

How to Extract Data from the Binary File of SIGLENT Oscilloscope

EN03B

Revision Record

Version	Update Date	Revise content	
E02A	2022-1-17	None	
EN03A 2024-6-4	Add a new table "Version Compatibility Table" with		
	2024-6-4	different versions of Bin as chapters.	
		2. Add a chapter with bin_head_ver=6.	
		3. Fixed some issues.	
EN03B	2025-7-15	1. Fixed the address issue in V6 version	

Note: When the file is first to be pigeonholed, 'Revise Reason' and 'Revise Content' are write to 'None'.

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Waveform Binary Format Description

Version Compatibility

Version	Update Date	Model Support
Binary Format in Old	2017-10-25	SDS1000X
Platform	2017-10-25	SDS2000X
Binary Format V0.1	2018-3-1	SDS1xx2X-E
Billary Format vo. 1	2010-3-1	SDS1xx4X-E(6.1.20~6.1.25)
Binary Format V0.2	2023-2-7	SDS1xx2X-E(1.3.20&later)
		SDS1xx4X-E (6.1.26&later) SDS2000X-
Binary Format V1.0	2018-6-15	E(1.1.8&later) SDS5000X(0.6.7~0.8.5R2)
		SDS2000X Plus (1.1.6~1.2.3)
Binary Format V2.0	2019-7-22	SDS5000X (0.8.6~0.9.3Rx)
Billary Format V2.0		SDS2000X Plus (1.2.6~1.3.9)
Binary Format V2.0	2021-4-28	SDS5000X(0.9.5&later)
Billary Format V2.0		SDS6000(1.2.2.0&later)
		SDS800X HD
	2022-1-17	SDS1000X HD
		SDS2000X HD
Binary Format V4.0		SDS2000X Plus (1.5.2&later)
Billary Format V4.0		SDS3000X HD
		SDS5000X(0.9.6&later)
		SDS6000(1.4.1.0&later)
		SDS7000
Binary Format V6.0	2023.3.13	SDS1002X-E(V1.3.27&later)
Binary Format V6.0	2023-8-10	SigScopeLab(0.4.9.0&later)

Binary Format in Old Platform

Desciption:

This version format is only valid for SDS1000X and SDS2000X.

Table 1 Format of the Binary File

Parameter	Address	Description
-----------	---------	-------------

wave_length	0x00-0x03	Reserved
mso_wave_length	0x04-0x07	Digital channels wave length
mso_ch_open_num	0x10-0x13	Wave length in units of sample points.
		32-bit integer
mso_ch_open_stats	0x14-0x23	on/off status of d0-d15, 1 - ON, 0 - OFF
		32-bit integer
		d0:0x14 d8:0x15
		d1:0x16 d9:0x17
		d2:0x18 d10: 19
		d3:0x1a d11: 1b
		d4: 0x1c d12:0x1d
		d5: 0x1e d13:0x1f
		d6: 0x20 d14:0x21
		d7: 0x22 d15:0x23
ch1_volt_div_val	0xbc-0xbf	V/div value of CH1, in units of mV. Such as 2.48
		mV/div.
		32-bit float point, little endian.
ch2_volt_div_val	0xc0-0xc3	V/div value of CH2.
ch3_volt_div_val	0xc4-0xc7	V/div value of CH3.
ch4_volt_div_val	0xc8-0xcb	V/div value of CH4.
ch1_vert_offset	0xdc-0xdf	Offset value of CH1, with the unit of pixel. Refer
		to "Calculate the Vertical Offset" to get the
		actual offset voltage.
		32-bit signed integer, little endian.
ch2_vert_offset	0xe0-0xe3	Offset value of CH2.
ch3_vert_offset	0xe4-0xe7	Offset value of CH3.
ch4_vert_offset	0xe8-0xeb	Offset value of CH4.
ch1_on	0x100-0x103	on/off status of CH1, 1 - ON, 0 - OFF
		32-bit signed integer, little endian.
ch2_on	0x104-0x107	on/off status of CH2.
ch3_on	0x108-0x10b	on/off status of CH3.
ch4_on	0x10c-0x10f	on/off status of CH4.
time_div	0x248-0x24b	T/div index. Refer to Table 2 for the details.
		32-bit signed integer, little endian.
time_delay	0x250-0x253	Time delay (Trigger delay) value, in units of
		pixel. Refer to "Calculate the Time Delay" to get
		the actual time delay.
		32-bit signed integer, little endian.
data	0x1470-end	Data. Analog data first, and then digital data.
		Only data of the enabled channel(s) are stored
		to the file.

8-bit unsigned integer for analog data.
1-bit binary integer for digital data.

Table 2 T/div Table

Index	SDS1000X	SDS2000X
0		1 ns/div
1	2 ns/div	2 ns/div
2	5 ns/div	5 ns/div
3	10 ns/div	10 ns/div
4	20 ns/div	20 ns/div
5	50 ns/div	50 ns/div
6	100 ns/div	100 ns/div
7	200 ns/div	200 ns/div
8	500 ns/div	500 ns/div
9	1 us/div	1 us/div
10	2 us/div	2 us/div
11	5 us/div	5 us/div
12	10 us/div	10 us/div
13	20 us/div	20 us/div
14	50 us/div	50 us/div
15	100 us/div	100 us/div
16	200 us/div	200 us/div
17	500 us/div	500 us/div
18	1 ms/div	1 ms/div
19	2 ms/div	2 ms/div
20	5 ms/div	5 ms/div
21	10 ms/div	10 ms/div
22	20 ms/div 20 ms/div	
23	50 ms/div	50 ms/div
24	100 ms/div	100 ms/div
25	200 ms/div	200 ms/div
26	500 ms/div	500 ms/div
27	1 s/div	1 s/div
28	2 s/div	2 s/div
29	5 s/div	5 s/div
30	10 s/div 10 s/div	
31	20 s/div	20 s/div
32	50 s/div	50 s/div

Table 3 V/div Table

Index	SDS1000X	SDS2000X
0	500uV/div	1 mV/div

Index	SDS1000X	SDS2000X
1	1 mV/div	2 mV/div
2	2 mV/div	5 mV/div
3	5 mV/div	10 mV/div
4	10 mV/div	20 mV/div
5	20 mV/div	50 mV/div
6	50 mV/div	100 mV/div
7	100 mV/div	200 mV/div
8	200 mV/div 500 mV/div	
9	500 mV/div	1 V/div
10	1 V/div	2 V/div
11	2 V/div	5 V/div
12	5 V/div 10 V/div	
13	10 V/div	

Calculate the Sample Rate

```
sample_rate = (wave_length) /(hori_div_num*time_div_val)
[example]
hori_div_num = 14 # total horizontal divisions, on SDS2000X is 14
wave_length = 700 pts # length of each frame. Could be got by calculating the length of the data section in the file
time_div_val = 50 ns/div # use the T/div index got from the binary file to search Table 2
So:
sample_rate = 700/(14*50e-9) = 1e9(Sa/s)
```

Calculate the Vertical Offset

```
vert_offset = (ch_vert_offset-220)*(ch_volt_div_val / pixel_per_div)
[example]
pixel_per_div = 50 # total display pixels in a vertical division, on SDS2000X is 50
ch_vert_offset = 270 # offset value, with the unit of pixel, got from the binary file
ch_volt_div_val = 50 mV/div # use the V/div index got from the binary file to search Table 3
So:
vert_offset = (270-220)/(50/50) = 50(mV)
```

Calculate the Time Delay

```
hori_offset_time = (time_offset-349)*(time_div_val / pixel_per_div)
[example]
pixel_per_div = 50 # total display pixels in a horizontal division, on SDS2000X is 50
time_offset = 299 # offset value, with the unit of pixel, got from the binary file
time_div_val = 50 ns/div # use the T/div index got from the binary file to search Table 2

So:
hori_offset_time = (299-349)*(50/50) = -50(ns)
```

Convert the Data to Voltage

```
voltage = (data-128) * ch_volt_div_val /1000/code_per_div + ch_vert_offset
[example]
code_per_div = 50 # total data code in a horizontal division, on SDS2000X is 25
data = 194 # got from the binary file
ch_volt_div_val = 5000 mV/div # V/div, in units of mV
ch_vert_offset = -7.7 V # vertical offset

So:
voltage = (194-128)*5000/1000/25+(-7.7) = 5.5(V)
```

Binary Format V0.1

Description:

The first binary file version, in addition to waveform parameters and data, also includes some device configuration information. The following table only lists waveform related information addresses. The numeric types with units(scp_data_unit) occupy 16 bytes (the numerical value is 8 bytes, order of magnitude is 4 bytes, unit is 4 bytes)

Table 4 Format of the Binary File

Parameter Address [Description
---------------------	-------------

Attack and the	004.003	Time div (time been) unless Cook as 2 40 mg/div
time_div	0xa84-0xa93	Time div (time base) value, Such as 2.48 ms/div.
		Unit of value, such as s from 0xa90-0xa93, refer
		to Table 6 for the details.
		Units of value's magnitude from 0xa8c-0xa8f,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0xa84-
		0xa8b
time_delay	0xa94-0xaa3	Time delay (Trigger delay) value, Such as 2.48
		ms.
		Unit of value, such as s from 0xaa0-0xaa3, refer
		to Table 6 for the details.
		Units of value's magnitude from 0xa9c-0xa9f,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0xa94-
		0xa9b.
wave_length	0xaa4-0xaa7	Wave length in units of sample points.
1.0.000.00		32-bit integer
Sample_rate	0xaa8-0xab7	Sample Rate value, Such as 500M Sa/s.
Sample_rate	Oxado Oxabi	units of value's magnitude from 0xab0-0xab3,
		Refer to Table 6 for the details.
		64-bit float point, data of value from 0xaa8- 0xaaf.
-1.4	0.44.0.47	
ch1_on	0x44-0x47	on/off status of CH1, 1 - ON, 0 - OFF
		32-bit signed integer, little endian.
ch1_volt_div_val	0x90-0x9f	V/div value of CH1, such as 2.48 mV/div.
		Unit of value, such as V from 0x9c-0x9f, refer to
		Table 6 for the details.
		Units of value's magnitude from 0x98-0x9b,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0x90-0x97.
ch1_vert_offset	0xa0-0xaf	Offset value of CH1, such as 2.48 mV.
		Unit of value, such as V from 0xac-0xaf, refer to
		Table 6 for the details.
		Units of value's magnitude from 0xa8-0xab,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0xa0-0xa7.
ch2_on	0xc0-0xc3	on/off status of CH2 32-bit integer
ch2_volt_div_val	0x10c-0x11b	V/div value of CH2, such as 2.48 mV/div.
		Unit of value, such as V from 0x118-0x11b, refer
		to Table 6 for the details.
		Units of value from 0x114-0x117, refer to Table
		omits of value from 0x114-0x117, feler to fable

