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# Specification of BrainVision Core Data Format 1.0

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## 1 GENERAL STATEMENTS

1. An EEG recording consists of three files: the header file, the marker file and the EEG data file.
  - a. Header file and EEG data file are mandatory.
  - b. Marker file is optional.
  - c. All files have to be in the same folder.
2. EEG data file is a binary file whose structure is described in the header file.
3. Header file and the marker file are simple text files which almost fully conform to the [Windows® INI file format](#).

The deviations from INI format are the following:

  - a. The very first line in a header or marker file must be an identification line, which is neither a section nor a key.
  - b. The section [Comment] in the header file contains an arbitrary text rather than usual keys.
4. Sections and keys which are not described in this document are not supported and make the file non-compliant to BVCDF 1.0.

### Notes:

- The correct abbreviation for the 'BrainVision Core Data Format' is BVCDF.
- In order to allow a short reference "*See Appendix 6.1 BrainVision Recorder 1 specific info*" is simply abbreviated by '*See R1*'.
- In order to allow a short reference "*See Appendix 6.2 BrainVision Analyzer 2 specific info*" is simply abbreviated by '*See A2*'.
- In order to allow a short reference "*See Chapter 5 Comments*" is simply abbreviated by '*See C*'.

## 2 EEG DATA FILE SPECIFICATION

The data file must have one of the following file extensions: “eeg”, “avg” or “seg”. *See A2.*

## 3 HEADER FILE SPECIFICATION

The Header file describes the structure of EEG data file.  
The file extension must be “vhdr”.

### 3.1 Identification line

The file must begin with an identification line.  
Neither white spaces nor comments may not be present before this line.  
The identification line must be one of the following:  
[BrainVision Data Exchange Header File Version 1.0](#)  
or an obsolete line, accepted only due to backward compatibility:  
[Brain Vision Data Exchange Header File Version 1.0](#) (with a space between Brain and Vision)

### 3.2 'Common Infos' section

This section is mandatory.

Key	Meaning	Type	Unit	Valid Values	Mandatory [Default value]	Comment
Codepage	Character encoding of header file	String		UTF-8	Yes	In fact, the encoding needs to be known before the file is read.
DataFile	Name of the EEG data file	String		File name of EEG data file	Yes	<i>See: A2-Filename-Placeholder</i> <i>See: A2-File-Links</i>
MarkerFile	Name of marker file	String		File name of marker file	No	<i>See: A2-Filename-Placeholder</i> <i>See: A2-File-Links</i>
DataFormat	Encoding of data in EEG data file	String		BINARY	Yes	
DataOrientation	Arrangement of data in EEG data file	String		MULTIPLEXED The data for all channels are written sequentially in one line for one sampling point in	Yes	

				time. The next line contains the data for all channels for the next sampling point in time.		
<b>DataType</b>	Data domain	String		<b>TIMEDOMAIN</b>	No [ <b>TIMEDOMAIN</b> ]	
<b>NumberOfChannels</b>	Number of channels in the EEG data file	Int		>0	Yes	
<b>SamplingInterval</b>	Sampling interval	Double	μs	>0.0	Yes	
<b>Averaged</b>	Indicates whether the data set is averaged	String		<b>YES</b> <b>NO</b>	No [ <b>NO</b> ]	

	across segments					
<b>AveragedSegments</b>	Number of segments included in the average	Int		>0 (if <b>Averaged=YES</b> )	Yes, if <b>Averaged=YES</b> Otherwise No	If <b>Averaged=NO</b> , the value shall be ignored (it may be = 0)
<b>SegmentDataPoints</b>	Number of data points in the averaged segment	Int		>0	Yes, if <b>SegmentationType != NOTSEGMENTED</b> Otherwise No	If <b>SegmentationType = NOTSEGMENTED</b> , the value shall be ignored (it may be = 0)
<b>SegmentationType</b>	Type of segmentation	String		<b>NOTSEGMENTED</b> The data set is not segmented <b>MARKERBASED</b> The data set is segmented based	Yes, if <b>Averaged=YES</b> Otherwise No [ <b>NOTSEGMENTED</b> ]	If <b>Averaged = YES</b> then the value must not be <b>NOTSEGMENTED</b> .  <i>See: R1-SegmentationType, See: A2-SegmentationType</i>

				on marker positions		
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### 3.3 'Binary Infos' section

This section is mandatory.

