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 MLC (multi-level cell) and SLC (single-level cell) flash blocks.
SLC flash memory has a guaranteed service life 10 times longer than MLC flash memory, which means that only CompactFlash cards with SLC flash blocks are used for industrial applications.

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 makes it possible to utilize unused flash blocks when writing to a file.
If 80% of the data storage medium is already taken up by files, then 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

Bit errors can result from the inactivity or operation of a certain cell. Error-correcting code (ECC) added by the hardware or software can detect and correct many errors of this type.

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 was introduced to monitor important parameters and detect imminent failures. Critical performance and calibration data is monitored and stored in an effort to predict the probability of error states.

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

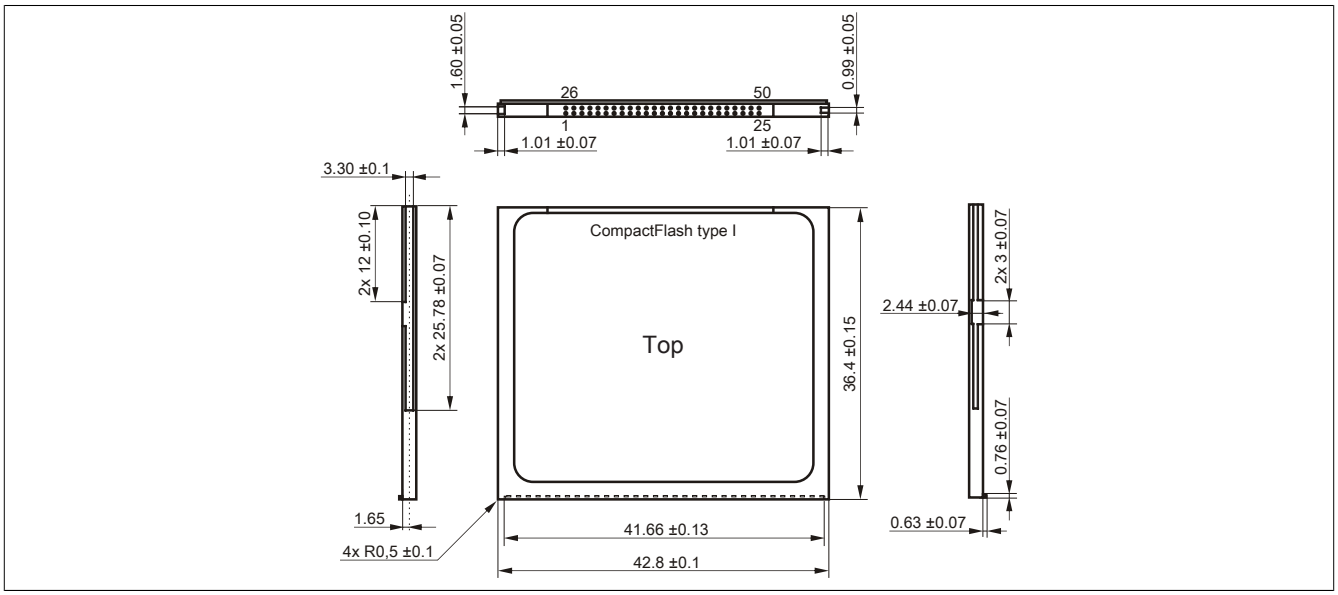

Figure 1: CompactFlash card type I dimensions

4 0CFCRD.xxxxE.01

4.1 General information

Information:

On Windows CE 5.0 devices, 0CFCRD.xxxxE.01 CompactFlash cards up to 1 GB are supported.

4.2 Order data

Model number	Short description	Figure
	CompactFlash cards	
0CFCRD.0512E.01	CompactFlash 512 MB extended temp.	
0CFCRD.2048E.01	CompactFlash 2048 MB extended temp.	

Table 1: 0CFCRD.0512E.01, 0CFCRD.2048E.01 - Order data

4.3 Technical data

Caution!

A sudden power failure may 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.

