WAVE2 Serial Interface

Applicable firmware: 113-15801-076 or later

1. **Introduction**

   The WAVE2 serial interface allows users to set the working parameters and perform various operations on the oscilloscope through a serial connection. It benefits users who want to integrate the oscilloscope into their own applications.

   The WAVE2 serial interface works in two modes, Text and Binary. The commands sent in different modes can be interwoven. No mode switching is required. This design note provides the details of the commands in both of these two modes.

   The serial port is accessible through the Auxiliary Port. Please refer to the user manual for details of the connections. The signal level of the port is LVTTL. The uart data format is 8N1 (8 data bits, 1 stop bit, and no parity). The baudrate of transfer is 115200 bps fixed.

2. **Text Mode**

   In Text Mode all the commands and their returns are transferred in plain ASCII coded texts. A command takes the general format below. Each command must be terminated by a LF (Line Feed, 0x0A) character or a combination of CR (Carriage Return, 0x0D) and LF.

   General command format:

   <div align="center">CmdName[n][=Val]</div>

   Where

   > CmdName – Specifies a parameter or an operation. Command names are not case sensitive.

   > n – Specifies channel. It takes the value of 1 or 2. For the oscilloscope this is corresponding to Channel 1 or Channel 2 respectively. For the function generator it is corresponding to Channel A or Channel B respectively. When n is omitted the value of 1 is assumed.

   > Val – The value to be set to the parameter specified by the CmdName. Values are not case sensitive.

   All the text commands can be grouped into four categories.
   1) Oscilloscope parameter setting commands
   2) Oscilloscope operation executing commands
   3) Function generator parameter setting commands
   4) Function generator operation executing commands

   The following tables list the name of each command and the value it can take. The names in parentheses are alternative command names.

Note 1：*In a parameter setting command when the Val field is replaced with a "?" mark the command will return the current setting of that parameter.*

Note 2：*Sending a single letter "R" or "r" will repeat the previously sent command.*

Table 1: Oscilloscope parameter setting commands

CmdName	Descriptions	Value Range	Examples
VSEN	Vertical sensitivity	See Table 5.	Vsen2 = 5mV
CPL	Coupling	See Table 6.	Cpl = ac
VPOS	Vertical position	Divisions with respect to the vertical center point of the screen.	VPOS1 = 1.5
TIMEBASE (TB)	Time base	See Table 10.	Tb = 50us
TRIGMODE	Trigger mode	See Table 7.	TrigMode = Norm
TRIGSLOPE (TRIGEDGE)	Trigger slope	See Table 8	Trigslope = rising
TRIGLEVEL (TRIGLVL)	Trigger level	In V or mV	Triglevel = 2.3v
TRIGSOURCE (TRIGSRC)	Trigger source	See Table 9.	Trigsrc = ch2
HPOS	Horizontal position	The divisions with respect to the horizontal center point of the screen.	hpos = -5.5
SRATE	Sampling rate	See Table 11.	srate = 2.5k
D-VMAX	Display Vmax	ON or OFF	d-vmin = on d-vpp2 = off 10x2 = ON
D-VMIN	Display Vmin	ON or OFF	
D-VAVR	Display Vavr	ON or OFF	
D-VPP	Display Vpp	ON or OFF	
D-VRMS	Display Vrms	ON or OFF	
D-FREQ	Display frequency	ON or OFF	
D-CYCLE	Display cycle	ON or OFF	
D-DUTY	Display duty cycle	ON or OFF	
D-ALL	Display all	ON or OFF	
10X	10x probe enable	ON or OFF	
AUTOOFF	Set auto power off time	0 – 255 (in minute)	autooff = 36

Table 2: Oscilloscope operation executing commands

CmdName	Descriptions	Value Range	Examples/Remarks
HOLD	Enter HOLD state	None or '?'	Hold = ? returns current HOLD state
RUN	Exit HOLD state	None	
YTMODE	Enter Y-T mode	None	
YXMODE	Enter Y-X mode	None	
CLROFFSET	Clear VPOS offsets	None	
SENDDATA	Output waveform data	None	
SENDFV	Output frequency and voltages	None	The output is in the following order: Fa, Fb, Vmax1, Vmin1, Vavr1, Vpp1, Vrms1, Freq1, Vmax2, Vmin2, Vavr2, Vpp2, Vrms2, Freq2 [CR]. Fa and Fb are the frequencies of Ch A and Ch B of the function generator.
DEFAULT	Restore factory defaults	None	
SAVEWF	Save waveform	1 – 4	savewf = 3
LOADWF	Load waveform	1 – 4	LOADWF = 1
REBOOT	Reboot	None	
POWEROFF	Power off	None	

Table 3: Function generator parameter setting commands

CmdName	Descriptions	Value Range	Examples
WAVEFORM (WF)	Waveform type	See Table 12.	Wf = square
FREQ	Frequency	0.0 – 20.0KHz	Freq2 = 3.66Khz
CYCLE	Cycle	0.00005 – 1000.0s	cycle = 0.08ms
AMP	Amplitude	0.0V – 3.0V	AMP2 = 1.3V
OFS	Offset	-3.3V – 3.3V (**Note**: any value other than 0.0 sent will actually set the offset to 3.3V, i.e. the actual offset can only have two values, 0V or 3.3V.)	OFS = 0
DUTY	Duty cycle	0.0 – 100.0 (in percentage)	duty1 = 40
PHASE	Phase	-360.0 – 360.0 (in degree)	Phase2 = -45
FREQSS	Frequency step size	0.0 – 20.0KHz	freqSS1 = 5hz
CYCLESS	Cycle step size	0.00005 – 1000.0s	Cycless2 = 0.5ms