		5 for the details.
		64-bit float point, data of value from 10c-0x113.
ch2_vert_offset	0x11c-0x12b	Offset value of CH2, such as 2.48 mV.
		Unit of value, such as V from 0x128-0x12b, refer
		to Table 6 for the details
		Units of value's magnitude from 0x124-0x127,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0x11c-
		0x123
ch3_on	0x13c-0x13f	on/off status of CH3 32-bit integer
ch3_volt_div_val	0x188-0x197	V/div value of CH3, such as 2.48 mV/div.
		Unit of value, such as V from 0x194-0x197, refer
		to Table 6 for the details.
		Units of value's magnitude from 0x190-0x193
		refer to Table 5 for the details.
		64-bit float point, data of value from 0x188-
		0x18f.
ch3_vert_offset	0x198-0x1a7	Offset value of CH3, such as 2.48 mV.
		Unit of value, such as V from 0x1a4-0x1a7, refer
		to Table 6 for the details.
		Units of value's magnitude from 0x1a0-0x1a3,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0x198-
		0x19f.
ch4_on	0x1b8-0x1bb	on/off status of CH4 32-bit integer
ch4_volt_div_val	0x204-0x213	V/div value of CH4, such as 2.48 mV/div.
		Unit of value, such as V from 0x210-0x213, refer
		to Table 6 for the details.
		units of value's magnitude from 0x20c-0x20f,
		Refer to Table 5 for the details.
		64-bit float point, data of value from 0x204-
		0x20b.
ch4_vert_offset	0x214-0x223	Offset value of CH4, such as 2.48 mV.
		Unit of value, such as V from 0x220-0x223, refer
		to Table 6 for the details
		Units of value's magnitude from 0x21c-0x21f,
		refer to Table 5 for the details
		64-bit float point, data of value from 0x214-
		0x21b.
reserved	0x8a04-	reserved
	0x8a07	
	0,0007	

		8-bit unsigned integer for analog data
		file.
uala	Oxodou-end	Data from analog channel 1 to channel 4. Only data of the enabled channel(s) are stored to the
data	0x8433 0x8a60-end	Data from applied chapped 1 to chapped 4. Only
reserved	0x8430-	reserved
reserved	0x842c-0x842f	reserved
	0x842b	
reserved	0x8428-	reserved
	0x8427	
reserved	0x8424-	reserved
	0x8423	
reserved	0x8420-	reserved
reserved	0x841c-0x841f	reserved
	0x841b	
reserved	0x8418-	reserved
	0x8417	
reserved	0x8414-	reserved
	0x8413	
reserved	0x8410-	reserved
reserved	0x840c-0x840f	reserved
	0x840b	
reserved	0x8408-	reserved
reserved	0x8407	reserved
reserved	0x8404-	reserved
reserved	0x8400- 0x8403	reserved
reserved	0x83tc-0x83tt 0x8400-	reserved
	0x83fc-0x83ff	reserved
reserved	0x83f8-0x83fb	reserved
reserved	0x82f8-0x82fb 0x83f4-0x83f7	reserved reserved

Table 5 Magnitude Table

Index	SDS1000X-E
0	YOCTO
1	ZEPTO
2	ATTO
3	FEMTO
4	PICO
5	NANO
6	MICRO
7	MILLI
8	IU
9	KILO
10	MEGA
11	GIGA
12	TERA
13	PETA

Table 6 Units Table

Index	SDS1000X-E	Index	SDS1000X-E
0	V	14	S
1	Α	15	SA
2	VV	16	PTS
3	AA	17	NULL
4	ΟU	18	DB
5	W	19	DBV
6	SQRT_V	20	DBA
7	SQRT_A	21	VPP
8	INTEGRAL_V	22	VDC
9	INTEGRAL_A	23	DBM
10	DT_V		
11	DT_A		
12	DT_DIV		
13	Hz		

Binary Format V0.2

Description:

The waveform horizontal parameter address has changed.

Table 5 Format of the Binary File

Parameter	Address	Description
time_div	0xdb8-0xdc7	Time div (time base) value, Such as 2.48 ms/div.
		Unit of value, such as s from 0xdc3-0xdc7, refer
		to Table 6 for the details.
		Units of value's magnitude from 0xdc0-0xdc3,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0xdb8-
		0xdbf.
time_delay	0xdc8-0xdd7	Time delay (Trigger delay) value, Such as 2.48
		ms.
		Unit of value, such as s from 0xdd3-0xdd7, refer
		to Table 6 for the details.
		Units of value's magnitude from 0xdd0-0xdd3,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0xdc8-
		Oxdcf.
wave_length	0xdd8-0xddb	Wave length in units of sample points.
		32-bit integer
Sample_rate	0xddc-0xdeb	Sample Rate value, Such as 500M Sa/s.
		units of value's magnitude from 0xde4-0xde7,
		Refer to Table 6 for the details.
		64-bit float point, data of value from 0xddc-
		0xde3.
ch1_on	0x44-0x47	on/off status of CH1, 1 - ON, 0 - OFF
		32-bit signed integer, little endian.
ch1_volt_div_val	0xb4-0xc3	V/div value of CH1, such as 2.48 mV/div.
		Unit of value, such as V from 0xc0-0xc3, refer to
		Table 6 for the details.
		Units of value's magnitude from 0xbc-0xbf,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0xb4-
		0xbb.
ch1_vert_offset	0xc4-0xd3	Offset value of CH1, such as 2.48 mV.
		Unit of value, such as V from 0xd0-0xd3, refer
		to Table 6 for the details.
		Units of value's magnitude from 0xcc-0xcf, refer
		to Table 5 for the details.
		64-bit float point, data of value from 0xc4-0xcb.
ch2_on	0xe8-0xeb	on/off status of CH2 32-bit integer
C112_011		·

		I
		Unit of value, such as V from 0x164-0x167,
		refer to Table 6 for the details.
		Units of value from 0x160-0x163, refer to Table
		5 for the details.
		64-bit float point, data of value from 0x158-
		0x15f.
ch2_vert_offset	0x168-0x177	Offset value of CH2, such as 2.48 mV.
		Unit of value, such as V from 0x174-0x177,
		refer to Table 6 for the details
		Units of value's magnitude from 0x170-0x173,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0x168-
		0x16f
ch3_on	0x18c-0x18f	on/off status of CH3 32-bit integer
ch3_volt_div_val	0x1fc-0x20b	V/div value of CH3, such as 2.48 mV/div.
		Unit of value, such as V from 0x207-0x20b,
		refer to Table 6 for the details.
		Units of value's magnitude from 0x204-0x207
		refer to Table 5 for the details.
		64-bit float point, data of value from 0x1fc-
		0x203.
ch3_vert_offset	0x20c-0x21b	Offset value of CH3, such as 2.48 mV.
		Unit of value, such as V from 0x217-0x21b,
		refer to Table 6 for the details.
		Units of value's magnitude from 0x214-0x217,
		refer to Table 5 for the details.
		64-bit float point, data of value from 0x20c-
		0x213.
ch4_on	0x230-0x233	on/off status of CH4 32-bit integer
ch4_volt_div_val	0x2a0-0x2af	V/div value of CH4, such as 2.48 mV/div.
		Unit of value, such as V from 0x2ab-0x2af, refer
		to Table 6 for the details.
		units of value's magnitude from 0x2a8-0x2aa,
		Refer to Table 5 for the details.
		64-bit float point,data of value from 0x2a0-
		0x2a7.
ch4_vert_offset	0x2b0-0x2bf	Offset value of CH4, such as 2.48 mV.
		Unit of value, such as V from 0x2bb-0x2bf, refer
		to Table 6 for the details
		Units of value's magnitude from 0x2b8-0x2ba,
		refer to Table 5 for the details
		64-bit float point, data of value from 0x2b0-
	1	,

		0x2b7.
reserved	0x8a04-0x8a07	reserved
reserved	0x82f8-0x82fb	reserved
reserved	0x83f4-0x83f7	reserved
reserved	0x83f8-0x83fb	reserved
reserved	0x83fc-0x83ff	reserved
reserved	0x8400-0x8403	reserved
reserved	0x8404-0x8407	reserved
reserved	0x8408-0x840b	reserved
reserved	0x840c-0x840f	reserved
reserved	0x8410-0x8413	reserved
reserved	0x8414-0x8417	reserved
reserved	0x8418-0x841b	reserved
reserved	0x841c-0x841f	reserved
reserved	0x8420-0x8423	reserved
reserved	0x8424-0x8427	reserved
reserved	0x8428-0x842b	reserved
reserved	0x842c-0x842f	reserved
reserved	0x8430-0x8433	reserved
data	0x932c-end	Data from analog channel 1 to channel 4. Only
		data of the enabled channel(s) are stored to the
		file.
		8-bit unsigned integer for analog data

Table 8 Magnitude Table

Index	SDS1000X-E
0	YOCTO
1	ZEPTO
2	ATTO
3	FEMTO
4	PICO
5	NANO
6	MICRO
7	MILLI
8	IU
9	KILO
10	MEGA
11	GIGA
12	TERA
13	PETA

Table 9 Units Table

Index	SDS1000X-E	Index	SDS1000X-E
0	V	14	S
1	А	15	SA
2	VV	16	PTS
3	AA	17	NULL
4	OU	18	DB
5	W	19	DBV
6	SQRT_V	20	DBA
7	SQRT_A	21	VPP
8	INTEGRAL_V	22	VDC
9	INTEGRAL_A	23	DBM
10	DT_V		
11	DT_A		
12	DT_DIV		
13	Hz		

Convert the Data to Voltage

voltage = (data-128) * ch_volt_div_val /code_per_div + ch_vert_offset
[example]
code_per_div = 25 # total data code in a horizontal division, on SDS1000X-E is 25

```
data = 194  # get from the binary file
ch_volt_div_val = 5000 mV/div  # V/div, in units of mV
ch_vert_offset = -7.7 V  # vertical offset
So:
voltage = (194-128) * 5/25+(-7.7) = 5.5 V
```

Binary Format V1.0

Description:

Binary files no longer contain device setup information, waveform parameters start from address 0X00. The header size is 2k bytes.

