

INSTRUCTION MANUAL



CFM100 CompactFlash[®] Module

Revision: 9/16



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Table of Contents

PDF viewers: These page numbers refer to the printed version of this document. Use the PDF reader bookmarks tab for links to specific sections.

1. Introduction	1
2. Precautions	1
3. Initial Inspection.....	2
4. QuickStart.....	2
4.1 Preparation	2
4.2 Programming the Datalogger to Send Data to the CFM100	2
4.3 Data Retrieval	3
5. Overview	3
5.1 LEDs/Buttons.....	4
5.2 Power	5
5.2.1 Primary Power	5
5.2.2 Backup Power and Data Retention	5
6. Specifications.....	5
6.1 Power	5
7. Operation	6
7.1 File Formats	6
7.1.1 Data Files	6
7.1.2 Program Files.....	6
7.1.3 Power-Up Files (Powerup.ini)	6
7.1.3.1 Creating and Editing Powerup.ini	7
7.1.3.2 Applications	8
7.1.3.3 Program Execution.....	8
7.1.3.4 Example Powerup.ini Files.....	9
7.1.4 Camera Files	9
7.2 Programming.....	9
7.2.1 The CardOut() Instruction.....	9
7.2.2 Program Examples	10
7.2.2.1 Ring Mode.....	10
7.2.2.2 Fill-and-Stop Mode	10
7.2.2.3 Mixed Modes.....	11
7.2.3 Table Size and Mode	12
7.3 Data Retrieval	12
7.3.1 Via a Communication Link.....	12
7.3.2 Transporting CF Card to Computer	12
7.3.2.1 Converting File Formats.....	13

7.3.2.2	Reinserting the Card	14
7.3.2.3	Card Swapping	14

Appendix

A. CF Card Maintenance.....A-1

A.1	Formatting CF Card	A-1
A.1.1	Windows Explorer	A-1
A.1.2	CR1000KD.....	A-2
A.1.3	<i>LoggerNet File Control</i>	A-2
A.2	Checking CF Card Integrity	A-3

Figures

5-1.	CompactFlash Module.....	4
7-1.	<i>CardConvert</i>	13

Tables

7-1.	Powerup.ini Commands	8
------	----------------------------	---

CRBasic Examples

7-1.	Powerup.ini Code	8
7-2.	Run Program on Power-up	9
7-3.	Format the USB: Drive.....	9
7-4.	Send OS on Power-Up	9
7-5.	Run Program from CRD: Drive	9
7-6.	Run Program Always, Erase CF Data	9
7-7.	Run Program Now, Erase CF Data.....	9
7-8.	Ring Mode.....	10
7-9.	Fill-and-Stop Mode	11
7-10.	Mixed Modes.....	11

CFM100 CompactFlash® Module

1. Introduction

Campbell Scientific's CFM100 CompactFlash® Module stores the datalogger's data on a removable CompactFlash (CF) card. The CFM100 module connects to the datalogger via the 40-pin peripheral port. Currently, only the CR1000 and CR3000 dataloggers have the 40-pin peripheral port; the CFM100 is not compatible with the CR200-series, CR800-series, CR6-series, CR300-series, CR5000, and CR9000X dataloggers.

Before using the CFM100, please study:

- Section 2, *Precautions* (p. 1)
- Section 3, *Initial Inspection* (p. 2)
- Section 4, *QuickStart* (p. 2)

The QuickStart explains how to quickly begin using a CFM100 for straightforward data-storage operations. The remainder of the manual is a technical reference which describes in detail such operations as file formats, datalogger programming, and data retrieval.

2. Precautions

- READ AND UNDERSTAND the *Safety* section at the front of this manual.
- The CFM100 is rugged, but it should be handled as a precision scientific instrument. There are no user-serviceable parts inside the module.
- The 28033 surge suppressor and/or a shielded 10base-t Ethernet cable should be used for locations susceptible to power surges and for cable lengths longer than 9 ft.
- Always power down the datalogger before installing to or removing the CFM100 from the datalogger.
- Removing a CompactFlash card while it is active can cause garbled data and can actually damage the card. **Always** press the **Initiate Removal** button and wait for a green light before removing card.
- *LoggerNet File Control* should not be used to retrieve data from a CompactFlash card. Using *File Control* to retrieve the data can result in a corrupted data file.
- For a card formatted as FAT16, the maximum number of files that can be stored is 512. To reach that maximum you must keep filenames to 16 characters plus 3 characters for the extension. FAT32 formatted cards do not have the same limitation, and the number of files that can be stored is limited by the amount of space on the card.

- A CFM100 with a serial number less than 9728 requires a firmware update to function properly when attached to a CR3000 datalogger with a serial number greater than 6260. This update must be performed by Campbell Scientific. If you require this firmware update, see the [Assistance](#) section at the front of this manual for information on returning your CFM100 to Campbell Scientific.

3. Initial Inspection

Upon receipt of the CFM100, inspect the packaging and contents for damage. File damage claims with the shipping company.

4. QuickStart

This section describes the basics of storing and retrieving datalogger data. These operations are discussed in detail in Section 7, *Operation (p. 6)*, of this manual.

