CompactFlash cards

1 General information

CompactFlash cards are easily replaceable storage media. Due to their robustness against environmental influences (temperature, shock, vibration, etc.), CompactFlash cards are ideal for use as storage medium in industrial environments.

2 Basic information

CompactFlash cards used in industrial automation must be extremely reliable. To achieve this, the following points are very important:

- The flash technology used
- An efficient algorithm for maximizing service life
- Good mechanisms for detecting and correcting errors in the flash memory

2.1 Flash technology

CompactFlash cards are currently available with different storage technologies. These include proven technologies such as multi-level cell (MLC) and single-level cell (SLC) flash memory.
SLC flash memory usually has a service life that is 10 times longer than MLC flash devices (and guaranteed), making CompactFlash cards with SLC flash memory the most robust and reliable solution for industrial use.

2.2 Wear leveling

Wear leveling refers to an algorithm that can be used to maximize the service life of a CompactFlash. Different algorithms are possible:

- No wear leveling
- Dynamic wear leveling
- Static wear leveling

The basic idea behind wear leveling is that data is distributed over a broad range of blocks or cells on the data storage medium so that the same areas are not erased and rewritten over and over again.

2.2.1 No wear leveling

The earliest CompactFlash cards did not have algorithms for maximizing service life. The service life of a CompactFlash card was determined only by the guaranteed lifespan of the flash blocks.

2.2.2 Dynamic wear leveling

Dynamic wear leveling offers the possibility to use unused flash blocks when writing to a file.
If the data storage medium is already 80% full of files, only 20% can be used for wear leveling.
The service life of the CompactFlash therefore depends on the unused flash blocks.

2.2.3 Static wear leveling

Static wear leveling additionally monitors which data is only seldom modified. From time to time, the controller moves this data to blocks that have already been written to frequently in order to prevent further wear on those cells.

2.3 ECC error correction

Inactivity or operation of a particular cell can cause bit errors. Error-correcting code (ECC) implemented by the hardware or software allows many such errors to be detected and corrected.

2.4 S.M.A.R.T. support

Self-Monitoring, Analysis and Reporting Technology (S.M.A.R.T.) is an industry standard for mass storage devices that has been introduced to monitor key parameters and detect imminent failures at an early stage. Monitoring and storing critical performance and calibration data attempts to predict the probability of error states.

A wear indicator, which is part of the S.M.A.R.T. parameters, makes it possible to calculate the expected service life and monitor the condition of the data storage medium on a daily basis.

2.5 Maximum reliability

CompactFlash cards supplied by B&R use SLC flash blocks and static wear leveling in combination with a powerful ECC algorithm to provide maximum reliability.

