MiCAM Series Data Format

Brainvision Inc.

1. MiCAM ULTIMA Format (*.rsh, *.rsd, *.rsm)

By saving acquired data MiCAM ULTIMA acquisition software, system will generate three types of files such as “xxxxx.rsh”, “xxxxx.rsm” and “xxxxx-(0).rsd”. “xxxxx.rsh” is a header file which contains text information about setup and file list. “xxxxx.rsm” is a background data file which contains bitmap of monitor image right before acquisition. “xxxxx-(0).rsd” is a data file which contains bitmaps of 256 images in one block. If page length is longer than 256 frames, xxxxx(0).rsd, xxxxx(1).rsd ,,,,, are generated according to frame number in block unit of 256 frames.

Technical chips:

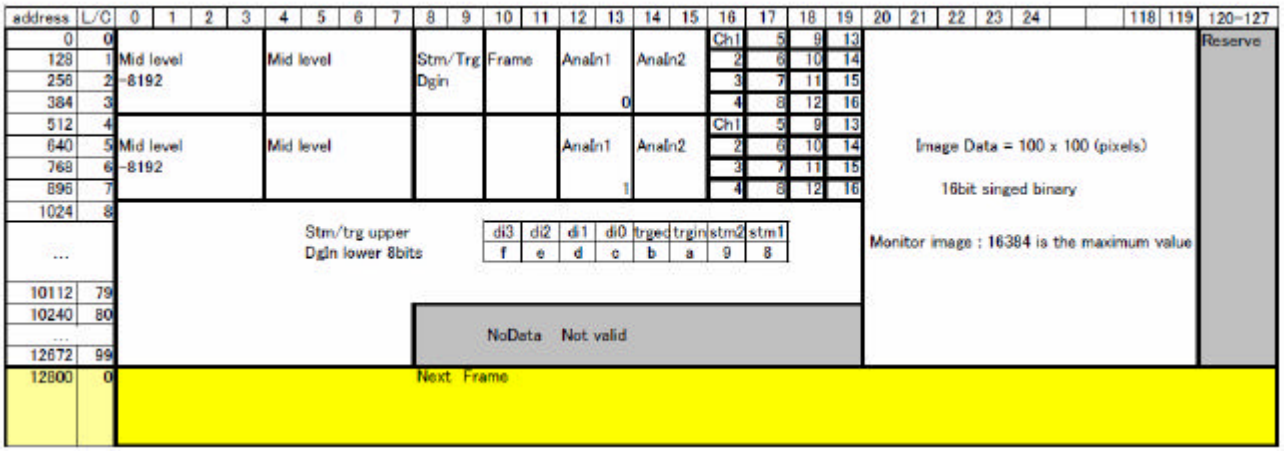
Data-file-list
xxxxx.rsm
xxxxx(0).rsd
xxxxx(1).rsd

A header file “xxxxx.rsh” contains file list as shown above. Linked files can be changed by editing this section. For example, in the case that a “xxxxxx.rsm” is lost by some unfortunate accident (too dark, noisy with FPN and out of focus), this section can be edited like below;

Data-file-list
yyyyyy.rsm
xxxxx(0).rsd
xxxxx(1).rsd

The software will read yyyyyy.rsm instead of xxxxxx.rsm when loading data. It may help missing of xxxxxx.rsm, if yyyyyyy.rsm is better one but almost identical to xxxxx.rsm.