Table 1 Format of the Binary File

Parameter	Address	Description
ch1_on	0x00-0x03	on/off status of CH1, 1 - ON, 0 - OFF 32-bit signed integer.
ch2_on	0x04-0x07	on/off status of CH2, 1 - ON, 0 - OFF 32-bit integer
ch3_on	0x08-0x0b	on/off status of CH3, 1 - ON, 0 - OFF
C13_011	OXOO OXOD	32-bit integer
ch4_on	0x0c-0x0f	on/off status of CH4, 1 - ON, 0 - OFF
	SAGE GAO!	32-bit integer
ch1_volt_div_val	0x10-0x1f	V/div value of CH1, such as 2.48 mV/div.
CIII_VOIL_UIV_VAI	0x10-0x11	Unit of value, such as V from 0x1c-0x1f, refer to Table for the details.
		Units of value's magnitude (MICRO) from 0x18- 0x1b, refer to Table for the details.
		64-bit float point, data of value from 0x10-0x17.

ch2_volt_div_val	0x20-0x2f 0x30-0x3f	V/div value of CH2, such as 2.48 mV/div. Unit of value, such as V from 0x2c-0x2f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x28-0x2b, refer to Table for the details. 64-bit float point, data of value from 0x20-0x27. V/div value of CH3, such as 2.48 mV/div.
		Unit of value, such as V from 0x3c-0x3f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x38-0x3b, refer to Table for the details. 64-bit float point, data of value from 0x30-0x37.
ch4_volt_div_val	0x40-0x4f	V/div value of CH4, such as 2.48 mV/div. Unit of value, such as V from 0x4c-0x4f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x48- 0x4b, refer to Table for the details. 64-bit float point, data of value from 0x40- 0x47.
ch1_vert_offset	0x50-0x5f	Offset value of CH1, such as 2.48 mV. Unit of value, such as V from 0x5c-0x5f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x58-0x5b, refer to Table for the details. 64-bit float point, data of value from 0x50-0x57.
ch2_vert_offset	0x60-0x6f	Offset value of CH2, such as 2.48 mV. Unit of value, such as V from 0x6c-0x6f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x68-0x6b, refer to Table for the details. 64-bit float point, data of value from 0x60-0x67.
ch3_vert_offset	0x70-0x7f	Offset value of CH3, such as 2.48 mV. Unit of value, such as V from 0x7c-0x7f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x78-0x7b, refer to Table for the details. 64-bit float point, data of value from 0x70-0x77.

ch4_vert_offset digital_on	0x80-0x8f 0x90-0x93	Offset value of CH4, such as 2.48 mV. Unit of value, such as V from 0x8c-0x8f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x88-0x8b, refer to Table for the details. 64-bit float point, data of value from 0x80-0x87. on/off status of digital, 1 - ON, 0 - OFF 32-bit integer
		32-bit integer
d0_d15_on	0x94-0xd3	on/off status of d0-d15, 1 - ON, 0 - OFF 32-bit integer d0:0x94-0x97
time_div	0xd4-0xe3	Time div (time base) value, Such as 2.48 ms/div. Unit of value, such as s from 0xe0-0xe3, refer to Table for the details. Units of value's magnitude (MICRO) from 0xdc- 0xdf, refer to Table for the details. 64-bit float point, data of value from 0xd4- 0xdb.
time_delay	0xe4-0xf3	Time delay (Trigger delay) value, Such as 2.48 ms. Unit of value, such as s from 0xf0-0xf3, refer to Table for the details. Units of value's magnitude (MICRO) from 0xec-0xef, refer to Table for the details. 64-bit float point, data of value from 0xe4-0xeb
wave_length	0xf4-0xf7	Wave length of the data points for analog channel. 32-bit integer

Sample_rate digital_wave_length	0xf8-0x107 0x108-0x10b	Sample Rate value for analog channel, Such as 500M Sa/s. Unit of value, such as Sa from 0x104-0x107, refer to Table for the details. Units of value's magnitude (MEGA) from 0x100-0x103, Refer to Table for the details. 64-bit float point, data of value from 0xf8-0xff. Wave length of the data points for digital. 32-bit integer
digital_sample_rate	0x10c-0x11b	Sample Rate value for digital, Such as 500M Sa/s. Unit of value, such as Sa from 0x118-0x11b, refer to Table for the details. Units of value's magnitude (MEGA) from 0x114-0x117, Refer to Table for the details. 64-bit float point, data of value from 0x10c-0x113.
reserved	0x11c~	reserved
reserved	~0x7ff	reserved
Wave_data	0x800-end	Data from CH1 to D15. Only data of the enabled channel(s) are stored to the file. I.E. if there are data of all channels(Ch1 to D15), and wave_length from 0xf4-0xf7 is 700(0x2bc). Data of CH1 is from 0x800 to 0xabb. Data of CH2 is from 0xabc to 0xd77. CH3 and CH4 are the same. Next block is the data of D0. The data length (digital_wave_length) from 0x108-0x10b is 1400. Data of D0 is from 0x12f0 to 0x1867. D1~D15 are the same.

Table 2 Magnitude Table

Index	Magnitude	Index	Magnitude
0	УОСТО	7	MILLI
1	ZEPTO	8	IU

Index	Magnitude	Index	Magnitude
2	ATTO	9	KILO
3	FEMTO	10	MEGA
4	PICO	11	GIGA
5	NANO	12	TERA
6	MICRO	13	PETA

Table 3 Units Table

Index	Unit	Index	Unit
0	V	12	DT_DIV
1	А	13	Hz
2	VV	14	S
3	AA	15	SA
4	ΟU	16	PTS
5	W	17	NULL
6	SQRT_V	18	DB
7	SQRT_A	19	DBV
8	INTEGRAL_V	20	DBA
9	INTEGRAL_A	21	VPP
10	DT_V	22	VDC
11	DT_A	23	DBM

Convert the Data to Voltage

```
voltage = (data-128) * ch_volt_div_val/code_per_div + ch_vert_offset

[example]
code_per_div = 25  # total data code in a horizontal division, on SDS1000X-E is 25
data = 194  # got from the binary file
ch_volt_div_val = 5000 mV/div  # V/div, in units of mV
ch_vert_offset = -7.7 V  # vertical offset

So:
voltage = (194-128) * 5/25+(-7.7) = 5.5 V
```

Calculate the Time Value of the Data

time value(S) = -(time_div *grid /2)+index*(1/ Sample_rate)

[example]

```
grid = 14  # The grid numbers in horizontal direction
time_div = 2 us  # s/div, in units of us
Sample_rate = 1 GSa/s  # Sa/s, in units of GSa/s
```

So:

The time value of the first point: -(2e-6*14/2)+0*(1/1e9) = -14e-6 s. The time value of the second point: -(2e-6*14/2)+1*(1/1e9) = -14.001e-6 s.

Binary Format V2.0

Description:

Binary file added description parameter: file format version. The size of numerical types with units(scp_data_unit) increased to 40 bytes(the numerical value is 8 bytes, order of magnitude is 4 bytes, unit is 28 bytes).

Table 7 Format of the Binary File

Parameter	Address	Description
version	0x00-0x03	Version number of the file.
		0 or 1,use V1.0 to extract data.
		2,use V2.0 to extract data.
ch1_on	0x04-0x07	on/off status of CH1, 1 - ON, 0 - OFF
		32-bit signed integer.
ch2_on	0x08-0x0b	on/off status of CH2, 1 - ON, 0 - OFF
		32-bit integer
ch3_on	0x0c-0x0f	on/off status of CH3, 1 - ON, 0 - OFF
		32-bit integer

ch4_on	0x10-0x13	on/off status of CH4, 1 - ON, 0 - OFF 32-bit integer
ch1_volt_div_val	0x14-0x3b	V/div value of CH1, such as 2.48 mV/div. Unit of value, such as V from 0x20-0x3b, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x1c-0x1f, refer to Table 8 for the details. 64-bit float point, data of value from 0x14-0x1b.
ch2_volt_div_val	0x3c-0x63	V/div value of CH2, such as 2.48 mV/div. Unit of value, such as V from 0x48-0x63, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x44-0x47, refer to Table 8 for the details. 64-bit float point, data of value from 0x3c-0x43.
ch3_volt_div_val	0x64-0x8b	V/div value of CH3, such as 2.48 mV/div. Unit of value, such as V from 0x70-0x8b, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x6c-0x6f, refer to Table 8 for the details. 64-bit float point, data of value from 0x64-0x6b.
ch4_volt_div_val	0x8c-0xb3	V/div value of CH4, such as 2.48 mV/div. Unit of value, such as V from 0x98-0xb3, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x94-0x97, refer to Table 8 for the details. 64-bit float point, data of value from 0x8c-0x93.
ch1_vert_offset	0xb4xdb	Offset value of CH1, such as 2.48 mV. Unit of value, such as V from 0xc0-0xdb, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0xbc-0xbf, refer to Table 8 for the details. 64-bit float point, data of value from 0xb4-0xbb.

ch2_vert_offset	0xdc-0x103	Offset value of CH2, such as 2.48 mV. Unit of value, such as V from 0xe8-0x103, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0xe4-0xe7, refer to Table 8 for the details. 64-bit float point, data of value from 0xdc-0xe3.
ch3_vert_offset	0x104-0x12b	Offset value of CH3, such as 2.48 mV. Unit of value, such as V from 0x110-0x12b, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x10c-0x10f, refer to Table 8 for the details. 64-bit float point, data of value from 0x104-0x10b.
ch4_vert_offset	0x12c-0x153	Offset value of CH4, such as 2.48 mV. Unit of value, such as V from 0x138-0x153, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x134-0x137, refer to Table 8 for the details. 64-bit float point, data of value from 0x12c-0x133.
digital_on	0x154-0x157	on/off status of digital, 1 - ON, 0 - OFF 32-bit integer
d0_d15_on	0x158-0x197	on/off status of d0-d15, 1 - ON, 0 - OFF 32-bit integer d0:0x158-0x15b
time_div	0x198-0x1bf	Time div (time base) value, Such as 2.48 ms/div. Unit of value, such as s from 0x1a3-0x1bf, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x1a0-0x1a3, refer to Table 8 for the details. 64-bit float point, data of value from 0x198- 0x19f.

time_delay wave_length	0x1c0-0x1e7 0x1e8-0x1eb	Time delay (Trigger delay) value, Such as 2.48 ms. Unit of value, such as s from 0x1cc-0x1e7, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x1c8-0x1cb, refer to Table 8 for the details. 64-bit float point, data of value from 0x1c0-0x1c7 Wave length of the data points for analog
		channel. 32-bit integer
Sample_rate	0x1ec-0x213	Sample Rate value for analog channel, Such as 500M Sa/s. Unit of value, such as Sa from 0x1f8-0x213, refer to Table 9 for the details. Units of value's magnitude (MEGA) from 0x1f4-0x1f7, Refer to Table 8 for the details. 64-bit float point, data of value from 0x1ec-0x1f3.
digital_wave_length	0x214-0x217	Wave length of the data points for digital. 32-bit integer
digital_sample_rate	0x208-0x23f	Sample Rate value for digital, Such as 500M Sa/s. Unit of value, such as Sa from 0x214-0x23f, refer to Table 9 for the details. Units of value's magnitude (MEGA) from 0x210-0x213, Refer to Table 8 for the details. 64-bit float point, data of value from 0x208-0x20f.
ch1_probe	0x240-0x247	Probe value of CH1,64-bit float point
ch2_probe	0x248-0x24f	Probe value of CH2,64-bit float point

ch3_probe	0x250-0x257	Probe value of CH3,64-bit float point	
ch4_probe	0x258-0x25f	Probe value of CH4,64-bit float point	
Data width	0x260	Data width of the waveform data, 0 – 8-bit, 1 – 16-bit, 8-bit unsigned integer	
reserved	0x261~	reserved	
	•••		
reserved	~0x7ff	reserved	
Wave_data	0x800-end	Data from CH1 to D15. Only data of the enabled channel(s) are stored to the file. I.E. If there are data of all channels(Ch1 to D15), wave_length from 0x1e8-0x1eb is 700(0x2bc).,and data width from 0x260 is 0(8-bit). Data of CH1 is from 0x800 to 0xabb. Data of CH2 is from 0xabc to 0xd77. CH3 and CH4 are the same. Next block is the data of D0. The data length (digital_wave_length) from 0x214-0x217 is 1400. Data of D0 is from 0x12f0 to 0x1867. D1~D15 are the same.	

