

Memory cards and card readers – White Paper Characteristics and influences



- when it has to be **right**

Leica
Geosystems

June 2010

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Abstract

This white paper gives an overview of the requirements that memory cards and card readers must fulfil and the characteristics they must possess in order to comply with the conditions for being an approved Leica Geosystems product and therefore ensure the highest quality and system performance.

Introduction

Leica Geosystems instruments and sensors are compatible with storage media based on a number of different technologies. These storage media have different dimensions, technologies and available memory space. However, all share the same characteristic that differentiates them from mass-produced items found in the general electrical or technical markets: they are manufactured and tested as industrial-grade products. These media offer considerably higher standards with regard to environmental conditions and specifications.

Industrial-grade memory cards

Industrial-grade cards are specially developed, manufactured and tested to withstand extreme environmental conditions.

The RISC controllers integrated into the cards offer improved product features, such as inbuilt error correction, automatic block management, power loss data protection and low power settings.

- The specially designed casings provide the best possible mechanical protection against bending or other imposed loads.
- The construction of the casings of industrial cards render them insensitive to the effects of electrostatic charges.
- The gold coatings on the contact surfaces are many times thicker than those of standard cards and are designed to be inserted at least 10,000 times.
- Power loss protection prevents data loss in the event of a sudden power failure.

- Inbuilt error correction and automatic block management ensure the longest possible service life by optimising the use of all the flash cells. If individual cells fail, they are registered by the system and blocked from further memory write events.

Technical specifications of an industrial-grade card

The data transfer rate is not the critical factor for a memory card used with TPS or GNSS instruments. The most important advantage of an industrial card is its extreme operating temperatures.

(See comparison of working temperatures of industrial, extended and standard grades).

Industrial Temp. Range -40°C – 85°C	I
Extended Temp. Range -25°C – 85°C	E
Standard Temp Range 0°C – 70°C	C

Fig. 1 - Temperature ranges of memory cards

Tests determine a card's resistance to high shock loads of up to 1000 g and drop heights of up to 1.5 m, depending on card type.

The card casings comply with a minimum ingress protection standard of IP54 and their resistance to environmental influences and salt are specified and tested to military standards.

Data storage and failure rate

The data retention period of the card is at least 10 years and the MTBF (Mean Time Between Failures) value can be up to 4,000,000 hours, depending on the card type. The MTBF value defines the average service life of a card.

The MTBF value is a measure of a product's reliability. In principle, the higher the MTBF value, the longer the product continues to function.

If an SD memory card has an MTBF value of 4,000,000 hours, which corresponds to 456 years, then the probability of the card failing during, for example, 5 years of use can be calculated from the equation below.

$$p(T) = 1 - e^{-\frac{T}{MTBF}}$$

$$p(5a) = 1 - e^{-\frac{5a}{456a}} = 1,1 \%$$

In this case, this means that the probability of failure within a period of use of 5 years is 1.1 %. This assumes that the storage medium has been subjected to normal use within the specified temperature and environmental conditions.

Leica Geosystems gives the following recommendations for the use of storage media

On the instrument

- Use only storage media that have been recommended by Leica Geosystems. These products have undergone many tests to ensure that they are compatible with the various sensors and therefore provide the highest possible safety to your data.
- Ensure that the instrument is switched off before you insert or remove the storage medium.
- Ensure that the storage medium is correctly inserted into the instrument. Do not use force while inserting the media. Observe the instructions on the instrument and/or in the operating instructions.
- Always format memory cards in the same place as they will be read. This is intended to ensure that the cards will always be able to be read in an external device. When formatting on a PC, consider whether you should use the FAT16 or the FAT32 file system. As a rule, the FAT16 file system is generally supported, but some newer instruments also support the FAT32 file system. Observe the advice in the operating instructions for your instrument.
- Back-up your data regularly, ideally at the end of each working day!
- If you have inadvertently deleted data from your storage medium, on no account continue to use the storage medium. You can recover the deleted data using special software, as long as it has not been overwritten.
- SRAM, PC cards or CF cards (with adapter) up to 32MB capacity can be used with Leica TPS1100 total stations and DNA digital levels. The TPS1100 total station can handle a maximum of 60 jobs.

- SRAM PC cards up to 16MB capacity can be used with Leica TPS1000/2000/5000 total stations. The TPS1000 total station can handle a maximum of 24 jobs.