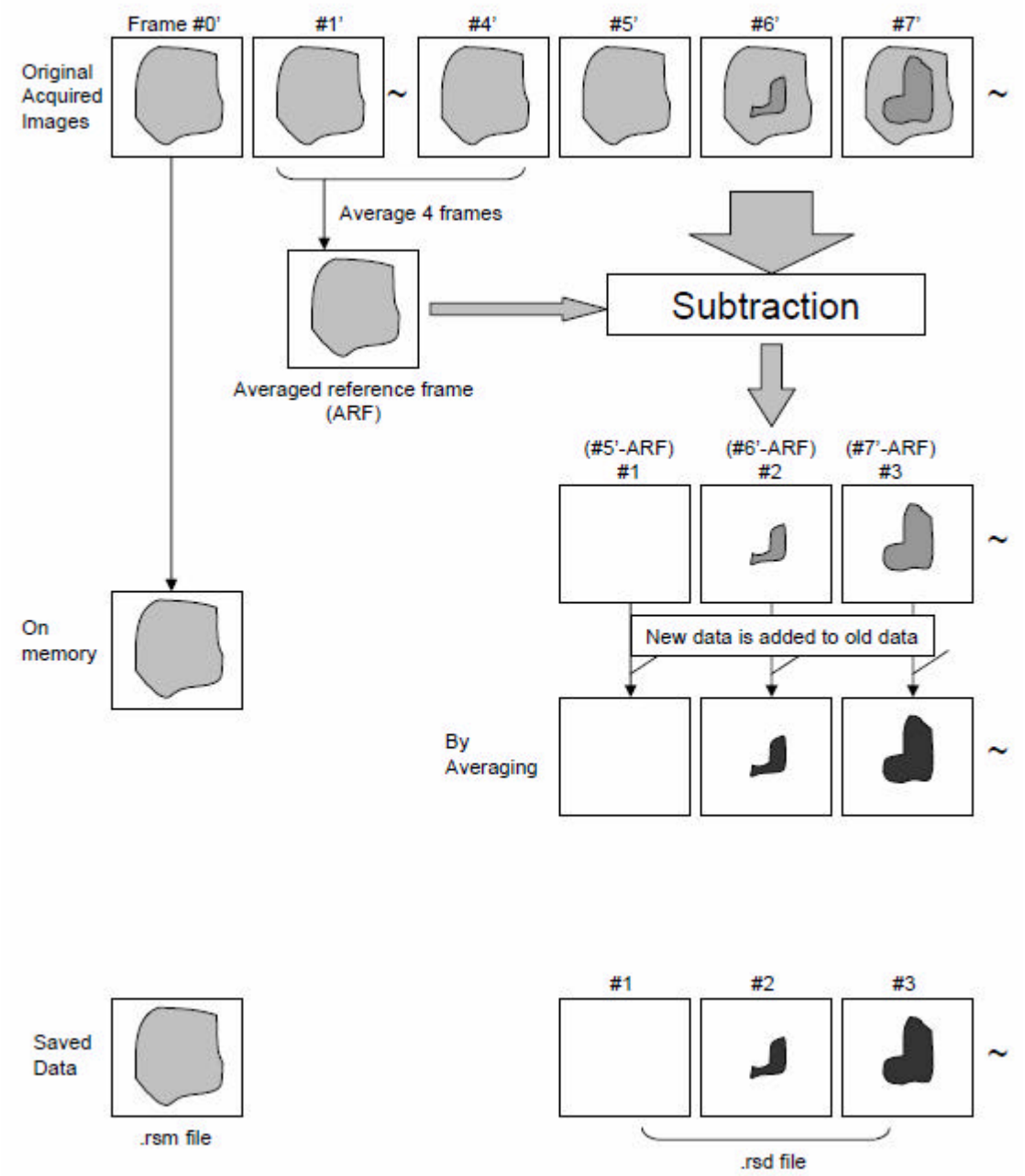
Data Format of “*.rsd”, “*.rsm”



A frame is 25.6K byte. A frame is consisted 100 lines x 128 columns x 2 bytes (16bits).
Optical image is located column 20 to 119 and line 0 to 99.
Analog and other signals is located column 8 to 19 and line 0 to 79 in 4 line group.
Averaged data is not divided by average number, so just added.

Saved differential values are the sum of differential value in each trial and not divided by number of averaging times.

MiCAM ULTIMA Raw Data



2. Unified Form Format （*.gsd）

1. Any imported data of MiCAM01/02/Ultima/Deltaron into BV_Analyzer is converted into same data format called “Unified Form”.

2. [Save] bottom at the upper-left of BV_Analyzer saves data on the canvas in “Unified Form”. Movie with all frames and/or movie with partial frames can be saved with “gsh” and “gsd” format files. “gsh” file has header information in text format, which information is mainly about acquisition condition. “gsd” file has data in “Unified Form” in binary.