Key	Meaning	Type	Unit	Valid Values	Mandatory	Comment
BinaryFormat	Encoding of data in EEG data file	String		<p>IEEE_FLOAT_32 IEEE floating-point format, single precision, 4 bytes per value</p> <p>INT_16 16-bit signed integer</p>	Yes	

### 3.4 'Channel Infos' section

This section is mandatory.

The number of channels defined in this section must be equal to the “NumberOfChannels” defined in the “Common Infos” section.

Channel numbers must start with 1 (“1-based”).

Channel numbers must increase in steps of 1.

Key	Meaning	Type	Unit	Valid Values	Mandatory	Comment	
Ch1	Comma separated channel properties: <channel name>,<reference channel name>,<resolution>,<unit>	channel name	String		Not empty	Yes	<i>See: A2-Comma-Placeholder</i>
		reference channel name	String			Yes	May be empty <i>See: R1-Ref-Ch</i>  <i>See: A2-Comma-Placeholder</i>
		resolution	Double	LSB/unit	>0.0	Yes	May be empty, if empty then resolution=1.0
		unit	String (see <b>C1</b> )			No	May be empty, if empty then unit=μV  <i>See: R1-Units</i> <i>See: A2-Units</i>

Ch2							
...							
Ch<x> where <x> stands for the channel number							

### 3.5 'Coordinates' section

This section is optional.

The number of channels defined in this section must be equal to the “**NumberOfChannels**” defined in the “**Common Infos**” section.

Channel numbers must start with 1 (“1-based”).

Channel numbers must increase in steps of 1.

Key	Meaning		Type	Unit	Valid Values	Mandatory	Comment
Ch1		Radius	Double		>=0.0	Yes	<i>See: A2-Radius</i>

	Comma separated channel Coordinates: <Radius>,<Theta>,<Phi>	Theta	Double	°		Yes	
		Phi	Double	°		Yes	
Ch2							
...							
Ch<x> where <x> stands for the channel number							

### 3.6 'Comment' section

This section is optional.

Key	Meaning	Type	Unit	Valid Values	Mandatory	Comment
	Arbitrary content				No	May contain additional information

## 4 MARKER FILE SPECIFICATION

The marker file contains a list of markers assigned to the EEG data.  
The file extension must be “vmrk”.

### 4.1 Identification line

The file must begin with an identification line.  
Neither white spaces nor comments may not be present before this line.  
The identification line must be one of the following:

[BrainVision Data Exchange Marker File Version 1.0](#)

or an obsolete line, accepted only due to backward compatibility:

[Brain Vision Data Exchange Marker File, Version 1.0](#)

[Brain Vision Data Exchange Marker File Version 1.0](#)

### 4.2 'Common Infos' section

This section is mandatory.

Key	Meaning	Type	Unit	Valid Values	Mandatory	Comment
-----	---------	------	------	--------------	-----------	---------

Codepage	Character encoding of Marker file	String		UTF-8	Yes	In fact, the encoding needs to be known before the file is read.
DataFile	Name of the EEG data file	String		File name of EEG data file	Yes	<i>See: A2- MarkerFile-DataFile</i>

### 4.3 'Marker Infos' section

This section is mandatory.

Marker numbers must start with 1 ("1-based").

Marker numbers must increase in steps of 1.

Key	Meaning		Type	Unit	Valid Values	Mandatory	Comment
Mk1	Comma separated marker properties: <type>,<description>,<position>,<points>,<channel number>[,<date>]	type	String			Yes	<i>See: A2-Comma-Placeholder</i>
		description	String			Yes	May be empty <i>See: A2-Comma-Placeholder</i>

		position	Int	sample	>0	Yes	“1-based” sample position
		points	Int	sample	>=0	Yes	Duration of marker (see <b>C2</b> )  <i>See: A2-Marker-Length</i>
		channel number	Int		<1,NumberOfChannels> or - 1 which means that it applies to all channels	Yes	
		Date	String		(see <b>C3</b> )	No	May be empty <i>See: R1-Date</i>
Mk2							
...							
Mk<x> where <x>							

stands for the marker number							
------------------------------------	--	--	--	--	--	--	--

