White Paper

Video Performance Guarantee Profile 5

Version 1.0

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Revision History

Revision	Date	Description
1.0	2025-02-27	Initial release

Table of Contents

1. What Is Video Performance Guarantee (VPG) Profile 5?

Video Performance Guarantee (VPG) is a standard established by the CompactFlash Association (CFA) to ensure that media cards capture high-data-rate video without dropping frames. With tight coupling between the media card and camera, VPG guarantees minimum sustained write performance for recording high-quality video.

The latest iteration of VPG is Profile 5 (VPG-5), finalized in November 2024. VPG-5 defines two new classes for CFexpress media cards that capture streaming video: VPG800 for 800MB/sec sustained write speed, and VPG1600 for 1600MB/sec sustained write speed. The VPG800 and VPG1600 classes are certified by CFA as designated by these logos that appear on CFexpress cards:


2. Why Is VPG Needed?

Video cameras, including still cameras with video-recording capability:

1) Capture video footage with an image sensor
2) Send the data through an internal data bus
3) Process the data using the image processor and internal random-access memory (RAM)
4) Write files to the media card (Flash memory)

With modern cameras' larger image sensors, more data is being processed by faster processors, using more memory that will, in turn, create bigger files to be written on faster cards. Higher resolution, a higher frame rate, and a higher dynamic range all contribute to a higher bit rate, resulting in the media card recording at an increasingly high-speed sustained write operations regardless of compressed or RAW video.
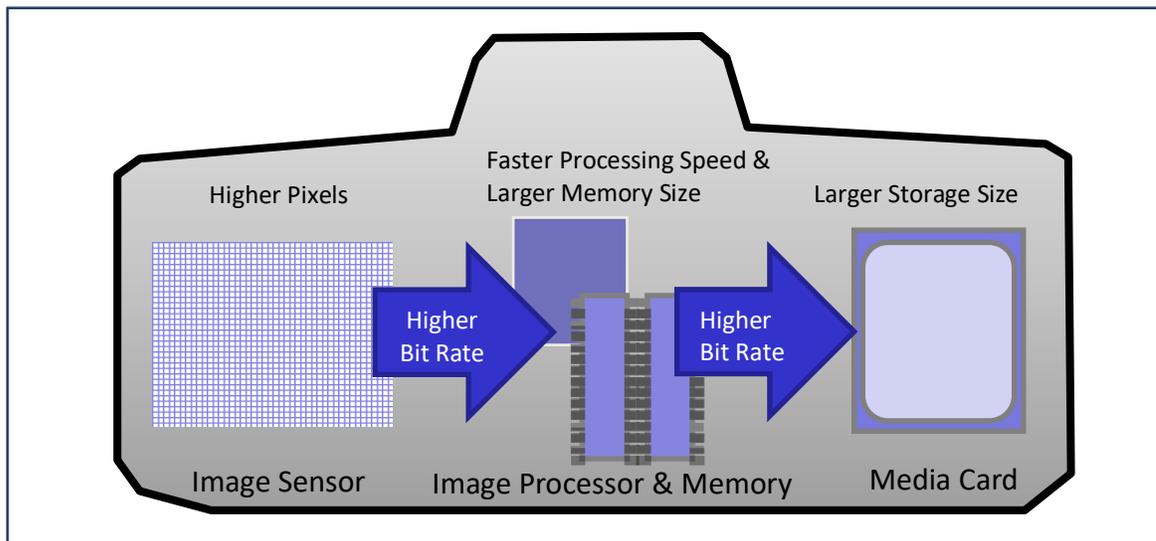
Unlike media cards used with PCs and embedded applications, which read and write small files in random locations in the storage element with little restrictions on read/write time, video cameras capture streaming video in real time. This means a video must be recorded by the media card at the same or greater bit rate as the incoming video data stream with minimal delay. This requires a more rigorous write operation by the camera and media card so that no frames are dropped (no data is lost).

The VPG standard ensures that the media card is capable of recording video at extremely high data rates by tightly coupling the card functionality with the camera to extract guaranteed write performance. VPG establishes a "contract", or profile, between the camera and media card to guarantee high performance.

The profiles embody a set of operational guardrails to ensure that:

- The media card has large contiguous portions of Flash memory
- Optimal stream recording boundaries are established
- Information is communicated between the media card and camera ensuring that the camera's internal buffer memory doesn't overflow and result in lost frames

As Flash technology moves forward and write speeds for video streaming increases, CFA responds by defining new profiles. Here are the specs for VPG profiles 1 through 5:

VPG Profile	Classes	Guaranteed Sustained Write	Underlying Standard
1	VPG20	20MB/sec	CompactFlash and CF+ v4.1
2	VPG65	65MB/sec	CompactFlash and CF+ v5.0 CFast v2.0 XQD v1.10
3	VPG130	130MBsec	CFast v2.0
4	VPG200	200MB/sec	CFexpress v2.0
	VPG400	400MB/sec	CFexpress v2.0
5	VPG800	800MB/sec	CFexpress v4.0/v2.0
	VPG1600	1600MB/sec	CFexpress v4.0

3. How is a VPG CFexpress Card Different from an Ordinary CFexpress Card?

Media cards that support VPG profiles are guaranteed to perform as defined for video capture. This provides a level of assurance for users such as video professionals who cannot afford the costs of failed recordings.