3. The structure of “Unified Form”

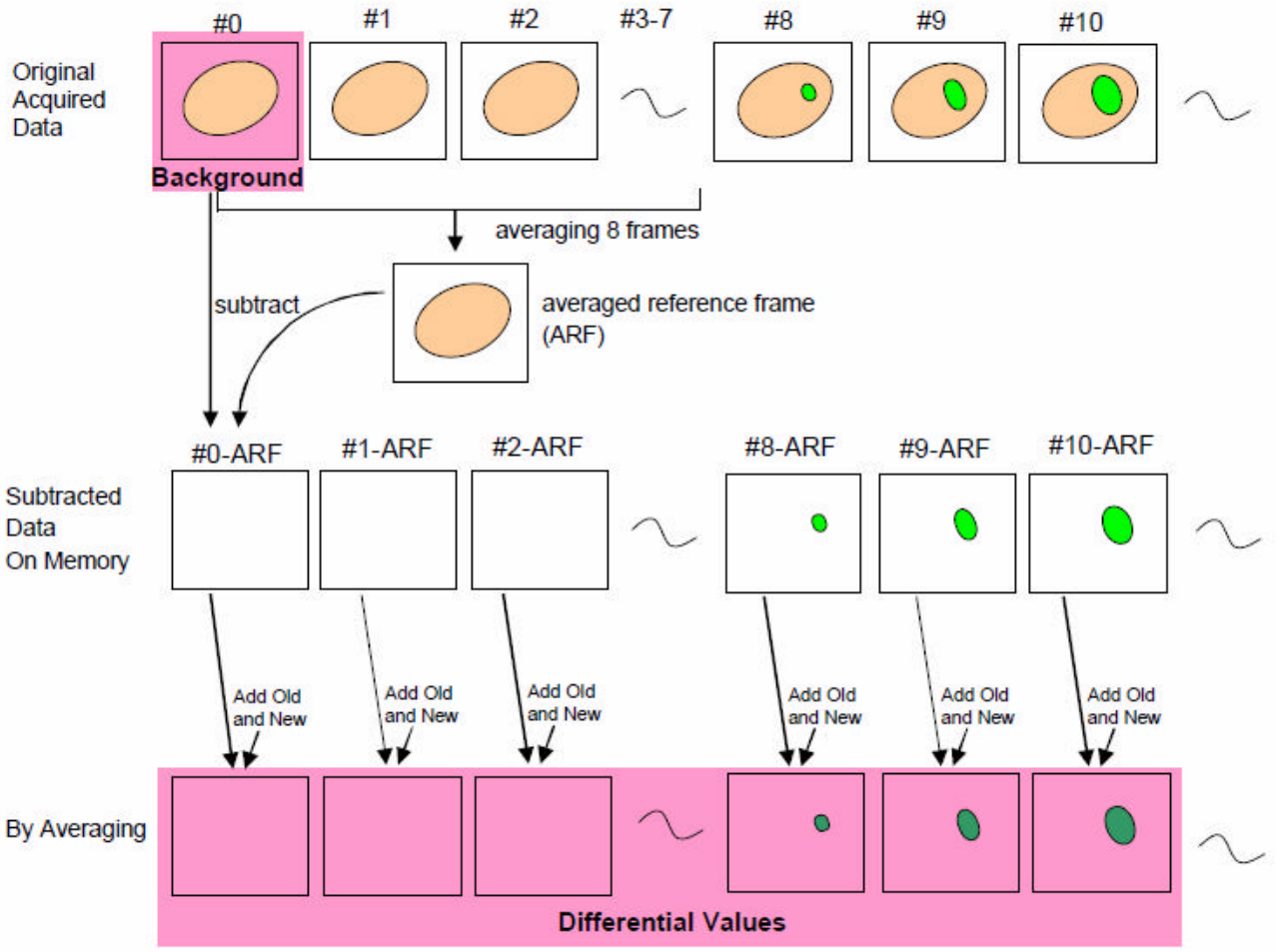
	Byte Address from file top
Reserved Header Information (256 byte)	0
Data Format information (72 bytes), refer to the structure of “FORM_INFO”	256 (100H)
Input signal information (20 bytes), refer to the structure of “AUX_INFO”	328 (148H)
Control information (624 bytes), refer to the structure of “CONTROL_INFO”	348 (15CH)
Background image data Short (16bit signed binary) Dark: 0 Saturation:16383 (X*Y*2 bytes)	972 (3CCH)
Differential data of 0th frame Short (16bit signed binary) Darker: Plus, Brighter: Minus (X*Y*2 byte)	972+X*Y*2
Differential data of 1st frame Short (16bit signed binary) (X*Y*2 byte)	
…	
Differential data of n-th frame Short (16bit signed binary) (X*Y*2 byte)	972+X*Y*2*(n-1)
Analog input signal data Short (16bit signed binary) (nChanum*nFarmeSize*nRate*2 bytes)	972+X*Y*2*n

Each pixel in the short-type format of “Background image data” is shown in the range from 0 to 16,384. Each pixel in the short-type format of “Differential image data” is shown in the value of negative or positive.

4. Each structure

Structure name	Data type	Data name	Byte from file start	Note
FORM_INFO 72 bytes	short	nDataXsize	256	Number of pixels on X axis
	short	nDataYsize	258	Number of pixels on Y axis
	short	nLeftSkip	260	Skipped number of pixels on X axis
	short	nTopSkip	262	Skipped number of pixels on Y axis
	short	nImgXsize	264	Number of effective pixels on X axis
	short	nImgYsize	266	Number of effective pixels on Y axis
	short	nFrameSize	268	Number of frames
	short	nOrgImgXsize	270	
	short	nOrgImgYsize	272	
	short	nOrgFrmSize	274	
	short	nShift	276	
	short	nDummy	278	
	float	dAverage	280	Number of averaging times
	float	dSampleTime	284	Sampling rate (msec)
	float	dOrgSampleTime	288	
	float	dDummy	292	
	char	chDum[32]	296	
AUX_INFO 20Byte	short	nChanum	328	Number of analog channels
	short	nRate	330	Temporal resolution
	short	nOfset	332	
	short	nChNext	334	
	short	nTimeNext	336	
	short	nFrameSize	338	Number of frames
	short	nShift	340	
	short	nDummy1	342	
	short	nDummy2	344	
	short	nDummy3	346	
CONTROL_INFO 624Byte			348	
	Information about data display (such as points, gain, color and so on)			

MiCAM02 Raw Data



* : raw data. saved in *.gsd file

*Averaged reference frame (ARF) is made from averaged initial 8 frames.