Model number	0CFCRD.0512E.01	0CFCRD.2048E.01
General information		
Capacity	512 MB	2048 MB
Data retention	10 years	
Data reliability	<1 unrecoverable error per 10^{14} bits read	
Lifetime monitoring	Yes	
MTBF	>3,000,000 hours (at 40°C)	
Maintenance	None	
Supported operating modes	PIO mode 0-6, Multiword DMA mode 0-4, Ultra DMA Mode 0-4	
Sequential read		
Typical	58 MB/s	
Maximum	65 MB/s	
Sequential write		
Typical	31 MB/s	
Maximum	35 MB/s	
Certifications		
CE	Yes	
UL	Not relevant	-
DNV GL	Temperature: **B** (0 - 55°C) Humidity: **B** (up to 100%) Vibration: **B** (4 g) EMC: **B** (bridge and open deck)	-
LR	ENV1	-

Table 2: 0CFCRD.0512E.01, 0CFCRD.2048E.01 - Technical data

Model number	0CFCRD.0512E.01	0CFCRD.2048E.01
Endurance		
SLC flash	Yes	
Erase/Write cycles		
Guaranteed	100,000	
Wear leveling	Static	
Error correction coding (ECC)	Yes	
S.M.A.R.T. support	Yes	
Environmental 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		
Operation	20 g peak, 20 to 2000 Hz, 4 in each direction (JEDEC JESD22, method B103) 5.35 g RMS, 15 min. per level (IEC 68-2-6)	
Storage	20 g peak, 20 to 2000 Hz, 4 in each direction (JEDEC JESD22, method B103) 5.35 g RMS, 15 min. per level (IEC 68-2-6)	
Transport	20 g peak, 20 to 2000 Hz, 4 in each direction (JEDEC JESD22, method B103) 5.35 g RMS, 15 min. per level (IEC 68-2-6)	
Shock		
Operation	1500 g peak, 0.5 ms 5 times (JEDEC JESD22, method B110) 30 g, 11 ms 1 time (IEC 68-2-27)	
Storage	1500 g peak, 0.5 ms 5 times (JEDEC JESD22, method B110) 30 g, 11 ms 1 time (IEC 68-2-27)	
Transport	1500 g peak, 0.5 ms 5 times (JEDEC JESD22, method B110) 30 g, 11 ms 1 time (IEC 68-2-27)	
Elevation		
Operation	Max. 4,572 m	
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.01, 0CFCRD.2048E.01 - Technical data

4.4 Temperature/Humidity diagram for operation and storage

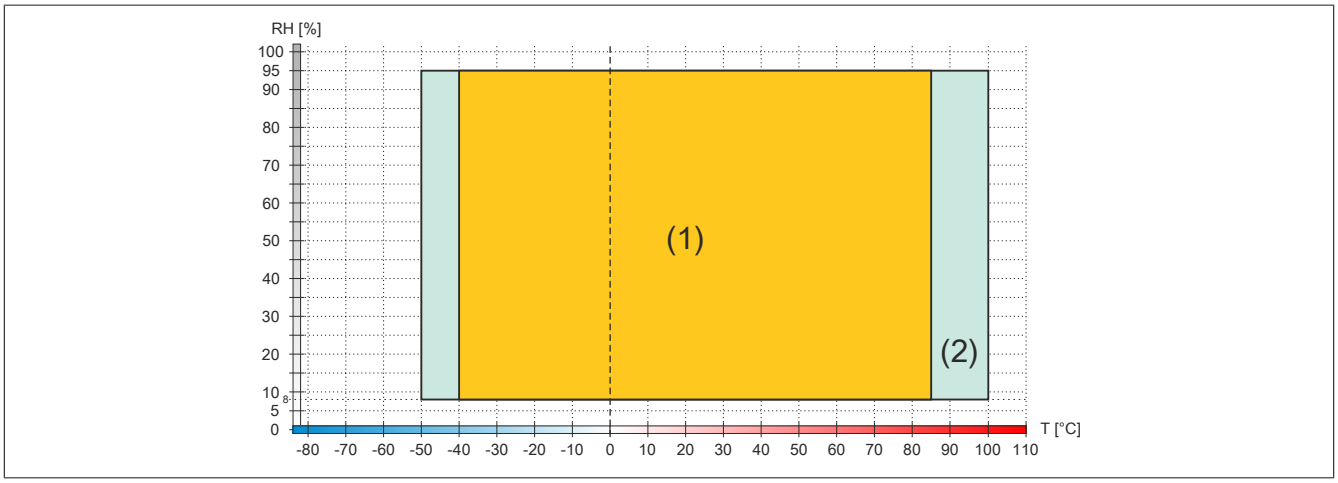

Figure 2: 0CFCRD.xxxxE.01 CompactFlash cards - Temperature/Humidity diagram

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

5 5CFCRD.xxxx-06

5.1 General information

Information:

B&R 5CFCRD.xxxx-06 CompactFlash cards and CompactFlash cards from other manufacturers are not permitted to be used in the same system at the same time. Due to differences in technology (older vs. newer technologies), problems can occur during system startup that are caused by different startup times.