Media cards bearing the VPG logo are certified by CFA to perform against the specified VPG profile, as opposed to manufacturers' self-certification for other CFA standards. Media card manufacturers test their candidate cards according to CFA's test specifications using a CFA-approved, tamper-proof tester and then submit the test reports to CFA for review and

certification. This quality-control step by an unbiased party ensures that the media cards will perform as guaranteed.

A CFexpress card's firmware holds data that describes its characteristics. One data element is the VPG flag used by camera manufacturers to identify that a card guarantees VPG operation for camera modes that require it. In an ideal world, the flag is set to 1 if the CFexpress card supports VPG and set to 0 if it doesn't. However, due to manufacturer error or nefarious activity, a CFexpress card may have the flag set to 1 but not actually be VPG certified. Also, if a card has not been submitted for VPG certification, CFA cannot identify the problem until it becomes endemic in the market.

This inconsistency obviously poses risks to users. Although non-VPG-certified cards may work fine for a while, there's no guarantee they will do so indefinitely. If a CFexpress card isn't VPG compliant, there is a strong possibility that it will fail during video recording. The result may be dropped frames, or, in a worst-case scenario, the camera shutting down. This lack of quality control is unacceptable for both users and CFA as it can erode consumer trust.

To remedy this problem, CFA maintains a list of VPG-certified memory cards on its [website](), which is updated in real time as CFA member companies' cards are certified. Camera manufacturers refer to this list when recommending media cards for use with their cameras that require VPG cards. Users can also refer to it to select a VPG card if their cameras require it.

## 4. VPG-5 is *Not* Backward Compatible with VPG-4

Users need to be aware that VPG-5 is *not* backward compatible with VPG-4.

It is counterintuitive, but a higher-performing VPG card, such as one supporting the VPG800 or VPG1600 class, won't necessarily work with a camera mode that requires VPG200 and/or VPG400. This is due to the following constraints:

• **The need for preconditioning.** To achieve the sustained write speeds of VPG-5, a VPG-5 card must be preconditioned (initialized) with low-level formatting. This preconditioning, which was not a requirement with VPG-4, resets the card to its original factory condition, clearing out any scattered data from the Flash memory. The clean card can then effectively manage the internal Flash memory, recording video without system interruptions such as "garbage collection", and deliver the most efficient recording.

• **A preference for cost-effectiveness.** When VPG-4 was introduced, the most advanced single-level-cell (SLC) NAND Flash was necessary, especially without preconditioning. This originally made VPG-4-certified cards very expensive. With advances in Flash controller technology and the availability of faster NAND Flash, card manufacturers can now meet VPG-4 requirements with more economical triple-level-cell (TLC) NAND Flash. However, meeting the high-speed VPG800 and VPG1600 requirements of the new VPG-5 using lower-cost TLC NAND Flash requires preconditioning of the media card.

Within CFA, there was much debate regarding this decision, but members agreed that foregoing compatibility of VPG-5 with VPG-4 would ultimately benefit users by providing lower-priced yet higher-performing VPG cards. In addition, the VPG-5 specification ensures that cameras supporting VPG-4 have few obstacles to supporting VPG-5.

Cards that support both VPG-4 (VPG200 and VPG400) *and* VPG-5 (VPG800 and VPG1600) will show certification logos for each like this:
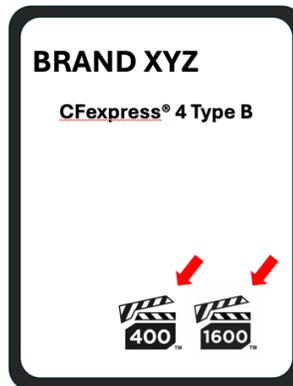
5. What Does This Mean to Users?

With today's cameras, users can perform quick formatting to remove files on media cards. After quick formatting a media card, deleted files are usually recoverable with the help of software applications.

Meanwhile, the low-level formatting required for preconditioning VPG-5 cards restores the NAND Flash memory on the media card to its original factory condition, resulting in permanent loss of data. For this reason, users should take extra care before deleting files and preconditioning a media card for VPG-5 use.

Future cameras that require VPG800 or VPG1600 modes will most likely provide low-level formatting as the default so that users won't have to worry about how to format their media cards to meet their cameras' VPG-5 requirements. However, when using the media card in different modes, the user should again take care to save earlier files before preconditioning it for VPG-5 use.

Also note that deleting a VPG-5 recording does not recover the consumed storage capacity for additional VPG-5 recording. For example, if you precondition a media card for VPG-5 recording, then record using the VPG-5 setting and stop midway to delete the recorded clip, only the remainder of the card will be usable for additional VPG-5 recording. To use the entire capacity of the card for VPG-5 video, you must again precondition the media card.

6. Conclusion

The VPG specification was established to guarantee high write performance for video capture. This is key for users who can't afford to retake failed recordings. The new CFA VPG-5 specification extends the VPG standard supporting VPG800 (sustained 800MB/sec write) and VPG1600 (sustained 1600MB/sec write) modes using the latest TLC NAND Flash technologies.

VPG-certified memory cards can be found on the CFA [website](#).