4.1 Preparation

CAUTION

Always power down the datalogger before installing to or removing the CFM100 from the datalogger.

After powering down the datalogger, plug the CFM100 into the datalogger peripheral port. Restore power to the datalogger. Insert formatted CF card. (For instructions on formatting a CF card, see Appendix A, *CF Card Maintenance (p. A-1)*.)

4.2 Programming the Datalogger to Send Data to the CFM100

The **CardOut()** instruction is used in the datalogger program to send data to the CF card. The **CardOut()** instruction must be entered within each **DataTable()** declaration that is to store data to the CF card. The file is saved to the card with the name stationname.tablename and a .DAT extension.

The **CardOut()** instruction has the following parameters:

StopRing: A constant is entered for the *StopRing* parameter to specify whether the **DataTable()** created should be a ring-mode table (0) or a fill-and-stop table (1).

Size: The *Size* parameter is the minimum number of records that will be included in the **DataTable()**. If -1000 is entered, the size of the file on the card will be the same as the size of the internal table on the datalogger. If any other negative number is entered, the memory that remains after creating any fixed-size tables on the card will be allocated to this table. If multiple DataTables are set to a negative number, the remaining memory will be divided among them. The datalogger attempts to size the tables so that all of them will be full at the same time

In the following example, the minimum batt_voltage and a sample of PTemp is written to the card each time the data table is called. The *StopRing* parameter is

0 for ring mode. This means that once the data table is full, new data will begin overwriting old data. The *size* parameter is -1, so all available space on the card will be allocated to the table.

DataTable(*Table1,1,-1*)

CardOut(*0,-1*)

Minimum(*1,batt_volt,FP2,0,False*)

Sample(*1,PTemp,IEEE4*)

EndTable

CAUTION

To prevent losing data, collect data from the CF card before sending the datalogger a new or modified program. When a program is sent to the datalogger using the **Send** button in the *Connect* screen of *LoggerNet* or *PC400*, an attribute is sent along with the program that commands the datalogger to erase all data on the CF card from the currently running program.

4.3 Data Retrieval

Data stored on cards can be retrieved through a communication link to the datalogger or by removing the card and carrying it to a computer with a CF adapter. With large files, transferring the CF card to a computer may be faster than collecting the data over a communication link. Data retrieval is discussed in detail in Section 7.3, *Data Retrieval* (p. 12).

CAUTION

Removing a card while it is active can cause garbled data and can actually damage the card. **Always** press the **Initiate Removal** button and wait for a green light before removing card.

CAUTION

LoggerNet File Control should not be used to retrieve data from a CompactFlash card. Using *File Control* to retrieve the data can result in a corrupted data file.

5. Overview

The CFM100 connects to a datalogger's peripheral port and has a slot for a Type I or Type II CF card (3.3 V, 75 mA). The CFM100/CF card combination can be used to expand the datalogger's memory, transport data/programs from the field site(s) to the office, upload datalogger power-up functions, and store JPEG images from the CC640 camera. Data stored on cards can be retrieved through a communication link to the datalogger or by removing the card and carrying it to a computer. The computer can read the CF card either with the CF1 adapter or 17752 Reader/Writer. The CF1 adapter allows the PC's PCMCIA card slot to read the CF card; the 17752 Reader/Writer allows the PC's USB port to read the CF card. User-supplied CF adapters may also be used.

CAUTION

LoggerNet File Control should not be used to retrieve data from a CompactFlash card. Using *File Control* to retrieve the data can result in a corrupted data file.



FIGURE 5-1. CompactFlash Module

5.1 LEDs/Buttons

There is one red-green-orange LED (light emitting diode) and two buttons: control and eject. The LED indicates the status of the module. The LED will flash red when the CF card is being accessed, solid green when it is OK to remove the card, solid orange to indicate an error, and flashing orange if the card has been removed and has been out long enough that CPU memory has wrapped and data is being overwritten without being stored to the card. The **Initiate Removal** button must be pressed before removing a card to allow the datalogger to store any buffered data to the card and then power it off.

NOTE

The CFM100 will consume more current if a **Status** LED is continuously on. When a red or green LED is continuously on, add 1 mA to the power consumption. When an orange LED is continuously on, add 2 mA to the power consumption.

5.2 Power

5.2.1 Primary Power

The CompactFlash module is powered by 12 Vdc received from the datalogger through the peripheral port.

5.2.2 Backup Power and Data Retention

The CF cards do not require power to retain data.

Typically, a CF card can be erased and rewritten a minimum of 100,000 times. Industrial CF cards, graded for 2,000,000 write cycles, are recommended for most applications.

6. Specifications

Storage Capacity:	Depends on card size (up to 2 GB supported)
Dimensions:	10.0 x 8.3 x 6.5 cm (4.0 x 3.3 x 2.6 in)
Weight:	132.5 g
Operating Temperature Range:	–35 to 65 °C (–55 to 85 °C optional)
Typical Access Speed:	200 to 400 kbits s ^{–1}
Memory Configuration:	User-selectable for either ring style (default) or fill-and-stop.
Compliance Information:	View the EU Declaration of Conformity at: www.campbellsci.com/cfm100

6.1 Power

The CFM100 receives 12 V power from the datalogger through the peripheral port. The following currents are for the CR1000 with the CFM100 attached and can vary with the card.