Table 8 Magnitude Table

Index	Magnitude	Index	Magnitude
0	YOCTO	9	KILO
1	ZEPTO	10	MEGA
2	ATTO	11	GIGA
3	FEMTO	12	TERA
4	PICO	13	PETA
5	NANO	14	EXA

Index	Magnitude	Index	Magnitude
6	MICRO	15	ZETTA
7	MILLI	16	YOTTA
8	IU		

Table 9 Units Table

First 32-bit is basic unit type:

Index	Unit	Index	Unit
0	Is composed of V,A and S.	8	DT_DIV
1	DBV	9	PTS
2	DBA	10	NULL_SENSE
3	DB	11	DEGREE
4	VPP	12	PERCENT
5	VDC		
6	DBM		
7	SA		

The next 64-bit describes the power of V, in which the first half represents the numerator and the next half represents the denominator.

The next 64-bit describes the power of A, in which the first half represents the numerator and the next half represents the denominator.

The next 64-bit describes the power of S, in which the first half represents the numerator and the next half represents the denominator.

For example, $\{0,1,1,0,1,0,1\}$ represents the unit V. The first number 0 means the unit is composed of V,A and S. The second number 1 and the third number 1 mean the power of V is 1/1. The fourth number 0 and the fifth number 1 mean the power of A is 0/1. The sixth number 0 and the seventh number 1 mean the power of S is 0/1. So the unit is V.

Convert the Data to Voltage

```
voltage = (data- 128) * ch_volt_div_val /code_per_div + ch_vert_offset

[example]
code_per_div = 25  # total data code in a horizontal division, on SDS1000X is 25
data = 194  # got from the binary file
ch_volt_div_val = 5000 mV/div  # V/div, in units of mV
ch_vert_offset = -7.7 V  # vertical offset

So:
voltage = (194-128) * 5/25+(-7.7) = 5.5 V
```

Calculate the Time Value of the Data

```
time value(S) = -( time_div *grid /2)+index*(1/ Sample_rate)

[example]

grid = 14  # The grid numbers in horizontal direction

time_div = 2 us  # s/div, in units of us

Sample_rate = 1 GSa/s  # Sa/s, in units of GSa/s

So:

The time value of the first point: -(2e-6*14/2)+0*(1/1e9) = -14e-6 s.

The time value of the second point: -(2e-6*14/2)+1*(1/1e9) = -14.001e-6 s.
```

Binary Format V3.0

Description:

Binary file added description parameter: Byte order, Hori_divnum, chx_vert_code_per_div, math parameters.

Table 7 Format of the Binary File

Parameter	Address	Description
version	0x00-0x03	Version number of the file.
		3,use this block.
ch1_on	0x04-0x07	on/off status of CH1, 1 - ON, 0 - OFF
		32-bit signed integer.
ch2_on	0x08-0x0b	on/off status of CH2, 1 - ON, 0 - OFF
		32-bit integer
ch3_on	0x0c-0x0f	on/off status of CH3, 1 - ON, 0 - OFF
		32-bit integer
ch4_on	0x10-0x13	on/off status of CH4, 1 - ON, 0 - OFF
		32-bit integer

ch1_volt_div_val	0x14-0x3b	V/div value of CH1, such as 2.48 mV/div. Unit of value, such as V from 0x20-0x3b, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x1c-0x1f, refer to Table 8 for the details. 64-bit float point, data of value from 0x14-0x1b.
ch2_volt_div_val	0x3c-0x63	V/div value of CH2, such as 2.48 mV/div. Unit of value, such as V from 0x48-0x63, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x44-0x47, refer to Table 8 for the details. 64-bit float point, data of value from 0x3c-0x43.
ch3_volt_div_val	0x64-0x8b	V/div value of CH3, such as 2.48 mV/div. Unit of value, such as V from 0x70-0x8b, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x6c-0x6f, refer to Table 8 for the details. 64-bit float point, data of value from 0x64-0x6b.
ch4_volt_div_val	0x8c-0xb3	V/div value of CH4, such as 2.48 mV/div. Unit of value, such as V from 0x98-0xb3, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x94-0x97, refer to Table 8 for the details. 64-bit float point, data of value from 0x8c-0x93.
ch1_vert_offset	0xb4-xdb	Offset value of CH1, such as 2.48 mV. Unit of value, such as V from 0xc0-0xdb, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0xbc-0xbf, refer to Table 8 for the details. 64-bit float point, data of value from 0xb4-0xbb.
ch2_vert_offset	0xdc-0x103	Offset value of CH2, such as 2.48 mV. Unit of value, such as V from 0xe8-0x103, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0xe4-0xe7, refer to Table 8 for the details. 64-bit float point, data of value from 0xdc-0xe3.

ch3_vert_offset ch4_vert_offset	0x104-0x12b 0x12c-0x153	Offset value of CH3, such as 2.48 mV. Unit of value, such as V from 0x110-0x12b, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x10c-0x10f, refer to Table 8 for the details. 64-bit float point, data of value from 0x104-0x10b. Offset value of CH4, such as 2.48 mV. Unit of value, such as V from 0x138-0x153, refer to Table 9 for the details. Units of value's magnitude (MICRO) from
		0x134-0x137, refer to Table 8 for the details. 64-bit float point, data of value from 0x12c- 0x133.
digital_on	0x154-0x157	on/off status of digital, 1 - ON, 0 - OFF 32-bit integer
d0_d15_on	0x158-0x197	on/off status of d0-d15, 1 - ON, 0 - OFF 32-bit integer d0:0x158-0x15b
time_div	0x198-0x1bf	Time div (time base) value, Such as 2.48 ms/div. Unit of value, such as s from 0x1a3-0x1bf, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x1a0-0x1a3, refer to Table 8 for the details. 64-bit float point, data of value from 0x198-0x19f.
time_delay	0x1c0-0x1e7	Time delay (Trigger delay) value, Such as 2.48 ms. Unit of value, such as s from 0x1cc-0x1e7, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x1c8-0x1cb, refer to Table 8 for the details. 64-bit float point, data of value from 0x1c0-

		0x1c7	
wave_length	0x1e8-0x1eb	Wave length of the data points for analog channel.	
		32-bit integer	
Sample_rate	0x1ec-0x213	Sample Rate value for analog channel, Such as 500M Sa/s.	
		Unit of value, such as Sa from 0x1f8-0x213, refer to Table 9 for the details.	
		Units of value's magnitude (MEGA) from	
		Ox1f4-0x1f7, Refer to Table 8 for the details. 64-bit float point, data of value from 0x1ec-	
		0x1f3.	
digital_wave_length	0x214-0x217	Wave length of the data points for digital.	
		32-bit integer	
digital_sample_rate	0x208-0x23f	Sample Rate value for digital, Such as 500M Sa/s.	
		Unit of value, such as Sa from 0x214-0x23f,	
		refer to Table 9 for the details.	
		Units of value's magnitude (MEGA) from	
		0x210-0x213, Refer to Table 8 for the details.	
		64-bit float point, data of value from 0x208-0x20f.	
ch1_probe	0x240-0x247	Probe value of CH1,64-bit float point	
ch2_probe	0x248-0x24f	Probe value of CH2,64-bit float point	
ch3_probe	0x250-0x257	Probe value of CH3,64-bit float point	
ch4_probe	0x258-0x25f	Probe value of CH4,64-bit float point	
Data width	0x260	Data width of the waveform data, 0 – 8-bit, 1 – 16-bit, 8-bit unsigned integer	
Byte order	0x261	Byte order of the waveform data, 0 – LSB, 1 – MSB, 8-bit unsigned integer	
Hori_div_num	0x268-0x26b	Hori div num,32-bit signed integer	

ch1_vert_code_per_div	0x26c-0x26f	Vertical code number per div of CH1,32-bit	
		signed integer	
ch2_vert_code_per_div	0x270-0x273	Vertical code number per div of CH2,32-bit signed integer	
ch3_vert_code_per_div	0x274-0x277	Vertical code number per div of CH3,32-bit signed integer	
ch4_vert_code_per_div	0x278-0x27b	Vertical code number per div of CH4,32-bit signed integer	
math1_switch	0x27c-0x27f	on/off status of math1, 1 - ON, 0 - OFF 32-bit signed integer.	
math2_switch	0x280-0x283	on/off status of math2, 1 - ON, 0 - OFF 32-bit signed integer.	
math3_switch	0x284-0x287	on/off status of math3, 1 - ON, 0 - OFF 32-bit signed integer.	
math4_switch	0x288-0x28b	on/off status of math4, 1 - ON, 0 - OFF 32-bit signed integer.	
math1_vdiv_val	0x28c-0x2b3	V/div value of math1, such as 2.48 mV/div. Unit of value, such as V from 0x298-0x2b3, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x294-0x297, refer to Table 8 for the details. 64-bit float point, data of value from 0x28c-0x293.	
math2_vdiv_val	0x2b4-0x2db	V/div value of math2, such as 2.48 mV/div. Unit of value, such as V from 0x2c0-0x2db, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x2bc-0x2bf, refer to Table 8 for the details. 64-bit float point, data of value from 0x2b4-0x2bb.	
math3_vdiv_val	0x2dc-0x303	V/div value of math3, such as 2.48 mV/div. Unit of value, such as V from 0x2e8-0x303, refer to Table 9 for the details. Units of value's magnitude (MICRO) from 0x2e4-0x2e7, refer to Table 8 for the details. 64-bit float point, data of value from 0x2dc-	