On the PC/laptop

- Defragment or format your storage media regularly (if used daily, at least once a month) to prevent your data from becoming unusable and/or destroyed through over-fragmentation.
- End your access to the storage medium on your PC/laptop properly before you remove the storage medium from the PC/laptop. In the Windows™ operating system, there is a symbol on the taskbar to allow you to do this.
- Back-up your data regularly.

Moving / storage

- Always move your storage media from one place to another in the supplied protective surround or cap.
- Protect cards from moisture or direct impacts.
- Keep your storage media in a safe place where they cannot be damaged by other objects.
- Never store your storage media in direct sunlight and certainly not in a motor vehicle, where interior temperatures can very quickly rise as high as 70 - 80 °C.

Portable data back-up

Data can be backed-up in the field in a number of ways:

- On a laptop (PC card adapter or USB connection may be required)
- On a portable PC (pocketPC, netbook, etc.)
- By email from a field controller
- Leica SmartWorx and SmartWorx Viva support the direct exchange of measurement data with the PC in the office. To do this requires an FTP server with a static IP address.
- A GPRS/UMTS radio connection is required for data transfer in the field (email, FTP). This can be through a modem integrated into the instrument or, for example, with an external cell-phone over a Bluetooth connection.

Reading card data

Although the international memory card standard (PCMCIA) applies to the card holder in appropriate card readers, it can be the case that some laptops or readers integrated into PCs cannot read or write to some memory cards. This is often due to different combinations of drivers, hardware and card readers used by the laptop/PC manufacturer. The only solution here is to obtain a high-quality card reader.

Card readers

Leica Geosystems offers the Omnidrive external reader, which connects to a PC by a USB interface. These high-quality card readers give years of problem-free service. They are so extremely robust that they are mainly used in industry or military applications. With the supplied driver and the applications, these readers can be used with all Windows™ operating systems from Windows 98 SE (except WIN NT).

Leica Geosystems has two different card readers in its range.



MCR7, USB card reader for SD and CF cards.

MCR8, USB card reader for SD/CF and SRAM cards.

Failure to recognise storage media

When cards are not recognised or read or write errors occur, the first thing to be investigated should always be the contacts on the card itself. If the contact strips show signs of pressure points or scratches, this may indicate that the card reader's

pin contacts are bent. A quick look inside the card slot should be able to confirm this or not. This happens quite often with cheap card readers. It is sometimes due to thin contact pins or inaccurate guide slots. These cheap readers do not meet the Leica Geosystems specification and can permanently damage your storage media.

Summary

Safe and efficient data exchange between instruments and PCs can only be assured by a combination of Leica card readers and Leica storage media.

The objective of this white paper is to provide the surveyor and user with a brief overview of the principles and requirements to which Leica Geosystems storage media and card readers are designed, developed, produced and continuously tested.

What you get is a „Black-Box“ purchase. Something that looks similar as a genuine Leica accessory but ultimately you just don't know what you have got ...

- Supplier qualification for a sustainable product quality
- Material and process qualification
- Ensure electronic quality
- Ensure environmental specifications
- Ensure compatibility to Leica Instruments
- Survey assembly process
- Fulfill national testings and regulations
- Requalification of technical specification in certain intervals

Figure 2 – Manufacturing process of Leica Geosystems originals vs. the copies.

Overview of the storage media used by Leica Geosystems






Storage media	Dimensions	Internal battery	Write protection switch	Additional information	Environmental Specifications
 SRAM	Type I: 85,6mm x 54,0mm x 3,3mm	Yes	No		Industrial grade
 ATA Flash	85,6mm x 53,85mm x 3,3mm	No	No		
 CompactFlash (CF)	Type II: 42,8mm x 36,4mm x 5,0mm	No	No	ATA Flash card compatible with MCFAD1 adapter	Working temperature -20°C to +70°C
 Secure Digital (SD)	32,0mm x 24,0mm x 2,1mm	No	Yes		Storage temperature -40°C to +85°C
 USB-Stick	USB A	No	No		

Figure 3 - Storage media used at Leica Geosystems.

Every day, tens of thousands of professionals put their trust in Leica Geosystems. This trust has developed over many years with the continued development of innovative technologies and solutions that deliver unprecedented accuracy, quality and performance. Leica Geosystems offers a complete portfolio of solutions for precise surveying, not just instruments. With Leica Geosystems no task is too challenging, leverage your professional imagination to success. Leica Geosystems' customers benefit from service and support that spans time zones and geography. With true partnerships – it's our commitment to continue to provide the level of support and collaboration you have come to expect when you put your trust in Leica Geosystems.

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