Writing to card with RS-232 port active:	30 mA (avg.)
Reading from card with RS-232 port active:	20 mA (avg.)
Writing to card with RS-232 port not active:	20 mA (avg.)
Reading from card with RS-232 port not active:	15 mA (avg.)
Low-power standby state:	700 to 800 µA

**Red or green LED
continuously on:**

Add 1 mA to current drain

**Orange LED
continuously on:**

Add 2 mA to current drain

7. Operation

7.1 File Formats

This section covers the different types of files stored on the CF card.

7.1.1 Data Files

The datalogger stores data on the CF card in TOB3 format. TOB3 is a binary format that incorporates features to improve reliability of the CF cards. TOB3 allows the accurate determination of each record's time without the space required for individual time stamps.

TOB3 format is different than the data-file formats created when data are collected via a communications link. Data files read directly from the CF card generally need to be converted into another format to be used.

When TOB3 files are converted to another format, the number of records may be slightly greater or less than the number requested in the data table declaration. There is always some additional memory allocated. When the file is converted, this will result in additional records if no lapses occurred. If more lapses occur than were anticipated, there may be fewer records in the file than were allocated.

The CardConvert software included in *LoggerNet*, *PC400*, and *PC200W* will convert data files from one format to another.

7.1.2 Program Files

The CF card can be used to provide extra program storage space for the datalogger. Program files can be copied to the card while it is attached as a drive on the computer. They can also be sent to the card using *LoggerNet File Control*. They may also be copied from CPU memory to the card (or from the card to CPU memory) using the keyboard display.

7.1.3 Power-Up Files (Powerup.ini)

Users can insert a properly-configured CF card into the CFM100, cycle through the datalogger power, and have power-up functions automatically performed.

Power-up functions of CompactFlash® cards can include:

- a) Sending programs to the CR1000 or CR3000
- b) Setting attributes of datalogger program files
- c) Setting disposition of old CF files
- d) Sending an OS to the CR1000 or CR3000

- e) Formatting memory drives
- f) Deleting data files

CAUTION

Test the power-up functions in the office before going into the field to ensure the power-up file is configured correctly.

The key to the CF power-up function is the powerup.ini file, which contains a list of one or more command lines. At power-up, the powerup.ini command line is executed prior to compiling the program. Powerup.ini performs three operations:

- 1) Copies the specified program file to a specified memory drive
- 2) Sets a file attribute on the program file
- 3) Optionally deletes CF data files from the overwritten (just previous) program

Powerup.ini takes precedence during power-up. Though it sets file attributes for the programs it uploads, its presence on the CF does not allow those file attributes to control the power-up process. To avoid confusion, either remove the CF card or delete the powerup.ini file after the powerup.ini upload.

7.1.3.1 Creating and Editing Powerup.ini

Powerup.ini is created with a text editor, and saved as “powerup.ini”.

NOTE

Some text editors (such as WordPad) will attach header information to the powerup.ini file causing it to abort. Check the text of a powerup.ini file with the datalogger keyboard display to see what the datalogger actually sees.

Comments can be added to the file by preceding them with a single-quote character ('). All text after the comment mark on the same line is ignored.

Syntax

Syntax allows functionality comparable to *File Control* in *LoggerNet*.

Powerup.ini is a text file that contains a list of commands and parameters. The syntax for the file is:

Command,File,Device

where

Command = one of the numeric commands in TABLE 7-1

File = file on CF associated with the action. Name can be up to 22 characters.

Device = the device to which the associated file will be copied. Options are CPU:, USR:, and CRD:. If left blank or with an invalid option, it will default to CPU:.

TABLE 7-1. Powerup.ini Commands	
Command	Description
1	Run always, preserve CF data files
2	Run on power-up
5	Format
6	Run now, preserve CF data files
9	Load OS (File = .obj)
13	Run always, erase CF data files now
14	Run now, erase CF data files now

By using the **PreserveVariables()** instruction in the datalogger CRBasic program, with options 1 and 6, data and variables can be preserved.

CRBasic Example 7-1. Powerup.ini Code

```
'Command = numeric power-up command
'File = file on CF associated with the action
'Device = the device to which File will be copied. Defaults to CPU:.

'Command,File,Device
13,Write2CRD_2.cr1,CPU:
```

7.1.3.2 Applications

- Commands 1, 2, 6, 13, and 14 (Run Now and/or Run On Power-up). If a device other than CRD: drive is specified, the file will be copied to that device.
- Command 1, 2, and 13 (Run On Power-up). If the copy (first application, above) succeeds, the new Run On Power-up program is accepted. If the copy fails, no change will be made to the Run On Power-up program.
- Commands 1, 6, 13, and 14 (Run Now). The Run Now program is changed whether or not the copy (first application, above) occurs. If the copy does succeed, the Run Now program will be opened from the device specified.
- Commands 13 and 14 (Delete Associated Data). Since CRD:powerup.ini is only processed at power-up, there is not a compiled program to delete associated data for. The information from the last-running program is still available for the datalogger to delete the files used by that program.