		0x2e3.
		uxzes.
math4_vdiv_val	0x304-0x32b	V/div value of math2, such as 2.48 mV/div.
		Unit of value, such as V from 0x310-0x32b,
		refer to Table 9 for the details.
		Units of value's magnitude (MICRO) from
		0x30c-0x30f, refer to Table 8 for the details.
		64-bit float point, data of value from 0x304-
		0x30b.
math1 vpos val	0x32c-0x353	Offset value of math1, such as 2.48 mV/div.
		Unit of value, such as V from 0x338-0x353,
		refer to Table 9 for the details.
		Units of value's magnitude (MICRO) from
		0x334-0x337, refer to Table 8 for the details.
		64-bit float point, data of value from 0x32c-
		0x333.
math2_vpos_val	0x354-0x37b	Offset value of math2, such as 2.48 mV/div.
		Unit of value, such as V from 0x360-0x37b,
		refer to Table 9 for the details.
		Units of value's magnitude (MICRO) from
		0x35c-0x35f, refer to Table 8 for the details.
		64-bit float point, data of value from 0x354-
		0x35b.
math3_vpos_val	0x37c-0x3a3	Offset value of math3, such as 2.48 mV/div.
matns_vpos_var	OX37C OX3G3	Unit of value, such as V from 0x388-0x3a3,
		refer to Table 9 for the details.
		Units of value's magnitude (MICRO) from
		0x384-0x387, refer to Table 8 for the details.
		64-bit float point, data of value from 0x37c-
		0x383.
math4_vpos_val	0x3a4-0x3cb	Offset value of math2, such as 2.48 mV/div.
matn4_vpos_vai	UX384-UX3CD	Unit of value, such as V from 0x3b0-0x3cb,
		refer to Table 9 for the details.
		Units of value's magnitude (MICRO) from
		0x3ac-0x3af, refer to Table 8 for the details.
		·
		64-bit float point, data of value from 0x3a4- 0x3ab.
math1 store lan	0v2cc 0v2cf	
math1_store_len	0x3cc-0x3cf	Wave length of the data points for math1.
		32-bit unsigned integer

	0 0 10 0 0 10	W. J. of 60 1	
math2_store_len	0x3d0-0x3d3	Wave length of the data points for math2. 32-bit unsigned integer	
math3_store_len	0x3d4-0x3d7	Wave length of the data points for math3. 32-bit unsigned integer	
math4_store_len	0x3d8-0x3db	Wave length of the data points for math4. 32-bit unsigned integer	
math1_f_time	0x3dc-0x3e3	Sample interval between two points of math1. 64-bit float point	
math2_f_time	0x3e4-0x3eb	Sample interval between two points of math2. 64-bit float point	
math3_f_time	0x3ec-0x3f3	Sample interval between two points of math3. 64-bit float point	
math4_f_time	0x3f4-0x3fb	Sample interval between two points of math4. 64-bit float point	
math_vert_code_per_div	0x3fc-0x3ff	Vertical code number per div of math,32-bit integer	
reserved	0x400~	reserved	
***	***		
reserved	~0x7ff	reserved	
Wave_data	0x800-end	Data from CH1 to D15. Only data of the enabled channel(s) are stored to the file. I.E. If there are data of all channels(Ch1 to D15), wave_length from 0x1e8-0x1eb is 700(0x2bc).,and data width from 0x260 is 0(8-bit).	
		Data of CH1 is from 0x800 to 0xabb. Data of CH2 is from 0xabc to 0xd77. CH3 and CH4 are the same. Next block is the data of math1,wave_length from 0x3cc-0x3cf is 700(0x2bc).,and data width from 0x260 is 0(8-bit).	

Data of math1 is from 0x12f0 to 0x15ab.
Data of math 2 is from 0x15ac to 0x1867.
math 3 and math 4 are the same.
Next block is the data of D0. The data length
(digital_wave_length) from 0x214-0x217 is
1400.
Data of D0 is from 0x1de0 to 0x1e8e.
D1~D15 are the same.

Table 8 Magnitude Table

Index	Magnitude	Index	Magnitude
0	УОСТО	9	KILO
1	ZEPTO	10	MEGA
2	ATTO	11	GIGA
3	FEMTO	12	TERA
4	PICO	13	PETA
5	NANO	14	EXA
6	MICRO	15	ZETTA
7	MILLI	16	YOTTA
8	IU		

Table 9 Units Table

First 32-bit is basic unit type:

Index	Unit	Index	Unit
0	Is composed of V,A and S.	8	DT_DIV
1	DBV	9	PTS
2	DBA	10	NULL_SENSE
3	DB	11	DEGREE
4	VPP	12	PERCENT
5	VDC		
6	DBM		
7	SA		

The next 64-bit describes the power of V, in which the first half represents the numerator and the next half represents the denominator.

The next 64-bit describes the power of A, in which the first half represents the numerator and the next half represents the denominator.

The next 64-bit describes the power of S, in which the first half represents the numerator and the next half represents the denominator.

For example, $\{0,1,1,0,1,0,1\}$ represents the unit V. The first number 0 means the unit is composed of V,A and S. The second number 1 and the third number 1 mean the power of V is 1/1. The fourth number 0 and the fifth number 1 mean the power of A is 0/1. The sixth number 0 and

Convert the Data to Voltage

```
voltage = (data- center_code ) * ch_volt_div_val /code_per_div + ch_vert_offset

[example]
code_per_div = 30  # get from the binary file head. For SDS5000X, it is 30
data = 194  # get from the binary file
ch_volt_div_val = 5000 mV/div  # V/div, in units of mV
ch_vert_offset = -7.7 V  # vertical offset
center_code = 2<sup>(data width-1)</sup> = 128  # for SDS5000X, the data_width is 8
So:
voltage = (194-128) * 5/30+(-7.7) = 3.3 V
```

Calculate the Time Value of the Data

Binary Format V4.0

Description:

Binary file added description parameter: data_offset_byte and memory parameters. The header size increased to 4k bytes.

Table 1 Format of the Binary File

Parameter	Address	Description	
version	0x00-0x03	Version number of the file.	
		4,use this block.	
data_offset_byte	0x04-0x07	Offset of wave data in this file.	
		32-bit integer.	
ch1_on	0x08-0x0b	on/off status of CH1, 1 - ON, 0 - OFF	
		32-bit signed integer.	
ch2_on	0x0c-0x0f	on/off status of CH2, 1 - ON, 0 - OFF	
_		32-bit integer	
ch3_on	0x10-0x13	on/off status of CH3, 1 - ON, 0 - OFF	
_		32-bit integer	
ch4_on	0x14-0x17	on/off status of CH4, 1 - ON, 0 - OFF	
_		32-bit integer	
ch1_volt_div_val	0x18-0x3f	V/div value of CH1, such as 2.48 mV/div.	
cni_voit_uiv_vai	0.10 0.51	Data With Unit, refer to Table2 for the	
		details.	
ch2_volt_div_val	0x40-0x67	V/div value of CH2, such as 2.48 mV/div.	
		Data With Unit, refer to <u>Table2</u> for the	
		details.	
ch3_volt_div_val	0x68-0x8f	V/div value of CH3, such as 2.48 mV/div.	
		Data With Unit, refer to <u>Table2</u> for the details.	
		2010.00	
ch4_volt_div_val	0x90-0xb7	V/div value of CH4, such as 2.48 mV/div.	
		Data With Unit, refer to <u>Table2</u> for the	
		details.	
ch1_vert_offset	0xb8-0xdf	Offset value of CH1, such as 2.48 mV.	
		Data With Unit, refer to <u>Table2</u> for the details.	
		uctalls.	

ch2_vert_offset	0xe0-0x107	Offset value of CH2, such as 2.48 mV. Data With Unit, refer to Table2 for the details.	
ch3_vert_offset	0x108-0x12f	Offset value of CH3, such as 2.48 mV. Data With Unit, refer to Table2 for the details.	
ch4_vert_offset	0x130-157	Offset value of CH4, such as 2.48 mV. Data With Unit, refer to Table2 for the details.	
digital_on	0x158-0x15b	on/off status of digital, 1 - ON, 0 - OFF 32-bit integer	
d0_d15_on	0x15c-0x19b	on/off status of d0-d15, 1 - ON, 0 - OFF Array of 16 32-bit integer	
time_div	0x19c-0x1c3	Time div (time base) value, Such as 2.48 ms/div. Data With Unit, refer to Table2 for the details.	
time_delay	0x1c4-0x1eb	Time delay (Trigger delay) value, Such as 2.48 ms. Data With Unit, refer to Table2 for the details.	
wave_length	0x1ec-0x1ef	Wave length of the data points for analog channel. 32-bit integer	
Sample_rate	0x1f0-0x217	Sample Rate value for analog channel, Such as 500M Sa/s. Data With Unit, refer to Table2 for the details.	
digital_wave_length	0x218-0x21b	Wave length of the data points for digital. 32-bit integer	

digital_sample_rate	0x21c-0x243	Sample Rate value for digital, Such as 500M Sa/s. Data With Unit, refer to Table2 for the details.	
ch1_probe	0x244-0x24b	Probe value of CH1,64-bit float point	
ch2_probe	0x24c-0x253	Probe value of CH2,64-bit float point	
ch3_probe	0x254-0x25b	Probe value of CH3,64-bit float point	
ch4_probe	0x25c-0x263	Probe value of CH4,64-bit float point	
Data width	0x264	Data width of the waveform data, 0 – 8-bit, 1 – 16-bit, 8-bit unsigned integer	
Byte order	0x265	Byte order of the waveform data, 0 – LSB, 1 – MSB, 8-bit unsigned integer	
Hori_div_num	0x26c-0x26f	Hori div num,32-bit signed integer	
ch1_vert_code_per_div	0x270-0x273	Vertical code number per div of CH1,32-bit signed integer	
ch2_vert_code_per_div	0x274-0x277	Vertical code number per div of CH2,32-bit signed integer	
ch3_vert_code_per_div	0x278-0x27b	Vertical code number per div of CH3,32-bit signed integer	
ch4_vert_code_per_div	0x27c-0x27f	Vertical code number per div of CH4,32-bit signed integer	
math1_switch	0x280-0x283	on/off status of math1, 1 - ON, 0 - OFF 32-bit signed integer.	
math2_switch	0x284-0x287	on/off status of math2, 1 - ON, 0 - OFF 32-bit signed integer.	
math3_switch	0x288-0x28b	on/off status of math3, 1 - ON, 0 - OFF 32-bit signed integer.	
math4_switch	0x28c-0x28f	on/off status of math4, 1 - ON, 0 - OFF 32-bit signed integer.	