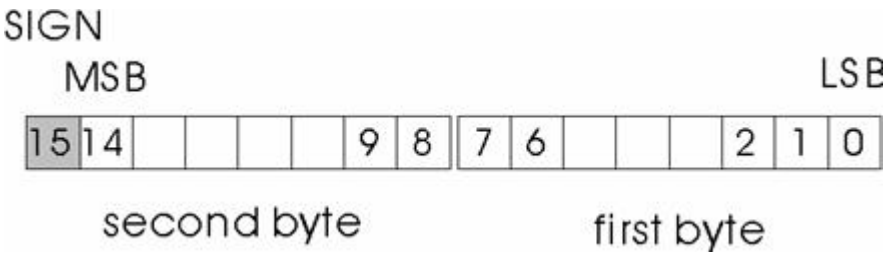
*Differential values are not divided by number of averaging times (just added)

*Fractional Change (%/div) .= $\frac{\text{- differential value * 100}}{\text{background value *averaging times}}$

3. MiCAM01 Format (*.dml, *dmm)

(1) A WORD

One word is 16 bit signed binary. Byte order is least byte first (Intel format).



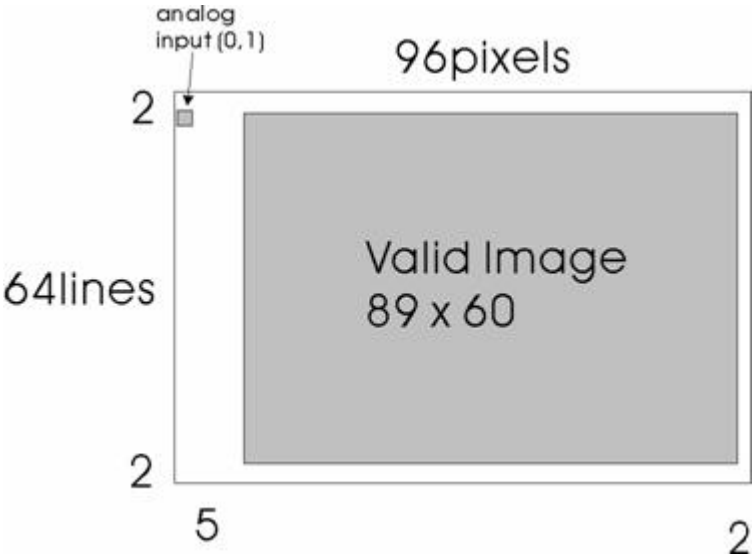
Original data are acquired in 13bit format and adjust to 16bit word.

Then, original pixel data are varied from -4096 to +4097.

Most dark is -4096 and most bright is +4097.

(2) A FRAME

A frame consists from 6144word pixels (12288bytes). Data aligned 96pixels by 64lines like picture below.



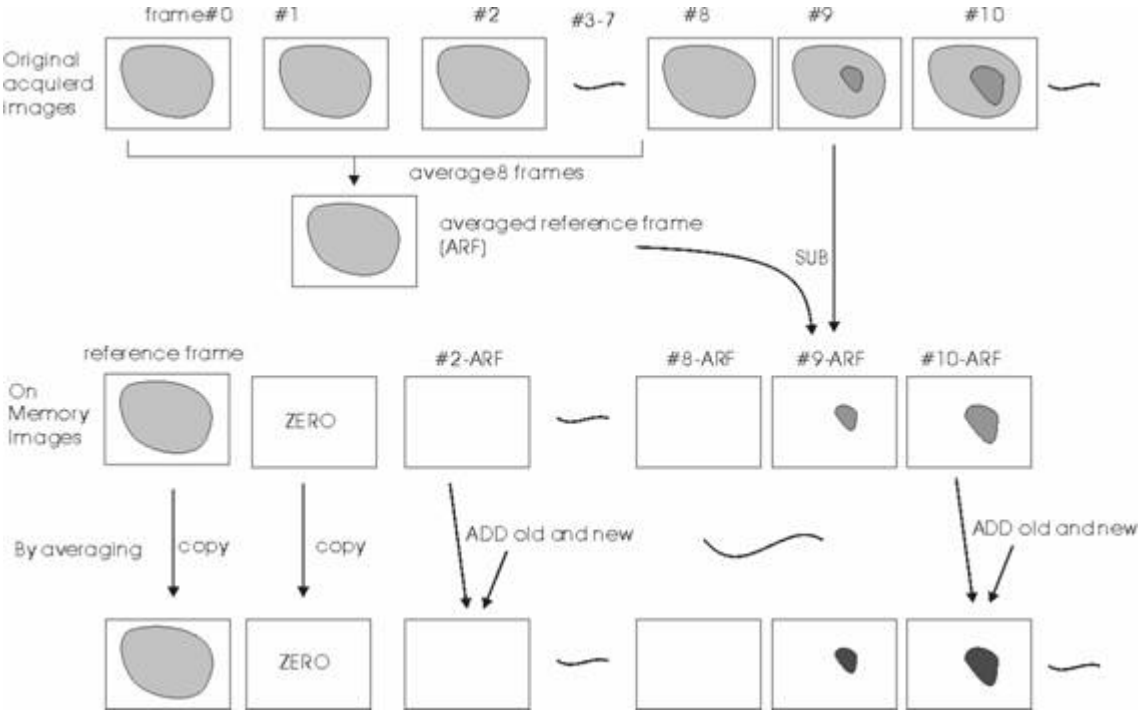
A first data is left-top corner and a last word is right-bottom corner.