Information:

5CFCRD.xxxx-06 CompactFlash cards are supported on B&R devices with WinCE version ≥ 6.0.

5.2 Order data

Model number	Short description	Figure
	CompactFlash cards	
5CFCRD.0512-06	CompactFlash 512 MB B&R (SLC)	
5CFCRD.1024-06	CompactFlash 1 GB B&R (SLC)	
5CFCRD.2048-06	CompactFlash 2 GB B&R (SLC)	
5CFCRD.4096-06	CompactFlash 4 GB B&R (SLC)	
5CFCRD.8192-06	CompactFlash 8 GB B&R (SLC)	
5CFCRD.016G-06	CompactFlash 16 GB B&R (SLC)	
5CFCRD.032G-06	CompactFlash 32 GB B&R (SLC)	

Table 3: 5CFCRD.0512-06, 5CFCRD.1024-06, 5CFCRD.2048-06, 5CFCRD.4096-06, 5CFCRD.8192-06, 5CFCRD.016G-06, 5CFCRD.032G-06 - Order data

5.3 Technical data

Caution!

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

To prevent damage and loss of data, the use of a UPS is recommended.

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, for example, the data specified for that complete system applies.

Model number	5CFCRD.0512-06	5CFCRD.1024-06	5CFCRD.2048-06	5CFCRD.4096-06	5CFCRD.8192-06	5CFCRD.016G-06	5CFCRD.032G-06
General information							
Capacity	512 MB	1 GB	2 GB	4 GB	8 GB	16 GB	32 GB
Data retention [1]	10 years						
Data reliability	<1 unrecoverable error per 10^{14} bits read						
Lifetime monitoring	Yes						
MTBF	>3,000,000 hours (at 25°C)						
Maintenance	None						
Supported operating modes	PIO mode 0-6, Multiword DMA mode 0-4, Ultra DMA Mode 0-4						
Sequential read							
Typical	50 MB/s		59 MB/s				58 MB/s
Maximum	53 MB/s		65 MB/s				
Sequential write							
Typical	25 MB/s		31 MB/s				
Maximum	27 MB/s		35 MB/s				
Certifications							
CE	Yes						
UL	cULus E115267 Industrial control equipment						
DNV GL	Temperature: **A** (0 - 45°C) Humidity: **B** (up to 100%) Vibration: **A** (0.7 g) EMC: **B** (bridge and open deck)						
GOST-R	Yes						
Endurance [1]							
SLC flash	Yes						
Guaranteed data volume							
Guaranteed [2]	50 TB	100 TB	200 TB	400 TB	800 TB	1600 TB	3200 TB
Results for 5 years [2]	27.40 GB/day	54.79 GB/day	109.59 GB/day	219.18 GB/day	438.36 GB/day	876.72 GB/day	1753.44 GB/day
Erase/Write cycles							
Guaranteed	100,000						
Wear leveling	Static						
Error correction coding (ECC)	Yes						
S.M.A.R.T. support	Yes						
Support							
Hardware	PP300/400, PP500, PPC300, PPC700, PPC725, PPC800, APC620, APC810, APC820						
Operating systems							
Windows 7 32-bit	No					Yes	
Windows 7 64-bit	No						Yes
Windows Embedded Standard 7 32-bit	No				Yes		
Windows Embedded Standard 7 64-bit	No					Yes	
Windows XP Professional	No			Yes			
Windows XP Embedded	Yes						
Windows Embedded Standard 2009	No	Yes					
Windows CE 6.0	Yes					Yes [3]	
Windows CE 5.0	No						
Software							
PVI Transfer	≥V3.2.3.8 (part of PVI Development Setup ≥ V2.06.00.3011)					≥V3.6.8.40 (part of PVI Development Setup ≥ V3.0.0.3020)	≥V4.0.0.8 (part of PVI Development Setup ≥V3.0.2.3014)
B&R Embedded OS Installer	≥V3.10					≥V3.20	≥V3.21