math1_vdiv_val	0x290-0x2b7	V/div value of math1, such as 2.48 mV/div. Data With Unit, refer to Table2 for the details.	
math2_vdiv_val	0x2b8-0x2df	V/div value of math2, such as 2.48 mV/div. Data With Unit, refer to Table2 for the details.	
math3_vdiv_val	0x2e0-0x307	V/div value of math3, such as 2.48 mV/div. Data With Unit, refer to <u>Table2</u> for the details.	
math4_vdiv_val	0x308-0x32f	V/div value of math4, such as 2.48 mV/div. Data With Unit, refer to Table2 for the details.	
math1_vpos_val	0x330-0x357	Offset value of math1, such as 2.5V. Data With Unit, refer to Table2 for the details.	
math2_vpos_val	0x358-0x37f	Offset value of math2, such as 2.5V. Data With Unit, refer to Table2 for the details.	
math3_vpos_val	0x380-0x3a7	Offset value of math3, such as 2.5V. Data With Unit, refer to Table2 for the details.	
math4_vpos_val	0x3a8-0x3cf	Offset value of math4, such as 2.5V. Data With Unit, refer to Table2 for the details.	
math1_store_len	0x3d0-0x3d3	Wave length of the data points for math1. 32-bit unsigned integer	
math2_store_len	0x3d4-0x3d7	Wave length of the data points for math2. 32-bit unsigned integer	
math3_store_len	0x3d8-0x3db	Wave length of the data points for math3. 32-bit unsigned integer	

math4_store_len	0x3dc-0x3df	Wave length of the data points for math4. 32-bit unsigned integer	
math1_f_time	0x3e0-0x3e7	Sample interval between two points of math1. 64-bit float point	
math2_f_time	0x3e8-0x3ef	Sample interval between two points of math2. 64-bit float point	
math3_f_time	0x3f0-0x3f7	Sample interval between two points of math3. 64-bit float point	
math4_f_time	0x3f8-0x3ff	Sample interval between two points of math4. 64-bit float point	
math_vert_code_per_div	0x400-0x403	Vertical code number per div of math,32- bit integer	
ch5_on	0x404-0x407	on/off status of CH5, 1 - ON, 0 - OFF 32-bit signed integer.	
ch6_on	0x408-0x40b	on/off status of CH6, 1 - ON, 0 - OFF 32-bit integer	
ch7_on	0x40c-0x40f	on/off status of CH7, 1 - ON, 0 - OFF 32-bit integer	
ch8_on	0x410-0x413	on/off status of CH8, 1 - ON, 0 - OFF 32-bit integer	
ch5_volt_div_val	0x414-0x43b	V/div value of CH5, such as 2.48 mV/div. Data With Unit, refer to Table2 for the details.	
ch6_volt_div_val	0x43c-0x463	V/div value of CH6, such as 2.48 mV/div. Data With Unit, refer to Table2 for the details.	
ch7_volt_div_val	0x464-0x48b	V/div value of CH7, such as 2.48 mV/div. Data With Unit, refer to Table2 for the details.	

ch8_volt_div_val	0x48c-0x4b3	V/div value of CH8, such as 2.48 mV/div. Data With Unit, refer to Table2 for the details.	
ch5_vert_offset	0x4b4-0x4db	Offset value of CH5, such as 2.48 mV. Data With Unit, refer to Table2 for the details.	
ch6_vert_offset	0x4dc-0x503	Offset value of CH6, such as 2.48 mV. Data With Unit, refer to Table2 for the details.	
ch7_vert_offset	0x504-0x52b	Offset value of CH7, such as 2.48 mV. Data With Unit, refer to Table2 for the details.	
ch8_vert_offset	0x52c-0x553	Offset value of CH8, such as 2.48 mV. Data With Unit, refer to <u>Table2</u> for the details.	
ch5_probe	0x554-0x55b	Probe value of CH5,64-bit float point	
ch6_probe	0x55c-0x563	Probe value of CH6,64-bit float point	
ch7_probe	0x564-0x56b	Probe value of CH7,64-bit float point	
ch8_probe	0x56c-0x573	Probe value of CH8,64-bit float point	
ch5_vert_code_per_div	0x574-0x577	Vertical code number per div of CH5,32-bit signed integer	
ch6_vert_code_per_div	0x578-0x57b	Vertical code number per div of CH6,32-bit signed integer	
ch7_vert_code_per_div	0x57c-0x57f	Vertical code number per div of CH7,32-bit signed integer	
ch8_vert_code_per_div	0x580-0x583	Vertical code number per div of CH8,32-bit signed integer	
ch_insert	0x584-0x5a3	Insert ceof of analog channels when current storage length is less than screen width. Array of 8 32-bit integer	
math_insert	0x5a4-0x5b3	Insert ceof of math when current storage length is less than screen width. Array of 4 32-bit integer	

digital_insert	0x5b4-0x5f3	Insert ceof of digital channel when current	
digital_inscrt	0,504 0,515	sigital storage length is less than screer	
		width.	
		Array of 16 32-bit integer	
ch_move	0x5f4-0x613	Position of first point of analog channels in	
_		the screen.	
		Array of 8 32-bit integer	
math move	0x614-0x623	Position of first point of math in the screen.	
_		Array of 4 32-bit integer	
digital_move	0x624-0x663	Position of first point of digital channels in	
		the screen.	
		Array of 16 32-bit integer	
memory_switch	0x664-0x673	On/off status of memory, 1 - ON, 0 - OFF	
		Array of 4 32-bit signed integer.	
memory_wave_format	0x674-0x67b	Wave format of memory wave.	
memory_wave_ronnac		0- analog	
		1- digital	
		2- frequency domain	
		3- XY	
		Array of 4 16-bit unsigned integer.	
memory_vdiv_val	0x684-0x723	Vdiv value of memory, such as 2.5V/div.	
		Array of 4 Data With Unit, refer to Table2	
		for the details.	
memory_vpos_val	0x724-0x7c3	Offset value of memory, such as 2.5V.	
7 <u>-</u>		Array of 4 Data With Unit, refer to Table2	
		for the details.	
memory_hdiv_val	0x904-0x9a3	Time div value of memory, such as 2.5s/div.	
<i>'-</i> -		Array of 4 Data With Unit, refer to Table2	
		for the details.	
memory_hpos_val	0x9a4-0xa63	Time delay (Trigger delay) value, Such as	
· -		2.48 ms.	
		Array of 4 Data With Unit, refer to Table2	
		for the details.	
memory_store_len	0xa64-0xa73	Wave length of the data points for memory.	
· — -		Array of 4 32-bit unsigned integer.	
memory_f_time	0xa74-0xa93	Sample interval between two points of	
		memory.	
		Array of 4 64-bit float point.	

memory_vert_code_per_div	0xa94-0xaa3	Vertical code number per div of memory. Array of 4 32-bit integer	
memory_insert	0xaa4-0xab3	Insert ceof of memory when current storage length is less than screen width. Array of 4 32-bit integer	
memory_move	0xab4-0xac3	Position of first point of memory in the screen. Array of 4 32-bit integer	
memory_probe_fval	0xac4-0xaf3	Probe value of memory. Array of 4 64-bit float point	
zoom_switch	0xaf4-0xaf7	On/off status of zoom. If zoom_switch is on, use zoom_td_val and zoom_trig_delay_val to calculate time stamp. 1 - ON 0 - OFF 32-bit signed integer.	
zoom_td_val	0xaf8-0xb1f	Time div (time base) value of zoom window, Such as 2.48 ms/div. Data With Unit, refer to Table2 for the details.	
zoom_trig_delay_val	0xb20-0xb47	Time delay (Trigger delay) value of zoom window, Such as 2.48 ms. Data With Unit, refer to Table2 for the details.	
zoom_vdiv_val	0xb48-0xc87	V/div value of zoom window, such as 2.48 mV/div. Array of 8 Data With Unit, refer to Table2 for the details.	
zoom_vpos_val	0xc88-0xdc7	Offset value of zoom window, such as 2.5V. Array of 8 Data With Unit, refer to Table2 for the details.	

reserved	0x400~	reserved
reserved	~0x7ff	reserved
Wave_data	0x1000-end	Data from CH1 to D15. Only data of the enabled channel(s) are stored to the file. I.E. If there are data of all channels(Ch1 to D15), wave_length from 0x1e8-0x1eb is 700(0x2bc).,and data width from 0x260 is 0(8-bit). Data of CH1 is from 0x800 to 0xabb. Data of CH2 is from 0xabc to 0xd77. CH3 and CH4 are the same. Next block is the data of math1,wave_length from 0x3cc-0x3cf is 700(0x2bc).,and data width from 0x260 is 0(8-bit). Data of math1 is from 0x12f0 to 0x15ab. Data of math 2 is from 0x15ac to 0x1867. math 3 and math 4 are the same. Next block is the data of D0. The data length (digital_wave_length) from 0x214-0x217 is 1400. Data of D0 is from 0x1de0 to 0x1e8e. D1~D15 are the same.

Table 2 Data With Unit Description

Parameter	Address	Description
value	0x00-0x07	64-bit float point
value's magnitude	0x08-0x0b	Units of value's magnitude, refer to <u>Table3</u> for the details.
Unit of value	0x0c-0x27	Unit of value, refer to <u>Table4</u> for the details.

Table 3 Magnitude Table

Index	Magnitude	Index	Magnitude
0	YOCTO	9	KILO
1	ZEPTO	10	MEGA

Index	Magnitude	Index	Magnitude
2	ATTO	11	GIGA
3	FEMTO	12	TERA
4	PICO	13	PETA
5	NANO	14	EXA
6	MICRO	15	ZETTA
7	MILLI	16	YOTTA
8	IU		

Table 4 Units Table

First 32-bit is basic unit type:

Index	Unit	Index	Unit
0	Is composed of V,A and S.	8	DT_DIV
1	DBV	9	PTS
2	DBA	10	NULL_SENSE
3	DB	11	DEGREE
4	VPP	12	PERCENT
5	VDC		
6	DBM		
7	SA		

The next 64-bit describes the power of V, in which the first half represents the numerator and the next half represents the denominator.

The next 64-bit describes the power of A, in which the first half represents the numerator and the next half represents the denominator.

The next 64-bit describes the power of S, in which the first half represents the numerator and the next half represents the denominator.

For example, $\{0,1,1,0,1,0,1\}$ represents the unit V. The first number 0 means the unit is composed of V,A and S. The second number 1 and the third number 1 mean the power of V is 1/1. The fourth number 0 and the fifth number 1 mean the power of A is 0/1. The sixth number 0 and the seventh number 1 mean the power of S is 0/1. So the unit is V.

Convert the Data to Voltage

```
[example]
code_per_div = 30  # get from the binary file head. For SDS5000X, it is 30
data = 194  # got from the binary file
ch_volt_div_val = 5000 mV/div  # V/div, in units of mV
ch_vert_offset = -7.7 V  # vertical offset
```

voltage = (data- center_code) * ch_volt_div_val /code_per_div + ch_vert_offset

Calculate the Time Value of the Data

```
time value(S) = -( time_div *grid /2)-time_delay+index*(1/ Sample_rate)

[example]
grid = 10  # The grid numbers in horizontal direction
time_div = 2 us  # s/div, in units of us
time_delay = 1 us  # s/div, in units of us
Sample_rate = 1 GSa/s  # Sa/s, in units of GSa/s

So:
The time value of the first point: -(2e-6*10/2)-1e-6+0*(1/1e9) = -11e-6 s.
The time value of the second point: -(2e-6*10/2) 1e-6+1*(1/1e9) = -11.001e-6 s.
```

Binary Format V5.0

Description:

This version format is only valid for SDS1002X-E (V1.3.27&later).