## 5 COMMENTS

C1	<p>The official symbol for the SI prefix <i>micro</i> (<math>\mu</math>) is encoded as U+00B5 (Alt+0181) rather than U+03BC (Alt+956) even if according to <a href="#">The Unicode Consortium</a>, the latter form is preferred.</p> <p>The U+00B5 (Alt+0181) represents micro character compliant to the "Latin-1 Supplement" (see <a href="#">ISO/IEC 8859-1</a>, <a href="#">DEC MCS</a>, <a href="#">ECMA-94</a> and notably <a href="#">Windows-1253</a>).</p> <p>The U+03BC (Alt+956) represents the Greek character.</p>
C2	<p>Marker points may be 0. It means that this marker has duration zero in time, i.e. no duration.</p>
C3	<p>Date format.</p> <p>The meaning of digits in a string:</p> <ul style="list-style-type: none"> <li>4 digits = year</li> <li>2 digits = month (01...12)</li> <li>2 digits = day</li> <li>2 digits = hour (24-hour system)</li> <li>2 digits = minute</li> <li>2 digits = second</li> <li>6 digits = microsecond</li> </ul> <p>The date has a time resolution of a microsecond.</p>

Date Example:

19990311140312003012 means 11 March 1999, 14:03:12.003012

## 6 APPENDIX

### 6.1 BrainVision Recorder 1 specific info

	Recorder 1 ignores unrecognized sections and keys.
	If a value of a key is invalid, Recorder 1 ignores the invalid value and takes the default value, without a warning.
<i>R1-Ref-Ch</i>	If <reference channel name> is empty, then the common reference channel is used as the reference
<i>R1-Units</i>	The following units are internally known and processed in Recorder 1: $\mu\text{V}$ , $\mu\text{V}/\text{Hz}$ , $\mu\text{V}^2$ , $\mu\text{V}^2/\text{Hz}$ , $\mu\text{V}/\text{m}^2$
<i>R1-Date</i>	In Recorder 1 the <date> value is only evaluated if the marker type is “New Segment”.
<i>R1-SegmentationType</i>	In Recorder 1 this value is only evaluated if <b>Averaged=YES</b> .

### 6.2 BrainVision Analyzer 2 specific info

	Analyzer 2 ignores unrecognized sections and keys.
<i>A2-EEG-Data-Extension</i>	Analyzer 2 ignores this restriction, it reads (and creates) files with any extension - even empty one, i.e. without a file extension.

<i>A2-File-Links</i>	Analyzer 2 supports file links.
<i>A2-Filename-Placeholder</i>	File name can contain a \$b placeholder. The placeholder is interpreted as the base name of the header file. Example: If the name of the header file is Test.vhdr, the entry Data-File=\$b-EEG.eeg is interpreted as DataFile=Test-EEG.eeg.
<i>A2-Comma-Placeholder</i>	Field may contain placeholders for comma characters. A placeholder is represented by a binary value (0x01). Each placeholder will be treated as regular comma character.
<i>A2-SegmentationType</i>	In Analyzer 2 the <b>SegmentationType</b> value is always used and requires individual segments of same length.
<i>A2-Units</i>	The following units are internally known and processed in Analyzer 2:  $\mu\text{V}$ , $\mu\text{V}/\text{Hz}$ , $\mu\text{V}^2$ , $\mu\text{V}^2/\text{Hz}$ , $\mu\text{V}/\text{m}^2$  All other units are treated as user-defined units.
<i>A2-Radius</i>	From Analyzer 2 Manual: “The radius r specifies the distance (in millimeters) between point P and the origin of the coordinate system. The only exceptions are $r = 0$ and $r = 1$ . $r = 0$ signifies an invalid position, for instance when the position of an electrode is not known. When realistic electrode coordinates are used, r can have a different value for each channel. In other cases, the value of r should be the same for all the channels if a spherical head model is used. For instance, in the Analyzer's standard coordinate system, $r = 1$ ”.
<i>A2-MarkerFile-DataFile</i>	Analyzer 2 ignores this value.

**A2 Marker Length**

In Analyzer 2, the marker duration 0 will be replaced by 1.

