

# Know Your Compact Flash Storage Media

## Make an Informed Decision When Choosing CF Cards

### The Problem

It is important to be aware that there are large differences between the various types of compact flash (CF) cards available to the consumer from the CF media storage supply industry. Some CF card manufacturers do not use controlled methods to monitor product quality. Many manufacturers are now issuing higher density/lower cost media, which have been found to be unsuitable for continuous data acquisition applications. Most important, in many cases the end user has no way of knowing that technology or quality degradation has occurred when buying based on a particular brand or model of card. The same brand and model may go through internal cost reduction exercises that affect media quality and robustness and hence reliability with no indication or notification to the card buyer. A CF card failure could potentially result in data loss.

### The Solution

Upon identifying this issue, and in an effort to avoid data loss should a failure occur, Nanometrics is now supplying superior quality CF cards of known technology and quality. More importantly, Nanometrics has identified which media storage providers offering CF media with specific technology/quality tiers. These suppliers use a tracking system that is based on a Bill of Materials (BOM), which traces directly to the Original Equipment Manufacturer specifications. If the specifications (technology/quality) change, so does the card model or revision information. This is typical of all Nanometrics products that are now shipped with a reliable and robust industrial grade CF card from suppliers that have demonstrated that they follow BOM control practices, e.g. Delkin industrial grade CF cards.

***Flash memory is a product component with a limited lifespan and must be replaced periodically. It is imperative to make an informed decision when purchasing or replacing a CF card.***

*(For more information see Key Characteristics Summary table below.)*

### Background Information

Type	Summary – Not all CF cards are alike
SLC Industrial Grade	Single-level Cell Now used for core storage media in Nanometrics products. Available as an option for removable media storage in Nanometrics products. Most reliable and expensive.
MLC Industrial Grade	Multi-level Cell Now used for removable media in Nanometrics products. MLC is more reliable than TLC Commercial Grade, but also more expensive.
TLC Commercial Grade	Triple-level Cell DO NOT USE - This is the least expensive option, but is the most unreliable with a very limited lifespan.

Performance characteristics vary between each type of card; SLC, MLC & TLC. When choosing to replace a CF card, consider the following:

- Flash technology choices exist (with trade-offs on cost & reliability)
  - SLC-based NAND flash provides the highest reliability and endurance but has capacity limitations
  - MLC-based NAND sacrifices endurance for capacity
  - TLC-based NAND should not be used in Nanometrics products
- The three different technologies are created differently:
  - SLC - single level cells
  - MLC - multi-level cells (4 levels)
  - TLC - triple level cells (8 levels)
- Temperature: CF cards are known to degrade exponentially with elevated temperatures (*for more details see chart below*)

### Summary of SLC or MLC Industrial Grade Compact Flash Benefits

- Wide operating temperature range (-40 °C to 85 °C / -40 °F to 185 °F )
- Controlled manufacturing processes - same part every time
- Advanced wear leveling
- Improved shock and vibration performance
- Improved water resistance
- Power Loss – minimize data loss: Industrial flash has power backup features to ensure that all NAND writes complete

### Key Characteristics Summary

Specification/Feature	SLC Industrial	MLC Industrial	TLC Commercial
Summary	Use Freely	Understand the Conditions	DO NOT USE
Applications	Mission Critical	Cost Sensitive	DO NOT USE
Environment	Rugged & Harsh	Moderate	Light
Density range (SSD)	1Gbit – 256Gbit	64Gbit – 512Gbit	128Gbit – 1Tbit
Cost per GB (SSD)	8 x TLC	2 x TLC	1
Reliability & Durability	+++	-	---
Bit per cell	1bit	2bit	3bit
Data retention	Up to 10 years	Up to 5 years	Up to 1 year
Endurance (Program/Erase PE cycle)	Up to 100k	Up to 3k	Up to 1k
Maximum temperature range	Widest Range -40 °C - +85 °C -40 °F - 185 °F	Moderate Range 0 °C - +70 °C 32 °F - +158 °F	TBD

## Conclusions and Recommendations

- Be aware of the key factors in determining the lifetime and quality of the CF card: type (SLC, MLC, TLC), storage size and temperature in which the instrument is deployed.
- For mission-critical applications ensure you are purchasing at least MLC, if not SLC based media.
- If using MLC with low store size or TLC CF cards, it is suggested that a procedure be implemented to track the lifetime of the CF card in order to anticipate and replace the card before any data loss occurs.
- Purchase cards of known quality from Nanometrics or your Nanometrics representative.
- If buying direct from a CF card supplier, contact Nanometrics for the approved/tested list of reputable products and suppliers.

*Additional information on CF storage media: [http://en.wikipedia.org/wiki/Flash\\_memory](http://en.wikipedia.org/wiki/Flash_memory)*

**Questions? Please contact [techsupport@nanometrics.ca](mailto:techsupport@nanometrics.ca) or phone us at: +613-592-6776**

**[www.nanometrics.ca](http://www.nanometrics.ca)**