3 Dimensions

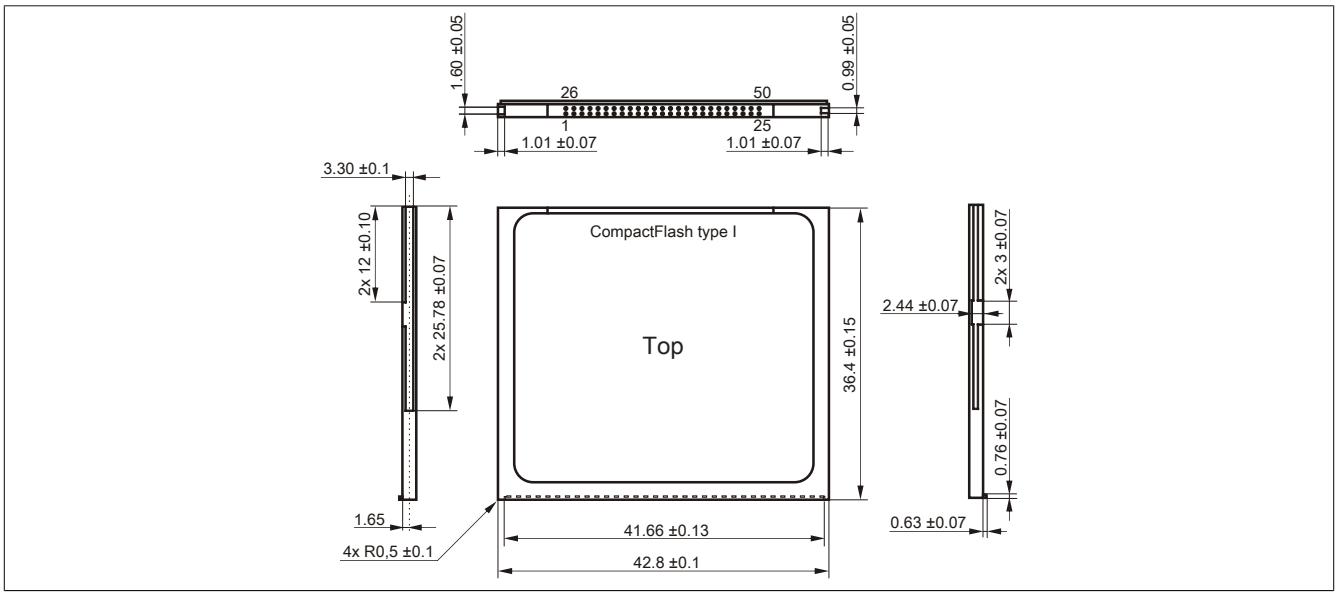


Figure 1: CompactFlash card type I dimensions

4 0CFCRD.xxxxE.02

4.1 Order data

Order number	Short description	Figure
	CompactFlash cards	
0CFCRD.0512E.02	CompactFlash 512 MB extended temp.	
0CFCRD.1024E.02	CompactFlash 1024 MB extended temp.	
0CFCRD.2048E.02	CompactFlash 2048 MB extended temp.	
0CFCRD.4096E.02	CompactFlash 4096 MB extended temp.	
0CFCRD.8192E.02	CompactFlash 8 GB extended temp.	
0CFCRD.016GE.02	CompactFlash 16 GB extended temp.	

Table 1: 0CFCRD.0512E.02, 0CFCRD.1024E.02, 0CFCRD.2048E.02, 0CFCRD.4096E.02, 0CFCRD.8192E.02, 0CFCRD.016GE.02 - Order data

4.2 Technical data

Caution!

A sudden power failure can result in data loss. In very rare cases, the mass storage device may also become damaged.

In order to prevent data loss or damage, B&R recommends the use of a UPS.

Information:

The following specifications, properties and limit values apply only to this accessory and may deviate from those that apply to the complete system. For the complete system in which this accessory is installed, the data specified for that complete system applies.

Order number	0CFCRD. 0512E.02	0CFCRD. 1024E.02	0CFCRD. 2048E.02	0CFCRD. 4096E.02	0CFCRD. 8192E.02	0CFCRD. 016GE.02
General information						
Capacity	512 MB	1024 MB	2048 MB	4096 MB	8192 MB	16 GB
Data retention	10 years (when new) to 1 year (end of service life)					
Data reliability	<1 unrecoverable error per 10^{17} bits read					
Lifetime monitoring	Yes					
MTBF	>3,000,000 hours (at 25°C)					
Servicing	None					
Supported operating modes	Up to UDMA6 / MDMA4 / PIO6					
Continuous reading						
Typical	32.2 MB/s	64.1 MB/s	62.9 MB/s	62 MB/s	64.3 MB/s	64.4 MB/s
Continuous writing						
Typical	19.9 MB/s	29 MB/s	28.6 MB/s	37.5 MB/s	39.0 MB/s	43.6 MB/s
Certifications						
CE	Yes					
DNV	In preparation				-	
Endurance						
SLC flash memory	Yes					
Erase/Write cycles						
Guaranteed	100,000					
Wear leveling	Global, dynamic and static					
Error-correcting code (ECC)	Yes					
S.M.A.R.T. support	Yes					
Support						
Hardware	X20CPxxxx					