Table 1 Format of the Binary File

Parameter	Address	Description
version	0x00-0x03	Version number of the file.
		5,use this block.
ch_setup[SCP_CH_C1].	0x76-0x79	on/off status of CH1, 1 - ON, 0 - OFF
ch_act		32-bit signed integer.
cii_det		32 Sit Signed integen.
ch_setup[SCP_CH_C2].	0xf0-0f3	on/off status of CH2, 1 - ON, 0 - OFF
ch_act		32-bit integer

ch_setup[SCP_CH_C3]. ch_act	0x194-0x197	on/off status of CH3, 1 - ON, 0 - OFF 32-bit integer	
ch_setup[SCP_CH_C4]. ch_act	0x238-0x241	on/off status of CH4, 1 - ON, 0 - OFF 32-bit integer	
ch_setup[SCP_CH_C1]. vdiv_val	0xab-0xba	V/div value of CH1, such as 2.48 mV/div. Unit of value, such as V from 0x1c-0x1f, refer to Table for the details. Units of value's magnitude (MICRO) from 0xb2-0xba, refer to Table for the details. 64-bit float point, data of value from 0xab-0xb1.	
ch_setup[SCP_CH_C2]. vdiv_val	0x160-0x16f	V/div value of CH2, such as 2.48 mV/div. Unit of value, such as V from 0x2c-0x2f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x168-0x16f, refer to Table for the details. 64-bit float point, data of value from 0x160 0x167.	
ch_setup[SCP_CH_C3]. vdiv_val	0x204-0x213	V/div value of CH3, such as 2.48 mV/div. Unit of value, such as V from 0x3c-0x3f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x20c-0x213, refer to Table for the details. 64-bit float point, data of value from 0x204-0x20b.	
ch_setup[SCP_CH_C4]. vdiv_val	0x2a8-0x2b7	V/div value of CH4, such as 2.48 mV/div. Unit of value, such as V from 0x4c-0x4f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x2b0-0x2b7, refer to Table for the details. 64-bit float point, data of value from 0x2a8-0x2af.	
ch_setup[SCP_CH_C1]. vpos_val	0xbc-0xcb	Offset value of CH1, such as 2.48 mV. Unit of value, such as V from 0x5c-0x5f, refer to Table for the details. Units of value's magnitude (MICRO) from 0xb4- 0xcc, refer to Table for the details.	

		64-bit float point, data of value from 0xbc-0xb3.
ch_setup[SCP_CH_C2]. vpos_val	0x170-0x17f	Offset value of CH2, such as 2.48 mV. Unit of value, such as V from 0x6c-0x6f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x178-0x17f, refer to Table for the details. 64-bit float point, data of value from 0x170- 0x177.
ch_setup[SCP_CH_C3]. vpos_val	0x214-0x223	Offset value of CH3, such as 2.48 mV. Unit of value, such as V from 0x7c-0x7f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x21c-0x223, refer to Table for the details. 64-bit float point, data of value from 0x214- 0x21b.
ch_setup[SCP_CH_C4]. vpos_val	0x2b8-0x2c7	Offset value of CH4, such as 2.48 mV. Unit of value, such as V from 0x8c-0x8f, refer to Table for the details. Units of value's magnitude (MICRO) from 0x2c0-0x2c7, refer to Table for the details. 64-bit float point, data of value from 0x2b8-0x2bf.
time_div	0x1b68-0x1b77	Time div (time base) value, Such as 2.48 ms/div. Unit of value, such as s from 0x1b70-0x1b77, refer to Table for the details. Units of value's magnitude (MICRO) from 0xdc- 0xdf, refer to Table for the details. 64-bit float point, data of value from 0x1b68- 0x1bbf.
time_delay	0x1b78-0x1b87	Time delay (Trigger delay) value, Such as 2.48 ms. Unit of value, such as s from 0x1b80-0x1b87, refer to Table for the details. Units of value's magnitude (MICRO) from 0xec-0xef, refer to Table for the details. 64-bit float point, data of value from 0x1b78-0x1b7f

wave_length	0x1b88-0x1b91	Wave length of the data points for analog channel. 32-bit integer
Sample_rate	0x1b92-0x1ba1	Sample Rate value for analog channel, Such as 500M Sa/s. Unit of value, such as Sa from 0x104-0x107, refer to Table for the details. Units of value's magnitude (MEGA) from 0x100-0x103, Refer to Table for the details. 64-bit float point, data of value from 0xf8-0xff.
reserved	0x11c~	reserved

reserved	~0x7ff	reserved
Wave_data	0x800-end	Data from CH1 to CH4. Only data of the enabled channel(s) are stored to the file. I.E. if there are data of all channels(Ch1 to CH4), and wave_length from 0x1b88-0x1b91 is 700(0x2bc). Data of CH1 is from 0x800 to 0xabb. Data of CH2 is from 0xabc to 0xd77. CH3 and CH4 are the same.

Convert the Data to Voltage

```
voltage = (data-128) * ch_volt_div_val /code_per_div + ch_vert_offset

[example]
code_per_div = 25  # total data code in a horizontal division, on SDS1002X-E is 25
data = 194  # got from the binary file
ch_volt_div_val = 5000 mV/div  # V/div, in units of mV
ch_vert_offset = -7.7 V  # vertical offset

So:
voltage = (194-128) * 5/25+(-7.7) = 5.5 V
```

Calculate the Time Value of the Data

```
time value(S) = -( time_div *grid /2)+index*(1/ Sample_rate)

[example]

grid = 14  # The grid numbers in horizontal direction

time_div = 2 us  # s/div, in units of us

Sample_rate = 1 GSa/s  # Sa/s, in units of GSa/s

So:

The time value of the first point: -(2e-6*14/2)+0*(1/1e9) = -14e-6 s.

The time value of the second point: -(2e-6*14/2)+1*(1/1e9) = -14.001e-6 s.
```

Binary Format V6.0

Description: New bin file structure

Table 1 File header

Parameter	Address	Description	
version	0x00-0x03	Version number of the file.	
		6,use this block.	
		32-bit unsigned integer.	
header_bytes	0x04-0x05	The number of bytes in the header of this	
		file.	
		16-bit unsigned integer.	
endian	0x06-0x07	Used to identify the size of files.	
		16-bit unsigned integer.	
module	0x08-0x27	Product model.	
		Array of 32 char.	
serial	0x28-0x47	product serial number.	
		Array of 32 char.	
software_version	0x48-0x67	Product software version number.	
		Array of 32 char.	
wave_number	0x68-0x6b	The number of waveforms stored in the	
		file.	
		32-bit unsigned integer.	

Table 2 Waveform data header

Parameter	Address	Description
Parameter	Audress	Description

	T	T	
base_header_type	0x00-0x03	Basic head type.	
		32-bit unsigned integer.	
base_header_bytes	0x04-0x07	The length information of the shared basic	
		header, excluding additional information.	
		32-bit unsigned integer.	
wave_type	0x08-0x0b	Waveform type, Normal/Digital/FFT	
		32-bit unsigned integer.	
channel_type	0x0c-0x0d	Channel type.	
		16-bit unsigned integer.	
channel_index	0x0e-0x0f	Channel index.	
		16-bit unsigned integer.	
label	0x10-0x1f	Channel labels.	
		Array of 16 char.	
date	0x20-0x2f	Sampling date YYYY mm dd.	
		Array of 16 char.	
time	0x30-0x4f	Sampling date HH-MM-SS SSSSSSSS.	
		Array of 32 char.	
hori_scale	0x50-0x57	Horizontal gear parameters with order of	
_		magnitude units of 1.	
		64-bit float point.	
hori_pos	0x58-0x5f	Horizontal position parameter with order	
		of magnitude units of 1.	
		64-bit float point.	
hori_origin_pos	0x60-0x67	Used to mark the position of the horizontal	
		origin (time=0) in the data.	
		64-bit float point.	
hori_interval	0x68-0x6f	Horizontal sampling interval for labeling	
_		data.	
		64-bit float point.	
hori unit	0x70-0x8f	Horizontal unit, used for parameter	
_		recovery, reserved externally.	
		Array of 8 32-bit integer.	
hori_unit_str	0x90-0x9f	Horizontal unit string.	
		Array of 16 char.	
vert_scale	0xa0-0xa7	Vertical gear parameters with order of	
_		magnitude units of 1.	
		64-bit float point.	
vert_pos	0xa8-0xaf	Vertical position parameter with order of	
		magnitude units of 1.	
		64-bit float point.	
vert_origin_pos	0xb0-0xb7	Used to mark the code value corresponding	
10.12.18.11_000	OADO OADI	osea to mark the code value corresponding	

	to the vertical origin (voltage=0).
	64-bit float point.
0xb8-0xbf	Used to mark the voltage corresponding to
	each code word value in the data.
	64-bit float point.
0xc0-0xdf	Vertical unit, used for parameter recovery,
	reserved externally.
	Array of 8 32-bit integer.
0xe0-0xef	Vertical unit string.
	Array of 16 char.
0xf0-0xf3	The length of additional information.
	32-bit unsigned integer.
0xf4-0xf7	data type
	32-bit unsigned integer.
0xf8-0xff	Number of data points.
	64-bit unsigned integer.
0x100-0x107	The total number of bytes in the data area.
	64-bit unsigned integer.
	additional information header
	0xc0-0xdf 0xe0-0xef 0xf0-0xf3 0xf4-0xf7 0xf8-0xff

Immediately after the file header, the waveform data header is stored, which includes the basic information header and the additional information header. The basic information header is a common part of information for different types of waveforms, while the additional information header is a unique part of information for each waveform.

Convert the Data to Voltage

```
voltage = (code -vert_origin_pos)* vert_interval

[example]
vert_origin_pos = 25  # The code value corresponding to the vertical origin (voltage=0)
code = 27  # got from the binary file
vert_interval = 2  # The voltage corresponding to each code word value in the data
vert_unit_str = "V"  # vertical unit string

So:
voltage = (27-25) *2 = 4 V
```

Calculate the Time Value of the Data

```
time value(S) = (index - hori_origin_pos)* hori_interval

[example]
index = 1  # The grid numbers in horizontal direction
hori_origin_pos = 0  # The position of the horizontal origin (time=0) in the data
hori_interval = 1e9  # Horizontal sampling interval of data
hori_unit_str = "s"  # Horizontal unit string

So:
The time value of the second point: (2 - 1)*(1e9) = 1e9s.
```

*.mlg File of Measure Logger

Table 6 Format of the Measure Logger File

Parameter	Address	Description			
file_type	0x00-0x07	Type of the file, the value is always "MSLG".			
		Array of 8 char.			
file_version	0x08-0x0b	Version number of the	Version number of the file.		
		32-bit unsigned intege	r.		
		0: V1.0			
model_number	0x0c-0x2b	Model number of the	oroduct.		
		Array of 32 char.			
serial_number	0x2c-0x4b	Serial number of the product.			
		Array of 32 char.	Array of 32 char.		
software_version	0x4c-0x6b	Version of the software.			
		Array of 32 char.			
start_time	0x6c-0x87	Start time of logging.			
		Array of 7 32-bit unsign	ned integer.		
		Index	Element		
		0	Year		
		1 Mouth			
		Day			
		3 Hour			
		4 Minute			
		5 Second			

		6	Millisecond	
stop_time	0x88-0xa3	Stop time of logging.	Williaccolla	
stop_time	1 35 5			
		Array of 7 32-bit unsigned integer. Index Element		
		0	Year Mouth	
		1 2		
		2 Day		
		3 Hour		
		4	Minute	
		5	Second	
		6	Millisecond	
log_interval_ms	0xa4-0xa7	Logging interval in milli		
		32-bit unsigned integer	:	
points_number	0xa8-0xab	Points per trace.		
	_	32-bit unsigned integer		
traces_number	0xac-0xaf	Number of enabled tra		
		32-bit unsigned integer	:	
traces_switch	0xb0-0xcf	Trace switch status.		
		Array of 8 32-bit unsign	ned integer.	
		0: OFF		
		1: ON		
source	0xd0-0xef	Source of log.		
		Array of 8 32-bit unsign	ied integer.	
		0: Measure		
		1: Meter The first source of measurement		
measure_source_A	0xf0-0x10f	The first source of measurement.		
		Array of 8 32-bit unsign	•	
			ogger on scope to recall,	
		refer to	the parameter	
_		"measure_source_A_st	_	
measure_source_B	0x110-0x12f	The second source of n		
		Array of 8 32-bit unsign		
		Only for the measure logger on scope to recall,		
		refer to the parame		
	0.420.0.455	"measure_source_B_string" for details.		
measure_type	0x130-0x14f			
		Array of 8 32-bit unsigned integer.		
		Only for the measure logger on scope to recall,		
		refer to the parameter "measure_type_string for details.		
it turns	0,450,0,465			
unit_type	0x150-0x16f	Unit.		