## 6.3 Examples

### 6.3.1 Header File

```
BrainVision Data Exchange Header File Version 1.0
; Data created by BrainVision Recorder

[Common Infos]
Codepage=UTF-8
DataFile=example.eeg
MarkerFile=example.vmrk
DataFormat=BINARY
; Data orientation: MULTIPLEXED=ch1,pt1, ch2,pt1 ...
DataOrientation=MULTIPLEXED
NumberOfChannels=34
; Sampling interval in microseconds
SamplingInterval=200

[Binary Infos]
BinaryFormat=IEEE_FLOAT_32

[Channel Infos]
; Each entry: Ch<Channel number>=<Name>,<Reference channel name>,
; <Resolution in "Unit">,<Unit>, Future extensions..
; Fields are delimited by commas, some fields might be omitted (empty).
; Commas in channel names are coded as "\1".
Ch1=Fp1,,0.5,µV
Ch2=Fp2,,0.5,µV
Ch3=F3,,0.5,µV
Ch4=F4,,0.5,µV
```

Ch5=C3,,0.5,µV  
Ch6=C4,,0.5,µV  
Ch7=P3,,0.5,µV  
Ch8=P4,,0.5,µV  
Ch9=O1,,0.5,µV  
Ch10=O2,,0.5,µV  
Ch11=F7,,0.5,µV  
Ch12=F8,,0.5,µV  
Ch13=T7,,0.5,µV  
Ch14=T8,,0.5,µV  
Ch15=P7,,0.5,µV  
Ch16=P8,,0.5,µV  
Ch17=Fz,,0.5,µV  
Ch18=Cz,,0.5,µV  
Ch19=Pz,,0.5,µV  
Ch20=Oz,,0.5,µV  
Ch21=FC1,,0.5,µV  
Ch22=FC2,,0.5,µV  
Ch23=CP1,,0.5,µV  
Ch24=CP2,,0.5,µV  
Ch25=FC5,,0.5,µV  
Ch26=FC6,,0.5,µV  
Ch27=CP5,,0.5,µV  
Ch28=CP6,,0.5,µV  
Ch29=TP9,,0.5,µV  
Ch30=TP10,,0.5,µV  
Ch31=EOG,,0.5,µV  
Ch32=ECG,,0.5,µV  
Ch33=EDA1,,0.00635833,µS  
Ch34=EDA2,,0.00635833,µS

[Coordinates]  
; Each entry: Ch<Channel number>=<Radius>,<Theta>,<Phi>  
Ch1=1,-60,-51  
Ch2=1,-49,-29  
Ch3=1,-45,0  
Ch4=1,-49,29  
Ch5=1,-60,51

```
Ch6=1,-90,-36
Ch7=1,-60,51
Ch8=1,-90,0
Ch9=1,-90,36
Ch10=1,-90,36
Ch11=1,90,-90
Ch12=1,23,90
Ch13=1,22,-90
Ch14=1,-49,-29
Ch15=1,-45,0
Ch16=1,60,51
Ch17=1,49,29
Ch18=1,45,0
Ch19=1,49,-29
Ch20=1,60,-51
Ch21=1,90,36
Ch22=1,60,-51
Ch23=1,90,0
Ch24=1,90,-36
Ch25=1,90,-36
Ch26=1,45,90
Ch27=1,0,0
Ch28=1,45,-90
Ch29=1,49,29
Ch30=1,45,0
Ch31=0,0,0
Ch32=0,0,0
Ch33=0,0,0
Ch34=0,0,0
```

[Comment]

A m p l i f i e r S e t u p  
=====

Number of channels: 34  
Sampling Rate [Hz]: 5000  
Sampling Interval [ $\mu$ S]: 200

Channels

```
-----
```

#	Name	Phys. Chn.	Resolution / Unit	Low Cutoff [s]	High Cutoff [Hz]	Notch [Hz]
1	Fp1	1	0.5 µV	10	250	Off
2	Fp2	2	0.5 µV	10	250	Off
3	F3	3	0.5 µV	10	250	Off
4	F4	4	0.5 µV	10	250	Off
5	C3	5	0.5 µV	10	250	Off
6	C4	6	0.5 µV	10	250	Off
7	P3	7	0.5 µV	10	250	Off
8	P4	8	0.5 µV	10	250	Off
9	O1	9	0.5 µV	10	250	Off
10	O2	10	0.5 µV	10	250	Off
11	F7	11	0.5 µV	10	250	Off
12	F8	12	0.5 µV	10	250	Off
13	T7	13	0.5 µV	10	250	Off
14	T8	14	0.5 µV	10	250	Off
15	P7	15	0.5 µV	10	250	Off
16	P8	16	0.5 µV	10	250	Off
17	Fz	17	0.5 µV	10	250	Off
18	Cz	18	0.5 µV	10	250	Off
19	Pz	19	0.5 µV	10	250	Off
20	Oz	20	0.5 µV	10	250	Off
21	FC1	21	0.5 µV	10	250	Off
22	FC2	22	0.5 µV	10	250	Off
23	CP1	23	0.5 µV	10	250	Off
24	CP2	24	0.5 µV	10	250	Off
25	FC5	25	0.5 µV	10	250	Off
26	FC6	26	0.5 µV	10	250	Off
27	CP5	27	0.5 µV	10	250	Off
28	CP6	28	0.5 µV	10	250	Off
29	TP9	29	0.5 µV	10	250	Off
30	TP10	30	0.5 µV	10	250	Off
31	EOG	31	0.5 µV	10	250	Off
32	ECG	32	0.5 µV	10	250	Off
33	EDA1	41	0.00635833 µs	DC	1000	Off
34	EDA2	42	0.00635833 µs	DC	1000	Off