Table 4: 5CFCRD.0512-06, 5CFCRD.1024-06, 5CFCRD.2048-06, 5CFCRD.4096-06, 5CFCRD.8192-06, 5CFCRD.016G-06, 5CFCRD.032G-06 - Technical data

Model number	5CFCRD. 0512-06	5CFCRD. 1024-06	5CFCRD. 2048-06	5CFCRD. 4096-06	5CFCRD. 8192-06	5CFCRD. 016G-06	5CFCRD. 032G-06
Environmental conditions							
Temperature							
Operation	0 to 70°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							
Operation	20 g peak, 20 to 2000 Hz, 4 in each direction (JEDEC JESD22, method B103) 5.35 g RMS, 15 min. per level (IEC 68-2-6)						
Storage	20 g peak, 20 to 2000 Hz, 4 in each direction (JEDEC JESD22, method B103) 5.35 g RMS, 15 min. per level (IEC 68-2-6)						
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Shock							
Operation	1500 g peak, 0.5 ms 5 times (JEDEC JESD22, method B110) 30 g, 11 ms 1 time (IEC 68-2-27)						
Storage	1500 g peak, 0.5 ms 5 times (JEDEC JESD22, method B110) 30 g, 11 ms 1 time (IEC 68-2-27)						
Transport	1500 g peak, 0.5 ms 5 times (JEDEC JESD22, method B110) 30 g, 11 ms 1 time (IEC 68-2-27)						
Elevation							
Operation	Max. 4,572 m						
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 4: 5CFCRD.0512-06, 5CFCRD.1024-06, 5CFCRD.2048-06, 5CFCRD.4096-06, 5CFCRD.8192-06, 5CFCRD.016G-06, 5CFCRD.032G-06 - Technical data

1) Per JEDEC (JESD47), EOL conditions are not permitted to be reached before 18 months. A higher average daily write workload reduces the expected service life and data retention of the data storage medium.
2) Endurance of B&R CFs (with linear written block size ≥128 kB).
3) Not supported by the B&R Embedded OS Installer.

5.4 Temperature/Humidity diagram

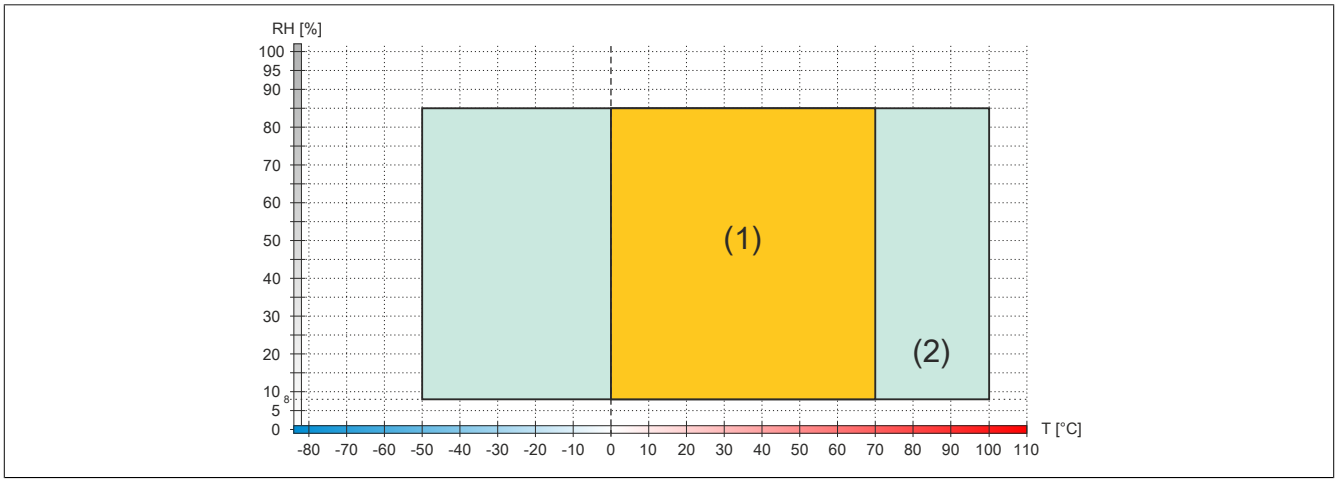

Figure 3: 5CFCRD.xxxx-06 CompactFlash cards - Temperature/Humidity diagram

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