7.1.3.3 Program Execution

After File is processed, the following rules determine what datalogger program to run:

- 1) If the Run Now program is changed, it will be the program that runs.
- 2) If no change is made to Run Now program, but Run on Power-up program is changed, the new Run on Power-up program runs.

- 3) If neither Run on Power-up nor Run Now programs are changed, the previous Run on Power-up program runs.

7.1.3.4 Example Powerup.ini Files

Examples 7-2 through 7-7 are example powerup.ini files.

CRBasic Example 7-2. Run Program on Power-up

```
'Copy pwrup.cr1 to USB:, will run only when powered-up later
2,pwrup.cr1,usr:
```

CRBasic Example 7-3. Format the USB: Drive

```
'Format the USB: drive
5,,usr:
```

CRBasic Example 7-4. Send OS on Power-Up

```
'Load this file into FLASH as the new OS
9,CR1000.Std.04.obj
```

CRBasic Example 7-5. Run Program from CRD: Drive

```
'Leave program on CRD:, run always, erase CRD: data files
13,toobigforcpu.cr1,crd:
```

CRBasic Example 7-6. Run Program Always, Erase CF Data

```
'Run always, erase CRD: data files
13,pwrup_1.cr1,crd
```

CRBasic Example 7-7. Run Program Now, Erase CF Data

```
'Copy run.cr1 to CPU:, erase CF data, run CPU:run.cr1, but not if later powered-up
14,run.cr1,cpu:
```

7.1.4 Camera Files

JPEG images taken by a digital camera connected to the datalogger can be stored to the CF card rather than CPU memory. This is done by configuring the PakBus setting “Files Manager” for the datalogger using the *Device Configuration Utility* or *PakBus Graph*.

7.2 Programming

7.2.1 The CardOut() Instruction

The **CardOut()** instruction is used to send data to a CF card. The **CardOut()** instruction must be entered within each **DataTable** declaration that is to store

data to the CF card. Data is stored to the card when a call is made to the data table.

CardOut(StopRing, Size)

Parameter & Data Type	Enter	
StopRing <i>Constant</i>	A code to specify if the data table on the CF card is fill-and-stop or ring (newest data overwrites oldest).	
	Value	Result
	0 1	Ring Fill-and-stop
Size <i>Constant</i>	The size to make the data table. The number of data sets (records) for which to allocate memory in the CF card. Each time a variable or interval trigger occurs, a line (or row) of data is output with the number of values determined by the output instructions within the table. This data is called a record.	
	Note Enter -1000 and the size of the table on the card will match the size of the internal table on the datalogger. Enter any other negative number and all remaining memory (after creating any fixed-size data tables) will be allocated to the table or partitioned among all tables with a negative value for size. The partitioning algorithm attempts to have the tables full at the same time.	

7.2.2 Program Examples

7.2.2.1 Ring Mode

The following program outputs the maximum and minimum of the panel temperature to the card once a second. The first parameter of the **CardOut()** instruction is 0, which sets the table on the card to ring mode. The second parameter is negative, so all available memory on the card will be allocated to the data table. Once all available memory is used, new data will begin overwriting the oldest data.

CRBasic Example 7-8. Ring Mode

```
'CR1000
Public temp

DataTable (Table1,1,-1)
  CardOut (0, -1)
  Maximum (1,temp,FP2,False,False)
  Minimum (1,temp,FP2,False,False)
EndTable

BeginProg
  Scan(1,SEC,3,0)
  PanelTemp(temp,250)
  CallTable Table1
  NextScan
EndProg
```

7.2.2.2 Fill-and-Stop Mode

The following program outputs a sample of the panel temperature to the card once a second. The first parameter of the **CardOut()** instruction is 1, which sets the table on the card to fill-and-stop mode. The second parameter (1000) is the number of records which will be written before the table is full and data

storage stops. Once 1000 records have been stored, data storage to the specified table on CRD: and CPU: datalogger memory drives will stop.

CRBasic Example 7-9. Fill-and-Stop Mode

```
'CR1000

Public temp

DataTable (Table1,1,1000)
  CardOut (1,1000)
  Sample(1,temp,IEEE4)
EndTable

BeginProg
  Scan(1,SEC,3,0)
  PanelTemp(temp,250)
  CallTable Table1
  NextScan
EndProg
```

To restart data storage to the fill-and-stop table, the table must be reset. To reset a table after a fill-and-stop table has been filled and stopped, either use the reset button in *LoggerNet* (LN Connect | Datalogger | Station Status | Table Fill Times, Reset Tables button) or use the CRBasic **ResetTable** instruction.

7.2.2.3 Mixed Modes

The following program stores four data tables to the card. The first two tables will output samples of the panel temperature and battery voltage to the card once a second. The first parameter of the **CardOut()** instructions is 1, which sets the tables on the card to fill-and-stop mode. The second parameter is 1000, so 1000 records will be written to each table before stopping.

