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How to obtain maximum performance from your SSD

In recent years, solid state drives have made a huge impact in the PC market thanks to their high reading and writing performance compared with conventional hard disks, both in small file (e.g. 4K) random access and amazing sequential read and write speeds. However, in “real-world” testing, many PC users have found that their SSD’s performance figures are often lower in comparison to figures published by some I.T. reviewers. Many of us tolerate this because we know that technical reviews and tests are mostly done on professional hardware platforms with accurate settings and configurations which are designed to maximize performance.

But the question remains - WHY is there often such a big gap between professional testing results and users’ own results? Here are some hints and tips which may help maximize performance and allow real-world data throughput figures to approach or exceed published SSD specifications.

1. Problem: AHCI function turned off ⇒ SSD performance will be decreased by over 30%

Make sure you have turned on the AHCI function in your BIOS. This needs to be done prior to OS installation. The AHCI (Advanced Host Controller Interface) function is a necessary hardware environment required by the latest generation of SSDs that support NCQ, especially SATA-III devices. SSDs’ maximum performance potential can be exploited only when this feature is turned on and will be seriously reduced if the older IDE protocol is enabled instead. The multi-tasking data processing ability of SSDs has an important role to play when the job queue depth (QD) increases and using AHCI can significantly increase the total R/W performance at a geometric level too. However, this setting has no impact on PATA SSDs because the old ATA/IDE profile does not support NCQ.

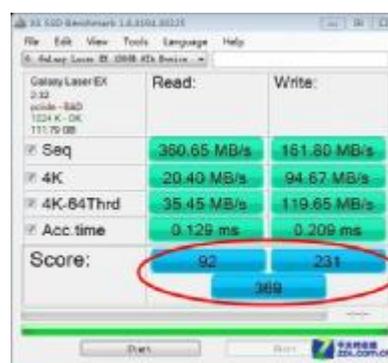
[BIOS settings]



[Performance test: AHCI turned on]



[Performance test: AHCI turned off]



2. Be careful about using the “Energy-saving Mode” on your motherboard

⚠ This may cause 4K IOPS performance greatly decreased

Your CPU's working frequency will greatly affect the performance of your SSD's 4K queue depth and other performance metrics. As an example, if we copy a single non-fragmented 1MB file to an SSD, if it is written in 4KB blocks then the operation will involve $1024KB / 4KB = 256$ IOPS. Each IOPS needs to make use of the bus bandwidth of the PC system in order to execute. In simple terms, if the CPU clock frequency is reduced in order to make a 10% energy saving, then sending instructions is 10% slower, so the theoretical SSD performance test result will be worsened by 10%.

[Energy-saving turned-on]



[Energy-saving turned-off]



Remember this: SSD testing programs (such as “AS SSD Benchmark”, “Crystal Disk Mark”, etc.) are designed to execute critical performance tests with a heavy workload. Their testing results are often almost equal to the theoretical specification ratings of the SSDs being tested.

So if you do have the need to run a thorough benchmark test on your SSD, please make sure that the energy-saving settings of your motherboard are turned off, (e.g. AMD's CnQ, Intel's C1E, EIST, etc.). However, please note that we don't recommend that our users make extensive use of SSD testing programs because of the risk of long-term performance and reliability degradation (see final page).

3. Incorrect connection to non-native SATA-III port:

à Believe it or not, choice of SATA-III port is an important factor that may affect the SSD's performance.....

Most motherboards with Intel chipsets (such as H67, P67, Z68), provide only two channels (ports) which have native SATA-III support. However, many motherboards are manufactured with four SATA-III ports, two of which are powered by a third party (i.e. non-Intel) SATA-III controller. If you fail to realize this, your SSD's performance can be negatively affected. It's generally best to connect SSDs to native chipset (Intel) ports rather than third party ports.

[With native SATA-III connection]



[With third party SATA-III connection]



Final advice: Treat your SSD well and don't benchmark excessively!

Now that some free but well-respected benchmarking programs like "Crystal Disk Mark" are widely used by SSD users to run tests on their newly-purchased drives, we as an SSD manufacturer would like to give our customers a few words of warning about their excessive usage.

No matter what kind of testing software you use, performance benchmarking programs will certainly generate a lot of temporary files on your SSD drive and it's worth remembering that their intensive writing and rewriting operations could potentially affect the lifespan of the NAND flash parts inside the SSD. (In SSDs, erase operations are actually executed as re-writes.)

If you really need to perform benchmarking tests on your SSD, we would suggest that you test with some relatively small sized files, (e.g. 100MB) in order to protect your SSD from long-term degradation of performance and reliability. After all, data safety is more important than speed for most people under most circumstances.