(3) A DATA SET

A data set consist from several frames.

Original images set are direct acquired images by camera. And internal process calculates averaged reference and deference from it just after each acquisition finished. A data set consists from a first reference image, a zero reserved frame and several time sequence images of difference from an averaged reference. The averaged reference is calculated using first 8 frames of time sequence images. To help understanding, please see picture below.

By averaging, reference frame is coped, but others are added. Not divided by averaging event number. Normally, fractional change of VSD is very small, like 1%, thus value of deference image is also small, like -50 to +50. This allows us that several time averaging without divide operation. In experience, 100 times averaging is no problem in most of experiments. But experiment condition is must be conceder if your specimen has a big movement or another source of large fractional change rather than VSD signal.



If your specimen has large movement, please save every data set without averaging.
And afterward, you must add a lot of files by hand or using another post-process software. We recommend to use IGOR software for this purpose.

Data set include header information byte 2 to 183. Averaging number is located 24byte from top of dataset. The MiCAM software adjust averaging number automatically by using header information. Header structure shown in below.

```
typedef struct tagAQSPARAM
{
	short page; //page model 0,1,3,7,15,31,63 **** 2bytes from top
	short pro_ver; //prosessor version
	short cam_ver; //camera version
				//bit 0 96x64/192x128 bit 1 non-inv/inv bit 2 FASTMODE bit 3 SuperFASTMODE
				//bit 4-7 0:ICX076.50M.LR 1:ICX076.50M.HR 2:ICX082.33M.HR 3:ICX248.33M.HR
4:ICX082.33M 5:ICX248.33M
				//bit 8-11 0:camera gain=1 1:g=2 2:g=3 3:g=4 (optinal)
	short bitshift; //13bit:0 14bit:1 15bit:2 16bit:3
	short sample; //sampling rate [10usec] **** 10bytes from top
	short gainsw; //0 / 1 ( this is not working)
	short trigger; //0:inter 1:startby 2:posttrg pre25 3:pre50 4:pre75
	short interlace; //interlaced aquisition (optional)
	short pagemode; //0:single 1:sequential 2:random 3:Fast
	short pagenum; //1-64 (page number at multi pagemode) **** 20bytes from top
	short repint; //repeat interval of internal trigger mode
	short average; // average (real events = average+1 ) **** 24bytes from top
	short vsub_l; // vsub value (hardware dependent)
	short format; // 0:fullbit 1:diff bit only  1の時は差分
	short offset; // value of offset which set on acquire dialog box) **** 30bytes from top
	short spare1;
	short def_gain; // default gain
	short scale; // scale value
	short dgo1dly; //delay of Digital out 1 [msec]
	short dgo3dly; //delay of Digital out 3 [msec] **** 40bytes from top
	short dgo2dly; //delay of Digital out 2 [msec]
	short dgo4dly; //delay of Digital out 4 [msec]
	BYTE dgo1dura; //duration og Digital out 1 [100usec] (optional)
	BYTE dgo1rep;
	short dgo1int;
	BYTE mas_sla; //master slave mode
				// 1bit:CHK_SLAVE, 2bit:CHK_SHORT,3bit:CHK_SHTNUM, 4bit:CHK_HEADFILE,
				// 5bit:CHK_HEADFILE2, 6bit: 空き 7bit:CHK_COMMCTL
	BYTE dio;
	short auxout; //digital output mode **** 50bytes from top
	short shuterdly;
	short spare4;
	// **** 56byte from top//28 shorts =56byte
	char filename[FILENAMELENGTH]; //20bytes **** 58bytes from top
	char comment[COMMENTLENGTH]; //32bytes **** 78bytes from top
	BYTE flag; //filesave=TRUE, fileUnSave=FALSE
	BYTE com_flg; //communication item
				// 1bit:CHK_COMOPTNUM, 2bit:CHK_COMOPTCOM,3bit:CHK_COMOPTSCAL,
4bit:CHK_COMOPTSEL,
				// 5bit:CHK_COMOPTDGOUT, 6bit: CHK_COMOPTVIEW
	//*** 110bytes from top
	short processed; // **** 112bytes from top
	char time[12]; //124 byte **** 114bytes from top
	short xpx; //horizontal pixels (64 or 128) **** 126bytes from top
	short ypx; //vertical pixels (96 or 192) **** 128bytes from top
} AQSPARAM, FAR *LPAQSPARAM;
```