Tables 3 and 4 will output the maximum and minimum of the panel temperature and battery voltage to the card every five seconds. (The tables will be called once a second. The **DataInterval()** instruction causes data to only be stored every five seconds.) The first parameter of the **CardOut()** instructions is 0, which sets the tables on the card to ring mode. The second parameter is negative, so all available memory on the card will be allocated to these tables, once space for the fixed-size tables has been allocated. The datalogger will attempt to size the tables so that both of them will be full at the same time.

CRBasic Example 7-10. Mixed Modes

```
'CR1000

Public temp
Public batt

DataTable (Table1,1,-1)
  CardOut (1,1000)
  Sample(1,temp,IEEE4)
EndTable

DataTable (Table2,1,-1)
  CardOut (1,1000)
  Sample(1,batt,IEEE4)
EndTable

DataTable (Table3,1,1000)
```

```

DataInterval(0,5,sec,4)
CardOut (0,-1)
Maximum (1,temp,FP2,False,False)
Minimum (1,temp,FP2,False,False)
EndTable

DataTable (Table4,1,1000)
DataInterval(0,5,sec,4)
CardOut (0,-1)
Maximum (1batt,FP2,False,False)
Minimum (1,batt,FP2,False,False)
EndTable

BeginProg
Scan(1,SEC,3,0)
PanelTemp(temp,250)
Battery(Batt)
CallTable Table1
CallTable Table2
CallTable Table3
CallTable Table4
NextScan
EndProg

```

7.2.3 Table Size and Mode

The size of each data table in CPU memory is set as part of the **DataTable()** instruction and the size of each data table on the CF card is set with the **CardOut()** instruction. Because they are set independently, they can be different. It is important to note that if the CPU memory is set to fill-and-stop mode, once a table is full, all data storage to the table will stop. No more records will be stored to the CPU memory or the card.

7.3 Data Retrieval

Data stored on CF cards can be retrieved through a communication link to the datalogger or by removing the card and carrying it to a computer.

7.3.1 Via a Communication Link

Data can be transferred to a computer via a communications link using one of Campbell Scientific's software packages (for example, *PC200W*, *PC400*, *LoggerNet*). There is no need to distinguish whether the data is to be collected from the CPU memory or a CF card. The software package will look for data in the CPU memory and then the CF card.

The datalogger manages data on a CF card as final-storage table data, accessing the card as needed to fill data-collection requests initiated with the **Collect** button in datalogger support software. If desired, binary data can be collected using the *File Control* utility in datalogger support software. Before collecting data this way, stop the datalogger program to ensure data are not written to the CF card while data are retrieved. Otherwise, data corruption and confusion will result.

7.3.2 Transporting CF Card to Computer

With large files, transferring the CF card to a computer may be faster than collecting the data over a link.

CAUTION

Removing a card while it is active can cause garbled data and can actually damage the card. Do not switch off the CR1000 power if a card is present and active.

To remove a card, press the **Initiate Removal** button on the CFM100. The CR1000 or CR3000 will transfer any buffered data to the card and then power off. The Status LED will turn green when it is OK to remove the card. The card will be reactivated after 20 seconds if it is not removed.

When the CF card is inserted in a computer, the data files can be copied to another drive or used directly from the CF card just as one would from any other disk. In most cases, however, it will be necessary to convert the file format before using the data.

NOTE

When dealing with large data files, it may be faster to use an external card reader (such as pn 17752) rather than a PC card slot.

7.3.2.1 Converting File Formats

Files can be converted using *LoggerNet CardConvert*. Begin by using **Select Output Drive** to indicate where the files to be converted are stored. Use **Change Output Dir** to choose where you would like the converted files to be stored. Place check marks next to the files to be converted. A default destination filename is given. It can be changed by right-clicking with the filename highlighted. Use the drop-down menu to select what file format to convert to. Press **Start Conversion** to begin converting files. Green checkmarks will appear next to each filename as conversion is complete.

