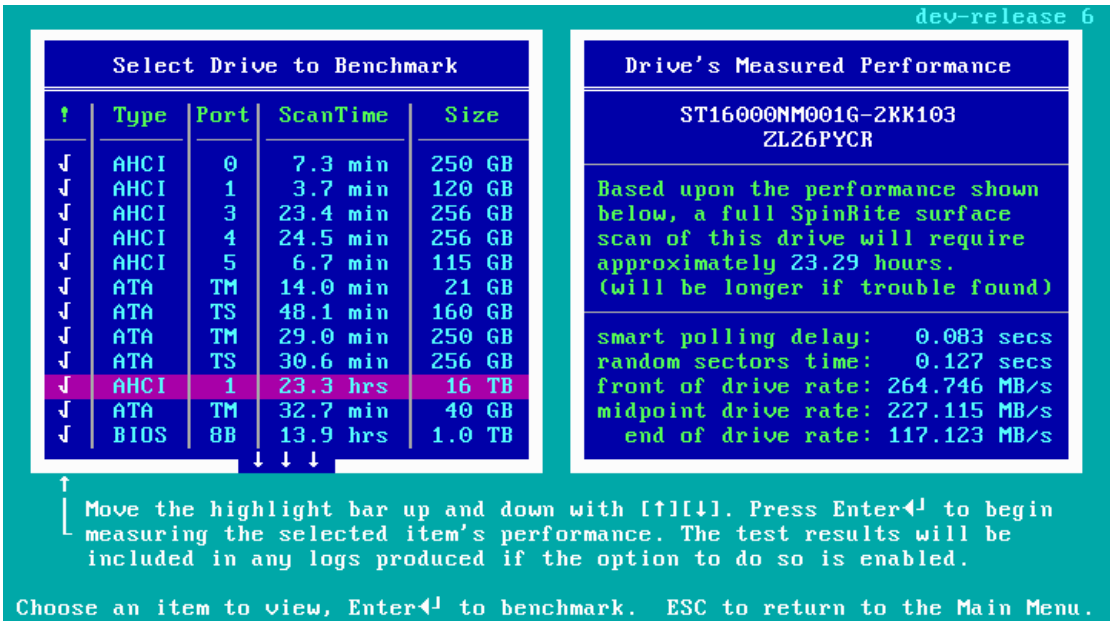
The Samsung SSD is attached to the computer with a JMicron Technology JMB363 combo SATA 2 and PATA (IDE parallel cable) controller which was used during development testing. As shown above, the Samsung can transfer at 6.0 Gb/sec SATA 3 speed, but it's connected to a much slower SATA 2 device.

To see what SpinRite **can** do, we can look at an SSD connected to the AMD motherboard's native SATA 3 port:

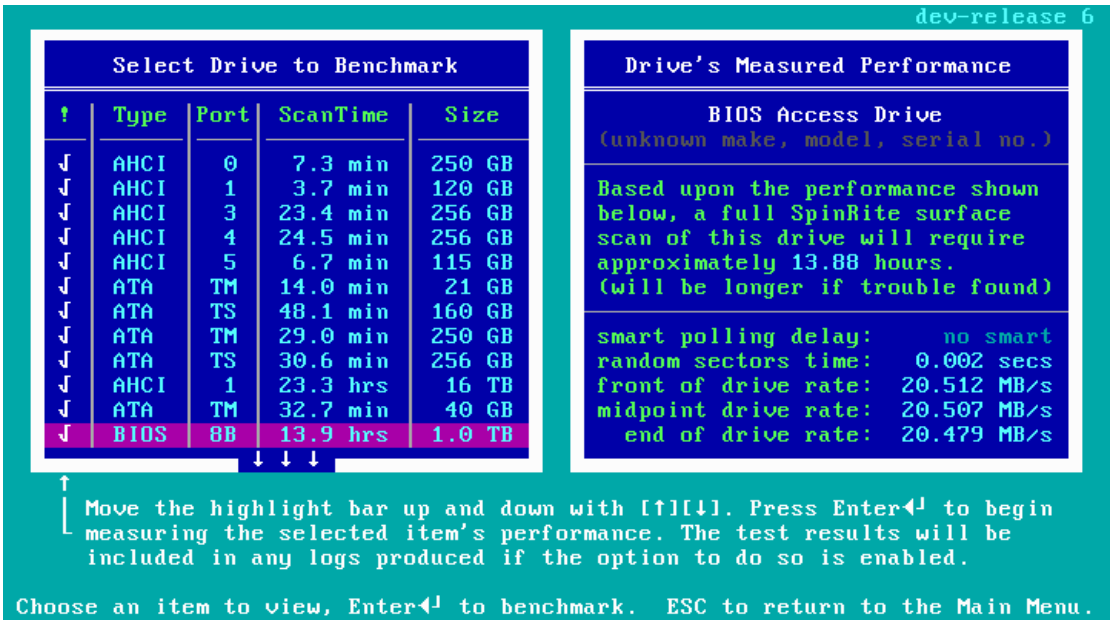


The CT250BX100SSD1 is an SSD made by Crucial and the screen snapshot above shows its performance clocking in at around 573 megabytes/second. This is as fast as SATA 3 can go and it's faster than most benchmarks can make it go. SATA 3 uses line rate of 6 gigabits per second and encodes each 8-bit byte of data into 10 bits on the wire. Therefore, 6 gigabits per second delivers 600 megabytes of theoretical data throughput. SATA control signal overhead of 4.5% reduces that to 573 megabytes/second. Thus, SpinRite's new hardware drivers are able to drive a system's adapters and their drives at their **maximum possible speed**. And also note that this Crucial **256GB** drive will now be scannable by SpinRite in just 7.3 minutes, making SpinRite's use for preventative maintenance far more practical.

Another point of note is a very large 16 terabyte spinning Seagate drive:



It's connected through a Marvell Technology SATA 3 adapter, but its speed is limited by its density and rotation rate, not its adapter. We see the characteristic transfer speed reduction toward the end of spinning drives which is caused by reduced track circumference allowing for fewer bits to be stored on the inner tracks. And here again, even though the benchmark indicates that it will take about a day (23.29 hours), SpinRite v6.1 can scan an entire 16TB spinning drive in a practical amount of time.



The slowest performer is shown above. It's a nice 1 terabyte external drive attached to the system via USB. The benchmark is only able to squeeze 20.5 megabytes/second of read performance from this system's USB BIOS. (We expect to see BIOS performance varying widely by motherboard.)

As you may know from the current SpinRite development roadmap...

https://www.grc.com/miscfiles/GRC-Development-Roadmap.pdf

… SpinRite won't be getting native USB drivers until it is moved over to the OnTime RTOS-32 OS for UEFI booting. So, depending upon the system (motherboard BIOS) where SpinRite is run, USB-attached drives will remain slow until native USB support can be added. But once that's done, we can expect to see USB 3.0 delivering the same performance as SpinRite's other new native hardware drivers.

Where we are at this moment (November 15th, 2021)**:**

This 6th development release needs a bit more work to handle benchmarking error recovery and manual interruption when attempting to benchmark extremely troubled drives. Once that's complete it will be turned over to the gang of testers at GRC's spinrite.dev newsgroup for their testing across a much wider range of hardware.

SpinRite's current drive identification and benchmarking subsystems thoroughly test **all** of SpinRite's new hardware dependent device driver code. So, we won't proceed until what we have is working universally, for everyone, everywhere.

Then, once we have that -- and we do appear to be close -- SpinRite's new foundation will have been solidified and the work on its data recovery systems can be completed.