Table 2: 0CFCRD.0512E.02, 0CFCRD.1024E.02, 0CFCRD.2048E.02, 0CFCRD.4096E.02, 0CFCRD.8192E.02, 0CFCRD.016GE.02 - Technical data

Order number	0CFCRD. 0512E.02	0CFCRD. 1024E.02	0CFCRD. 2048E.02	0CFCRD. 4096E.02	0CFCRD. 8192E.02	0CFCRD. 016GE.02
Ambient conditions						
Temperature						
Operation	-40 to 85°C					
Storage	-50 to 100°C					
Transport	-50 to 100°C					
Relative humidity						
Operation	Max. 85% at 85°C					
Storage	Max. 85% at 85°C					
Transport	Max. 85% at 85°C					
Vibration						
Storage	20 g peak, 10 to 2000 Hz					
Transport	20 g peak, 10 to 2000 Hz					
Shock						
Storage	1500 g peak ($JESD_{22}$, method B_{110})					
Transport	1500 g peak ($JESD_{22}$, method B_{110})					
Mechanical properties						
Dimensions						
Width	42.8 ±0.10 mm					
Length	36.4 ±0.15 mm					
Height	3.3 ±0.10 mm					
Weight	10 g					

Table 2: 0CFCRD.0512E.02, 0CFCRD.1024E.02, 0CFCRD.2048E.02, 0CFCRD.4096E.02, 0CFCRD.8192E.02, 0CFCRD.016GE.02 - Technical data

4.3 Temperature/Humidity diagram for operation and storage

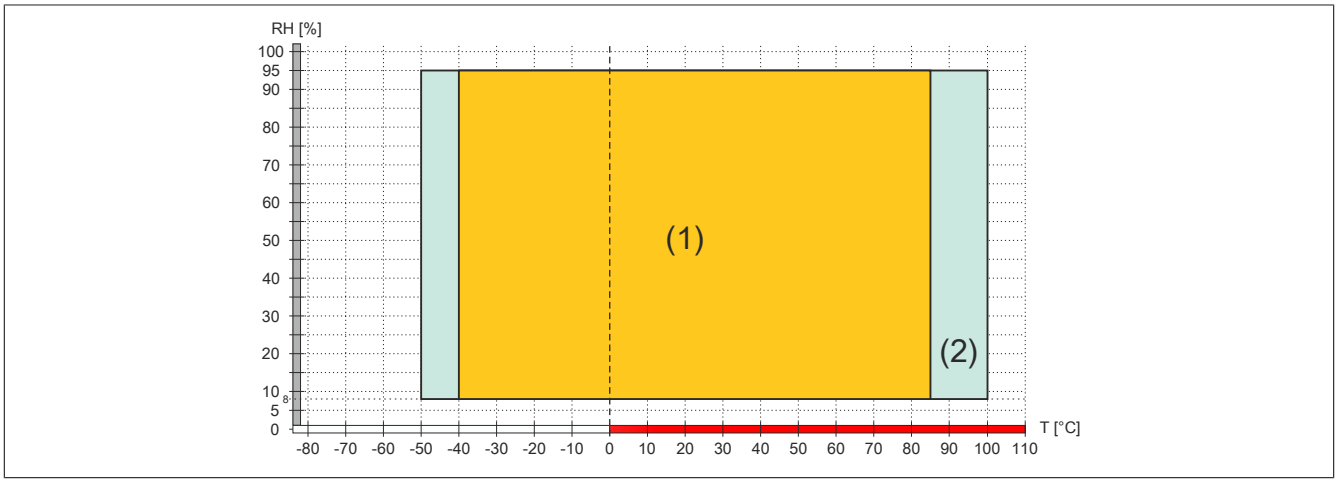


Figure 2: 0CFCRD.xxxxE.01 CompactFlash cards - Temperature/Humidity diagram

Diagram legend			
(1)	Operation	T [°C]	Temperature in °C
(2)	Storage and transport	RH [%]	Relative humidity (RH) in percent and **non-condensing**