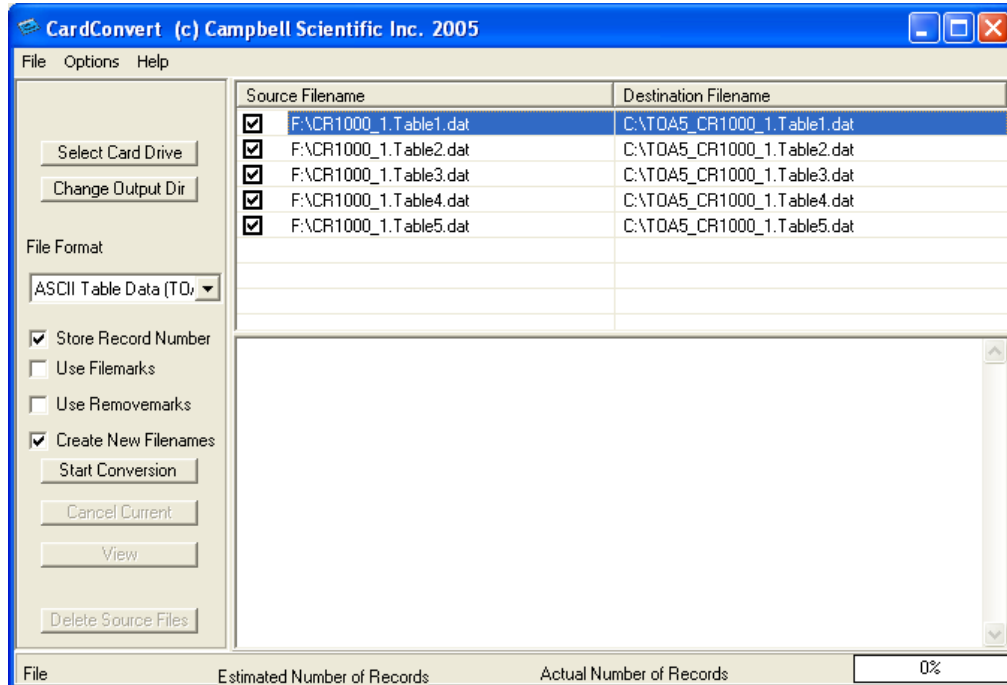


FIGURE 7-1. CardConvert

7.3.2.2 Reinserting the Card

If the same card is inserted again into the CFM100, the datalogger will store all data to the card that has been generated since the card was removed that is still in the CPU memory. If the data tables have been left on the card, new data will be appended to the end of the old files. If the data tables have been deleted, new ones will be generated.

NOTE

Check the status of the card before leaving the datalogger. If a CF card was not properly accepted, the CFM100 will flash orange. In that case, the CF card needs to be reformatted and all data erased. Formatting or erasing a CF card can be done on a PC or datalogger. The procedure for formatting a CF card is explained in Appendix A, *CF Card Maintenance (p. A-1)*.

7.3.2.3 Card Swapping

When transporting a CF card to a computer to retrieve data, most users will want to use a second card to ensure that no data is lost. For this method of collection, use the following steps.

1. Insert formatted card ("CF-A") in CFM100 attached to datalogger.
2. Send program containing **CardOut()** instruction(s).
3. When ready to retrieve data, press the **Initiate Removal** button to remove card. The LED will show red while the most current data is stored to the card and then will turn green. Eject card while LED is green.
4. Put in clean card ("CF-B").
5. Use *CardConvert* to copy data from CF-A to PC and convert. The default *CardConvert* filename will be TOA5_stationname_tablename.dat. Once the data is copied, use Windows Explorer to **delete all data files from the card**. NOTE: Windows98 and WindowsME users need to shift-delete to completely delete files. Using standard delete may create an invisible recycle bin on the CF card.
6. At the next card swap, eject CF-B and insert the clean CF-A.
7. Running *CardConvert* on CF-B will result in separate data files containing records since CF-A was ejected. *CardConvert* can increment the filename to TOA5_stationname_tablename_0.dat.
8. The data files can be joined using a software utility such as *WordPad* or *Excel*.

<i>CardConvert</i> File	CF-A Record Numbers	CF-B Record Numbers
TOA5_tablename.dat	0-100	
TOA5_tablename.dat		101-1234
TOA5_tablename.dat	1235-....	

Appendix A. CF Card Maintenance

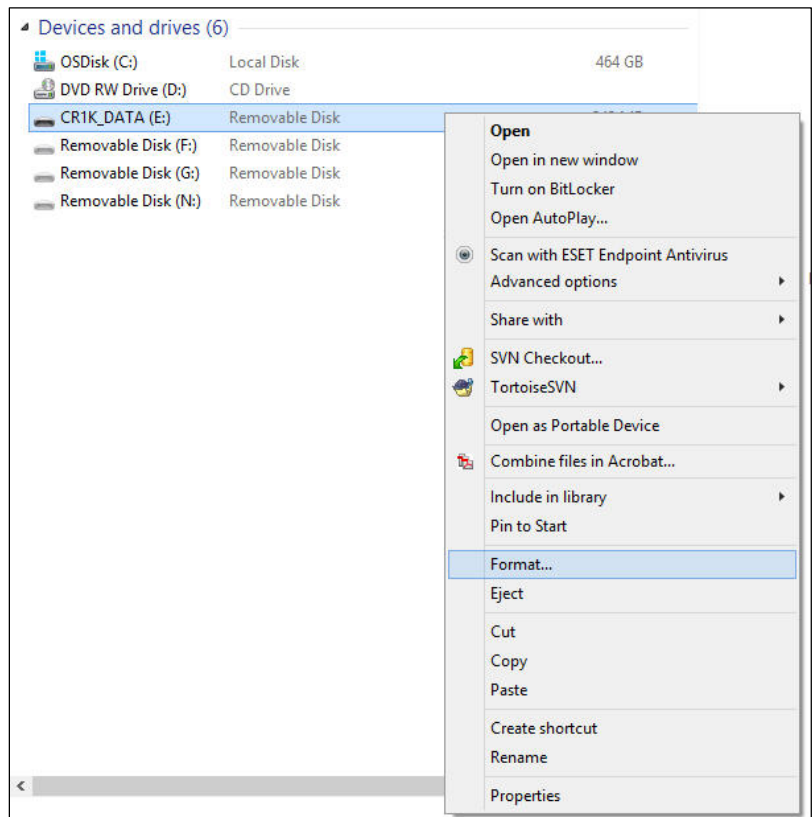
A.1 Formatting CF Card

The CF card can be formatted using 1) Windows Explorer, 2) the CR1000KD, or 3) *LoggerNet File Control*.