Most of user need to access red colored value.
2byte from top of file page: indicate page length 0: 341 1:682 2:1364 ,,,,,
10byte from top of file sample: indicate sample speed 10microsecond unit
24byte from top of file average: averaging number
58byte from top of file File-name strings (20byte)
78byte from top of file Comment strings (32byte)
114byte from top of file Time strings (12byte) "YMMDDHHMMSS"

4. CSV File Format for Image Data (*.csv)

This CSV file contains CSV data of background image and differential image data which is displaying on BV_Ana. The delimiter for this file is comma (,) and the file can be loaded in Microsoft Excel.

The first line keeps “file name”, “number of total frame” and “number of averaging times”. Lines below the [background image] keep background image values with x-pixel and y-pixel size. Background image values are the same through one data no matter which frame (differential image) is exported.

Lines below the [Image Ref Data] keep differential values of selected frame with x-pixel and y-pixel size. **These differential values are the sum of differential value in each trial and not divided by number of averaging times.**

p12, frm=227, average =8.00, shift=1
background Image
478,488,495,565,478,467,469,467,476,445,502,519,528,522,523,505,512,491,539,518,589,・・・・・・・・
483,517,488,491,489,506,478,502,442,486,472,504,521,524,498,496,481,544,522,521,550,・・・・・・・・
498,517,491,495,485,481,455,455,436,457,477,580,519,530,504,512,568,516,530,528,533,・・・・・・・・
516,505,511,484,538,475,503,464,444,489,493,555,548,534,536,528,550,539,540,585,654,・・・・・・・・
533,507,496,517,468,486,444,449,442,514,555,542,559,600,522,515,540,553,554,576,611,・・・・・・・・
530,496,491,479,476,519,459,433,453,522,559,546,517,573,587,527,521,617,558,579,658,・・・・・・・・
・・・・・・・・
・・・・・・・・
・・・・・・・・
・・・・・・・・
Image Ref Data
18,21,-1,-3,0,-1,-4,-14,0,-20,-8,-1,7,-2,-2,-33,0,-1,-6,-2,9,19,11,7,-6,・・・・・・・・
-11,-2,-10,9,-16,-9,-6,-15,18,7,-9,-25,-2,27,1,-5,-24,-20,8,-18,-15,・・・・・・・・
-22,-13,-18,-6,-18,-13,-1,-7,-13,9,-15,-10,-5,-29,-4,6,-31,7,-11,-7,・・・・・・・・
-5,3,0,-11,-27,-6,5,-17,-14,4,-7,-26,-2,4,3,0,-28,24,14,-4,2,15,23,8,・・・・・・・・
-15,-23,-14,-20,-17,-12,-24,5,-4,-23,-13,19,-19,-31,-14,-24,-12,・・・・・・・・
-8,-1,-15,4,4,-2,-17,-9,-16,6,-10,-20,-24,-2,-10,-16,-17,0,-11,0,9,・・・・・・・・
・・・・・・・・

5. CSV File Format for Wave Data (*.csv)

This CSV file contains differential values of selected wave with CSV file format. The delimiter for this file is comma (,) and the file can be loaded in Microsoft Excel.

The first line keeps “file name”, “number of total frame” and “number of averaging times”.
The second line keeps coordinates of the selected pixels.
The third line keeps background image value on the selected pixels
The lines below the fourth line keep time (msec unit) and differential values on the selected pixels. **These differential values are the sum of differential value in each trial and not divided by number of averaging times. Additionally, the values are calculated with the spatial and temporal filtering such as the [Pixel Filter] and [Tcnst Filter] on the [Wave Appearance Control] area.** Wave on the canvas window is divided by number of averaging times and reversed vertically.

The table below shows an example. Sampling time is 2msec and number of total frames is 512 and this data keeps differential values every 2 msec on (31,48) pixel and (58,40) pixel. Column 1-3 indicates time (msec), differential values on (31,48) pixel and differential values on (58,40) pixel, respectively.

p12, cnt =512, ave = 8.00
time,[31][48],[58][40]
back,1458,988
0.00,0,0
2.00,1,1
4.00,1,4
6.00,0,3
8.00,0,3
10.00,0,4
12.00,0,4

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6. CSV File Format for Analog Wave Data (*.csv)

Analog wave CSV data contains wave data of external analog signal. This CSV file has comma as delimiter and can be loaded in Microsoft Excel.