Software Filters  
=====

Disabled

Impedance [kOhm] at 14:27:08 :

Fp1:	8
Fp2:	10
F3:	6
F4:	6
C3:	7
C4:	6
P3:	8
P4:	6
O1:	7
O2:	5
F7:	6
F8:	8
T7:	7
T8:	6
P7:	7
P8:	6
Fz:	8
Cz:	7
Pz:	5
Oz:	6
FC1:	7
FC2:	5
CP1:	7
CP2:	5
FC5:	5
FC6:	6
CP5:	6
CP6:	6
TP9:	7
TP10:	6
EOG:	21

ECG: 17  
Ref: 7  
Gnd: 7

### 6.3.2 Marker File

BrainVision Data Exchange Marker File, Version 1.0

```
[Common Infos]
Codepage=UTF-8
DataFile=example.eeg
```

```
[Marker Infos]
; Each entry: Mk<Marker number>=<Type>,<Description>,<Position in data points>,
; <Size in data points>, <Channel number (0 = marker is related to all channels)>
; Fields are delimited by commas, some fields might be omitted (empty).
; Commas in type or description text are coded as "\1".
Mk1=New Segment,,1,1,0,20130909192513857877
Mk2=SyncStatus,Sync On,1,1,0
Mk3=SyncStatus,Sync On,5401,1,0
Mk4=SyncStatus,Sync On,15401,1,0
Mk5=SyncStatus,Sync On,25401,1,0
Mk6=SyncStatus,Sync On,35401,1,0
Mk7=SyncStatus,Sync On,45401,1,0
Mk8=SyncStatus,Sync On,55401,1,0
Mk9=SyncStatus,Sync On,65401,1,0
Mk10=SyncStatus,Sync On,75401,1,0
Mk11=SyncStatus,Sync On,85401,1,0
Mk12=SyncStatus,Sync On,95401,1,0
Mk13=SyncStatus,Sync On,105401,1,0
Mk14=SyncStatus,Sync On,115401,1,0
Mk15=SyncStatus,Sync On,125401,1,0
Mk16=SyncStatus,Sync On,135401,1,0
Mk17=SyncStatus,Sync On,145401,1,0
```

Mk18=SyncStatus, Sync On, 155401, 1, 0  
Mk19=SyncStatus, Sync On, 165401, 1, 0  
Mk20=SyncStatus, Sync On, 175401, 1, 0  
Mk21=SyncStatus, Sync On, 185401, 1, 0  
Mk22=SyncStatus, Sync On, 195401, 1, 0  
Mk23=Response, R128, 204001, 1, 0  
Mk24=SyncStatus, Sync On, 205401, 1, 0  
Mk25=Response, R128, 214001, 1, 0  
Mk26=SyncStatus, Sync On, 215401, 1, 0  
Mk27=Response, R128, 224001, 1, 0  
Mk28=SyncStatus, Sync On, 225401, 1, 0  
Mk29=Stimulus, S202, 227669, 1, 0  
Mk30=Stimulus, S208, 232669, 1, 0  
Mk31=Response, R128, 234001, 1, 0  
Mk32=SyncStatus, Sync On, 235401, 1, 0  
Mk33=Stimulus, S200, 237667, 1, 0  
Mk34=Stimulus, S207, 242498, 1, 0  
Mk35=Response, R128, 244001, 1, 0

< End of File >