		A	12			
		Array of 8 32-bit unsigned integer.				
		Only for the measure logger on scope to recall,				
		refer to the parameter "unit_string" for details.				
precision	0x170-0x18f	Precision of data.				
		•	32-bit signe	-		
				ogger on so	cope to recall.	
precision_type	0x190-0x1af	Type of precision.				
		1	32-bit unsigi	_		
		Only for the	e measure l	ogger on so	cope to recall.	
source_string	0x1b0-0x1ef	Source of lo	og.			
		Array of 8 a	rrays of 8 c	har.		
measure_source_A_string	0x1f0-0x22f	The first so	urce of mea	surement.		
		Array of 8 a	rrays of 8 c	har.		
measure_source_B_string	0x230-0x26f	The second	I source of r	neasureme	ent.	
		Array of 8 arrays of 8 char.				
measure_type_string	0x270-0x2ef	Type of measurement.				
		Array of 8 arrays of 16 char.				
unit_string	0x2f0-0x32f	Unit.				
		Array of 8 arrays of 8 char.				
Reserved.	0x330-0x7cf	Reserved.				
Data	0x7d0-End	Log data. A	rray of 32-b	it float.		
		Example:				
		Status of tr	aces:			
		Trace1	Trace2	Trace3	Trace4	
		OFF ON OFF		OFF	ON	
		Data:		<u>. </u>		
		Index Data				
		0 (Offset = 0x7d0)		data[0]		
		1 Trace4_data[0]				
		2 Trace2_d				
		3 Trace4_data[1				
		4 Trace2_data[2]				
					Trace4_data[2]	

*.slg File of Sample logger

Table 7 Format of the Sample Logger File.

Parameter	Address	Description	
product_info	0x00-0x7f	Product information. See the Table 8 Format of	
		Product Information. (Base offset = 0x00) for	
		details.	
record_info	0x80-0x17f	Record information. See the Table 9 Format of	
		Record Information. (Base offset = 0x80)	
Reserved	0x180-0x27f	Reserved.	
ch_1_info	0x280-0x37f	Channel 1 information. See the Table 10 Format	
		of Channel Information	
ch_2_info	0x380-0x47f	Channel 2 information.	
ch_3_info	0x480-0x57f	Channel 3 information.	
ch_4_info	0x580-0x67f	Channel 4 information.	
Reserved	0x680-	Reserved.	
	0x1000fff		
Data	0x1001000-	Due to memory limitation, data is written by	
	End	sector, see the Table 11 Format of Sector	
		Information.	

Table 8 Format of Product Information. (Base offset = 0x00)

Parameter	Offset	Description	
file_type	0x00-0x07	Type of file.	
		Array of 8 char.	
		The value is always "SPLG".	
file_version	0x08-0x0b Version number of the file.		
		0: V1.0	
model_number	0x0c-0x2b	Model number of the product.	
		Array of 32 char.	
serial_number	0x2c-0x4b	2c-0x4b Serial number of the product.	
		Array of 32 char.	
software_version	0x4c-0x6b	Version of the software.	
		Array of 32 char.	
Reserved	0x6c-0x7f	Reserved.	

Table 9 Format of Record Information. (Base offset = 0x80)

Parameter	Offset	Description	
enable_ch_num	0x00-0x03	Number of enabled channels.	
		32-bit unsigned integer.	
sector_num	0x04-0x07	Number of sectors per channel.	
		32-bit unsigned integer.	
tdiv_value	0x08-0x0f	Timebase when log start. (s/div)	
	1		

		64-bit double precision floating point.	
sample_rate	0x10-0x17	Sample rate. (Sa/s)	
		64-bit double precision floating point.	
record_time	0x18-0x1f	Recorded time in second.	
		64-bit double precision floating point.	
points_number	0x20-0x27	Number of data points per channel.	
		64-bit unsigned integer.	
start_sector_offset	0x28-0x2f	File offset of the first sector.	
		64-bit unsigned integer.	
end_sector_offset	0x30-0x37	File offset of the last sector.	
		64-bit unsigned integer.	
start_data_offset	0x38-0x3f	The start offset of the data area.	
		64-bit unsigned integer.	
end_data_offset	0x40-0x47	The end offset of the data area.	
data bit tada.	0.40.0.45	64-bit unsigned integer.	
data_bit_index	0x48-0x4b	Bits number of data.	
		32-bit unsigned integer. 8: 8-bit 11: 11-bit 14: 14-bit	
		9: 9-bit 12: 12-bit 15: 15-bit	
		10: 10-bit 13: 13-bit 16: 16-bit	
start time	0x4c-0x67	Start time of logging.	
_		Array of 7 32-bit unsigned integer.	
		Index Element	
		0 Year	
		1 Mouth	
		2 Day	
		3 Hour	
		4 Minute	
5		5 Second	
		6 Millisecond	
Reserved	0x68-0xff	Reserved.	

Table 10 Format of Channel Information

(Base offset: CH1 = 0x280, CH2 = 0x380, CH3 = 0x480, CH4 = 0x580)

Parameter	Offset	Description	
ch_act	0x00-0x03	Switch status of channel.	
		32-bit unsigned integer.	
		0: OFF	
		1: ON	
probe_index	0x04-0x07	Probe value index of channel.	

		32-bit unsigned integer.	
probe_custom_val	0x08-0x0f	Custom configured probe of channel.	
		64-bit double precision floating point	
vdiv_val	0x10-0x17	V/div value of channel.	
		64-bit double precision floating point.	
vpos_val	0x18-0x1f	Offset value of channel.	
		64-bit double precision floating point.	
value_per_adc_code	0x20-0x27	Vertical value per ADC code.	
		64-bit double precision floating point.	
zero_adc_code	0x28-0x2b	Reference code of value zero.	
		32-bit unsigned integer.	
unit_index	0x2c-0x2f	Type of channel unit.	
		32-bit unsigned integer.	
		0: V	
		1: A	
unit_string	0x30-0x37	Unit of channel.	
		Array of 8 char.	
Reserved	0x38-0xff	Reserved.	

Table 11 Format of Sector Information

Parameter	Offset	Description	
sector_index	0x00-0x07	Sector index.	
		64-bit unsigned integer.	
data_index_start	0x08-0x0f Data index of the first data in current sector.		
		64-bit unsigned integer.	
data_index_end	0x10-0x17	Data index of the last data in current sector.	
		64-bit unsigned integer.	
data_num	0x18-0x1f	Number of data in current sector.	
		64-bit unsigned integer.	
ch	0x20-0x23	Channel.	
		32-bit unsigned integer.	
Reserved	0x24-0x3b	Reserved.	
Data	0x3c-0x9ff	Waveform data.	
		8-bit or 16-bit unsinged integer.	
		2500 points per sector.	

Example:

ch_act[0] = OFF	#Channel 1 is off.
ch_act[1] = ON	#Channel 2 is on.
ch_act[2] = OFF	#Channel 3 is off.
ch act[3] = ON	#Channel 4 is on.

```
data_bit_index = 8 #8bit per point. So the size of sector is 2560 bytes.

start_sector_offset = 0x1001000

points_number = 3000 #2500 points are in the first sector, and the other 500 points are in the
```

points_number = 3000 #2500 points are in the first sector, and the other 500 points are in the second sector. The left space in the second sector will be filled with zero.

0x1001000 + 0x0000

0x1001000 + 0x003C

0x1001000 + 0x003D

0x1001000 + 0x003E

0x1001000 + 0x003F

0x1001000 + 0x09FF

0x1001000 + 0x0A00

0x1002400 + 0x003C

0x1002400 + 0x003D

0x1002400 + 0x023D

0x1002400 + 0x0231

0x1002400 + 0x0232

0x1002400 + 0x0232

So the file structure is shown in Figure 1.

	0x0000	
Product information	0x0080	Channel 2 Sector #1 Sector information
Record information	0x0180	Channel 2 Wave data #1
Reserved		Channel 2 Wave data #2
Channel 1 information	0x0280	Channel 2 Wave data #3
Channel 2 information	0x0380	
Channel 3 information	0x0480	Channel 2 Wave data #2500
Channel 4 information	0x0580	
Reserved	0x0680 0x1001000	Channel 2 Sector #2 Sector information
Channel 2 Sector #1	0x1001000 0x1001A00	Channel 2 Wave data #2501
Channel 4 Sector #1	0x1001A00	
Channel 2 Sector #2	0x1002400 0x1002E00	Channel 2 Wave data #3000
Channel 4 Sector #2	0x1002E00	Zero

Figure 1 Example for Sample Logger File Structure

Convert the Data to Voltage

```
voltage = (data - zero\_adc\_code) \cdot value\_per\_adc\_code - vpos\_val Example: unit\_string = \text{``V''} data = 145 zero\_adc\_code = 128 value\_per\_adc\_code = 0.04 \text{ V} vpos\_val = -1.0 \text{ V} So: voltage = (145 - 128) \times 0.04 - (-1.0) = 1.68 \text{ V}
```

Calculate the Time Value of Data

 $time_value = data_index/sample_rate$ Where: $data_index = sector_index \cdot 2500 + data_index_in_sector$ Example: $sector_index = 10$ $data_index_in_sector = 8$ $sample_rate = 25000 \ Sa/s$ So: $data_index = 10 \times 2500 + 8 = 25008$ $time_value = 25008 \div 25000 = 1.00032 \ s$