The first line keeps “data name”, “number of exported data“ and “number of averaging times”.
The second line keeps header, "time", "ana1", "ana2" (If there are 4 channels of analog inputs, "ana1", "ana2, "ana3" and "ana4".)
Lines below the third line keep time (msec order) and values of each channel.
The table below is the example of an analog wave CSV data file exported with 2 channel analog inputs.
Analog wave sampling rate is 20 times of imaging sampling time. For example, when imaging sampling time is 2msec, wave sampling time is 2/20msec=0.1msec. The column 1 has time (msec), the column 2 has values of channel1 and the column 3 has values of channel 2.

p12, cnt =10240, ave = 8.00
time ,ana1,ana2
0.000, 0, 0
0.100, 0, 0

2.000, -21093, -21093
2.100, -21026, -21026
2.200, -21151, -21151

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7. Simple ASCII File Format（*.dha, *.dna）

User can export MiCAM data as "Simple ASCII Format" by pushing the [OK] button with the [Simple Ascii] selected on the [Movie Export] window. The [Movie Export] window can be opened by pushing the [Movie Export] button on the [Control] page. With the [Insert header Information] checkbox on, data is saved in a "*.dha". With the [Insert header Information] checkbox off, data is saved in a "*.dna"

Contents of an ASCII File

* Header Information

In a ".dha" file exported with the [Insert header information] selected, X-size, Y-size, frame number and sampling time (100µ order) and 4 of zero with comma delimiter are inserted into first line of ".dha" file. An empty line is inserted after this line. A ".dna" file doesn't contain these header informations.

* Background Data

This section contains background image data (X-size * Y-size). The delimiter is comma and new line starts at every line on an image. An empty line is inserted after this section. Data is the same as the background image data in a ".gsd" file.

* Differential Data

This section contains differential data (X-size * Y-size * frame number). **Each differential values in a "Simple ASCII" data file is NOT the same as differential data in a ".gsd" file. Assuming value in an ASCII file is V1 and value in a ".gsd" file is V2, V1=-V2/averaging times.** The delimiter is comma and new line starts at every line on an image. Every frame, an empty line is inserted.

* External Analog Input

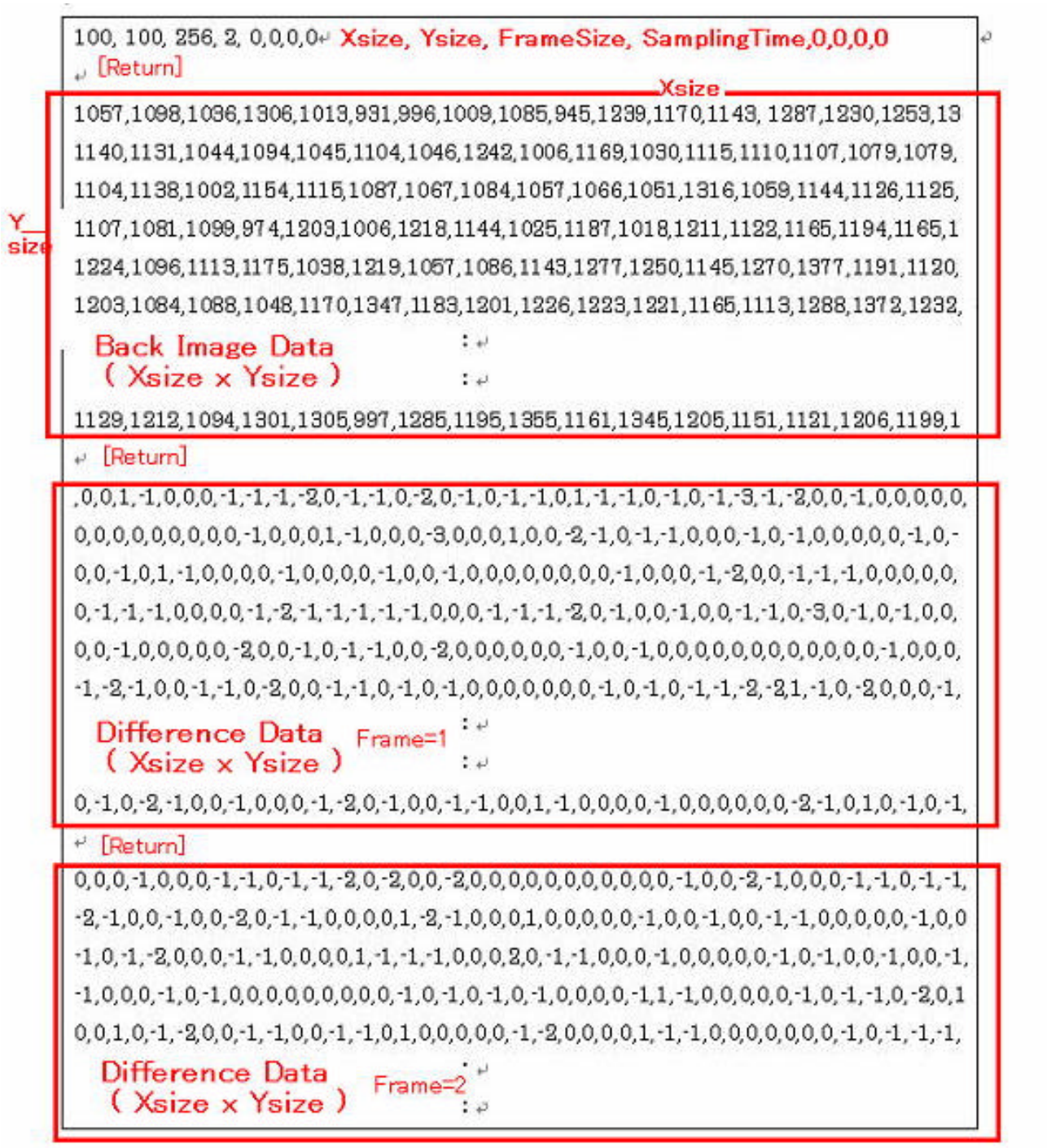
When exported with the [Insert 1ch analog input data at (0,0) pixel] selected, external analog input data from channel1 is inserted into (0, 0) pixel area on an image.
When exported with the [Insert 2ch analog input data at (0,1) pixel] selected, external analog input data from channel2 is inserted into (0, 1) pixel area on an image.