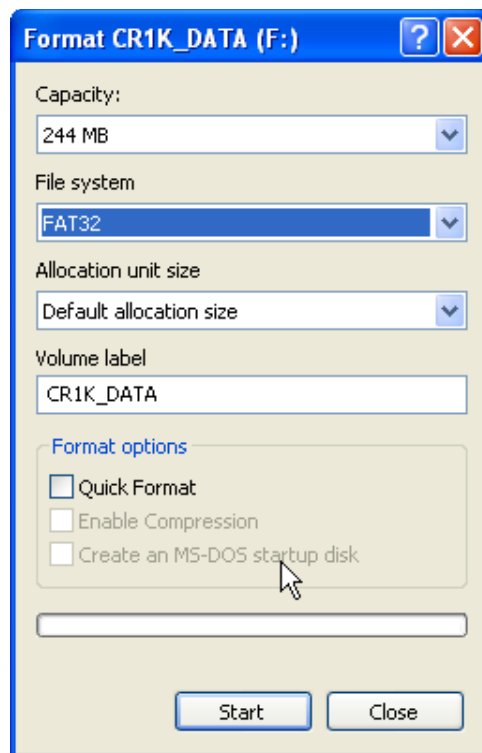
A.1.1 Windows Explorer

To format card using Windows Explorer:

- 1) Insert CF card into CF adapter or CF reader.
- 2) Windows Explorer should identify a drive as a removable disk (F:\).
- 3) Select that drive and right-click.



- 4) Choose **Format**.
- 5) Choose **FAT32** under file system, give the card a label, and press **Start**.
(The CR1000 will work with either FAT or FAT 32.)



A.1.2 CR1000KD

To format card using the CR1000KD:

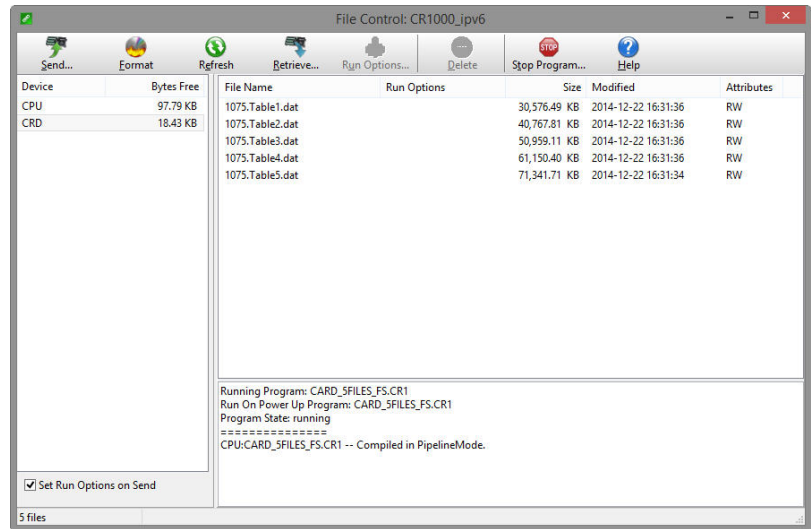
- 1) Insert CF card into CFM100.
- 2) From the main menu of CR1000KD, choose **PCCard**.
- 3) Choose **Format Card**.
- 4) Press **Yes** to proceed.

A.1.3 LoggerNet File Control

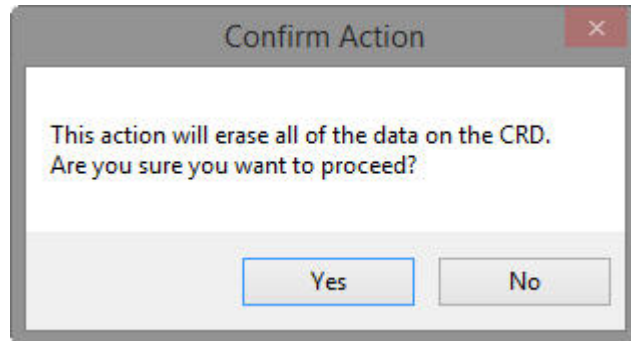
To format card using *LoggerNet File Control*:

- 1) Insert CF card into CFM100.
- 2) Use *LoggerNet* to connect to datalogger

- 3) Choose *FileControl* under the **Tools** menu of the *Connect* screen.



- 4) Highlight **CRD**.
- 5) Press **Format**.
- 6) Press **Yes** to confirm.

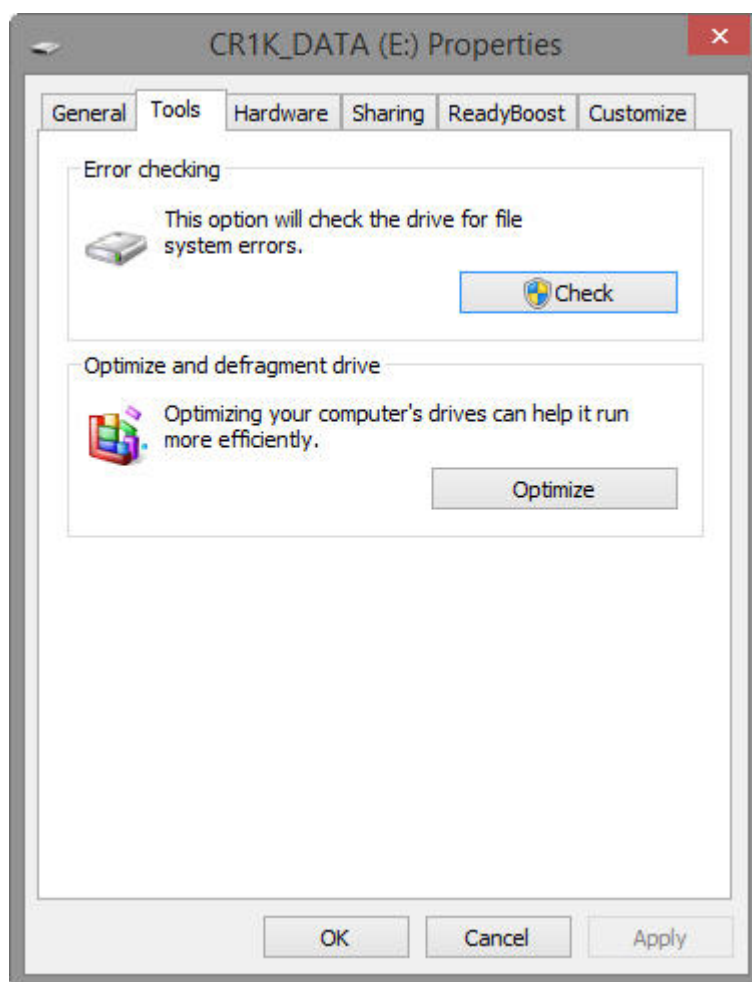


A.2 Checking CF Card Integrity

The Windows Check Disk tool can be used to check the integrity of a CF card. To access the Check Disk tool:

- 1) Insert CF card into CF reader.
- 2) Windows Explorer should identify a drive as removable disk.
- 3) Select that drive and right-click.
- 4) Choose **Properties**.

- 5) Navigate to the **Tools** tab.



- 6) Press **Check**.
- 7) Select **Scan and Repair Drive**.

Campbell Scientific Companies

Campbell Scientific, Inc.

815 West 1800 North
Logan, Utah 84321
UNITED STATES

www.campbellsci.com • info@campbellsci.com

Campbell Scientific Canada Corp.

14532 – 131 Avenue NW
Edmonton AB T5L 4X4
CANADA

www.campbellsci.ca • dataloggers@campbellsci.ca

Campbell Scientific Africa Pty. Ltd.

PO Box 2450
Somerset West 7129
SOUTH AFRICA

www.campbellsci.co.za • cleroux@csafrica.co.za

Campbell Scientific Centro Caribe S.A.

300 N Cementerio, Edificio Breller
Santo Domingo, Heredia 40305
COSTA RICA

www.campbellsci.cc • info@campbellsci.cc

Campbell Scientific Southeast Asia Co., Ltd.

877/22 Nirvana@Work, Rama 9 Road
Suan Luang Subdistrict, Suan Luang District
Bangkok 10250
THAILAND

www.campbellsci.asia • info@campbellsci.asia

Campbell Scientific Ltd.

Campbell Park
80 Hathern Road
Shepshed, Loughborough LE12 9GX
UNITED KINGDOM

www.campbellsci.co.uk • sales@campbellsci.co.uk

Campbell Scientific Australia Pty. Ltd.

PO Box 8108
Garbutt Post Shop QLD 4814
AUSTRALIA

www.campbellsci.com.au • info@campbellsci.com.au

Campbell Scientific Ltd.

3 Avenue de la Division Leclerc
92160 ANTONY
FRANCE

www.campbellsci.fr • info@campbellsci.fr

Campbell Scientific (Beijing) Co., Ltd.

8B16, Floor 8 Tower B, Hanwei Plaza
7 Guanghua Road
Chaoyang, Beijing 100004
P.R. CHINA

www.campbellsci.com • info@campbellsci.com.cn

Campbell Scientific Ltd.

Fahrenheitstraße 13
28359 Bremen
GERMANY

www.campbellsci.de • info@campbellsci.de

Campbell Scientific do Brasil Ltda.

Rua Apinagés, n.br. 2018 — Perdizes
CEP: 01258-00 — São Paulo — SP
BRASIL

www.campbellsci.com.br • vendas@campbellsci.com.br

Campbell Scientific Spain, S. L.

Avda. Pompeu Fabra 7-9, local 1
08024 Barcelona
SPAIN

www.campbellsci.es • info@campbellsci.es

Please visit www.campbellsci.com to obtain contact information for your local US or international representative.