(ATTN) Number of Actual Pixels Number of MiCAM02

Number of actual pixels is different from selected pixel number.

	Temporal Resolution（pixels）							
	High-Speed Type（HS）				High-Resolution Type（HR）			
Selected Pixel number	48x32	96x64	192x128	384x256	48 x32	96 x 64	192 x128	384 x256
Actual Pixel number	40x28	88 x 60	184x124	376 x 252	40 x 28	88 x 60	184 x 124	376 x 252

* An Example of Simple ASCII File（dha）



8. Simple Binary File Format（*.dhb, *.dnb）

User can export MiCAM data as "Simple Binary Format" by pushing the [OK] button with the [Simple Binary] selected on the [Movie Export] window. The [Movie Export] window can be opened by pushing the [Movie Export] button on the [Control] page. With the [Insert header Information] selected, data is saved in a "*.dhb". Without the [Insert header Information] selected, data is saved in a "*.dnb".

Contents of Simple Binary Data

* Header Information

A ".dhb" file which is exported with the [Insert header Information] selected contains header information such as X-size, Y-size, frame number, sampling time (100μ order) and reserved area. Each byte of X-size, Y-size, frame number, sampling time (100μ order) is 2 bytes and bytes of reserved area are 8 bytes. A ".dnb" file doesn't contain these information.

* Background Data

This section contains background image data (X-size * Y-size * 2byte). Each value is the same as background image data in a ".gsd" file.

* Differential Data

This section contains differential data (X-size * Y-size * frame number * 2byte).
Each differential values in a "Simple Binary" data file is NOT the same as differential values in a ".gsd" file. Assuming value in a binary file is V1 and value in a ".gsd" file is V2, V1=-V2/average times.

* External Analog Input

With the [Insert 1ch analog input data at(0,0) pixel] selected, external analog input data from channel1 is inserted into (0, 0) pixel area on an image. With the [Insert 2ch analog input data at(0,1) pixel] selected, external analog input data from channel2 is inserted into (0, 1) pixel area on an image.

(ATTN) Number of Actual Pixels Number of MiCAM02

Number of actual pixels is different from selected pixel number.

	Temporal Resolution（pixels）							
	High-Speed Type（HS）				High-Resolution Type（HR）			
Selected Pixel number	48x32	96x64	192x128	384x256	48 x32	96 x 64	192 x128	384 x256
Actual Pixel number	40x28	88 x 60	184x124	376 x 252	40 x 28	88 x 60	184 x 124	376 x 252

* An Example of Simple Binary File（.dhb）

Item	Byte Address from file top.
Xsize　short 2byte	0
Ysize short 2byte	2
FrameNum short 2byte	4
Sampling time（100μsec) short 2byte	6
Reserved 8byte	8
Background image data Short (16bit signed binary) (X*Y*2 bytes)	16
Differential data of 0th frame Short (16bit signed binary) (X*Y*2 byte)	16+Xsize*Ysize*2byte
Differential data of 1st frame Short (16bit signed binary) (X*Y*2 byte)	16+Xsize*Ysize*2byte*2