AMPSS	Amplitude step size	-3.0V – 3.0V	AMPSS2 = 0.2v
OFSSS	Offset step size	-3.3V – 3.3V	OFSSS = 0.5v
DUTYSS	Duty cycle step size	0.0 – 100.0 (in percentage)	DUTYSS2 = 80
PHASESS	Phase step size	-360.0 – 360.0 (in degree)	PHASESS2 = -2.5

Table 4: Function generator executing commands

CmdName	Descriptions	Value Range
FREQ++	Increase frequency by the frequency step size	None
CYCLE++	Increase cycle by the cycle step size	None
AMP++	Increase amplitude by the amplitude step size	None
OFS++	Increase offset by the offset step size	None
DUTY++	Increase duty cycle by the duty cycle step size	None
PHASE++	Increase phase by the phase step size	None
FREQ--	Decrease frequency by the frequency step size	None
CYCLE--	Decrease cycle by the cycle step size	None
AMP--	Decrease amplitude by the amplitude step size	None
OFS--	Decrease offset by the offset step size	None
DUTY--	Decrease duty cycle by the duty cycle step size	None
PHASE--	Decrease phase by the phase step size	None

The following tables define the values of some parameter settings. The value names are not case sensitive.

Table 5: Vertical sensitivity values

Setting	Values		Corresponding Analog Gain
	For text mode	For binary mode	
20V/div	20V	0x02	0.001
10V/div	10V	0x03	0.002
5V/div	5V	0x04	0.004
2V/div	2V	0x05	0.01
1V/div	1V	0x06	0.02
0.5V/div	0.5V	0x07	0.04
0.2V/div	0.2V	0x08	0.1
0.1V/div	0.1V	0x09	0.2
50mV/div	50MV	0x0A	0.4
20mV/div	20MV	0x0B	1
10mV/div	10MV	0x0C	2
5mV/div	5MV	0x0D	4

Table 6: Couple values

Setting	Values	
	For text mode	For binary mode
DC	DC	0x00
AC	AC	0x01

Table 7: Trigger mode values

Setting	Values	
	For text mode	For binary mode
AUTO	AUTO	0x00
NORMAL	NORM	0x01
SINGLE	SING	0x02

Table 8: Trigger slope values

Setting	Values	
	For text mode	For binary mode
Falling	FALLING	0x00
Rising	RISING	0x01

Table 9: Trigger source values

Setting	Values	
	For text mode	For binary mode
Channel 1	CH1	0x00
Channel 2	CH2	0x01
External	EXT	0x02

Table 10: Time base values

Setting	Values	
	For text mode	For binary mode
500s/div	500S	0x00
200s/ div	200S	0x01
100s/ div	100S	0x02

50s/ div	50S	0x03
20s/ div	20S	0x04
10s/ div	10S	0x05
5s/ div	5S	0x06
2s/ div	2S	0x07
1s/ div	1S	0x08
0.5s/ div	0.5S	0x09
0.2s/ div	0.2S	0x0A
0.1s/ div	0.1S	0x0B
50ms/ div	50MS	0x0C
20ms/ div	20MS	0x0D
10ms/ div	10MS	0x0E
5ms/ div	5MS	0x0F
2ms/ div	2MS	0x10
1ms/ div	1MS	0x11
0.5ms/ div	0.5MS	0x12
0.2ms/ div	0.2MS	0x13
0.1ms/ div	0.1MS	0x14
50us/ div	50US	0x15
20us/ div	20US	0x16
10us/ div	10US	0x17

Setting	**Values**	
	For text mode	For binary mode (These values are set to the time base parameter)
0.05S/s	0.05S	0x00
0.125S/s	0.125S	0x01
0.25S/s	0.25S	0x02
0.5S/s	0.5S	0x03
1.25S/s	1.25S	0x04
2.5S/s	2.5S	0x05
5S/s	5S	0x06
12.5S/s	12.5S	0x07
25S/s	25S	0x08

50S/s	50S	0x09
125S/s	125S	0x0A
250S/s	250S	0x0B
500S/s	500S	0x0C
1.25K/s	1.25K	0x0D
2.5K/s	2.5K	0x0E
5K/s	5K	0x0F
12.5K/s	12.5K	0x10
25K/s	25K	0x11
50K/s	50K	0x12
125K/s	125K	0x13
250K/s	250K	0x14
500K/s	500K	0x15
1.25M/s	1.25M	0x16
2.5M/s	2.5M	0x17

Table 12: Waveform type values

Setting	Values	
	For text mode	For binary mode
Sine	1	0x00
Square	2	0x01
Sawtooth	3	0x02
Stair	4	0x03

Here are more examples for the text commands.

Command	Explanation
Vsen2=5mv	Set channel 2 sensitivity to 5mV/div
TB=0.2ms	Set time base to 0.2ms/div
vsen=?	Read the current setting of channel 1 sensitivity.
trigsrc = ch2	Set trigger source to channel 2.
D-Vavr = ON	Turn the display of channel 1 Vavr on.
10x2 = on	Enable 10x probe on channel 2.
senddata	Send captured data in text format (this is equivalent to touch the "SendData" button in the menu on the device).
LoadWF=1	Load the waveform from memory location 1.

Savewf=4	Save the currently displayed waveform to memory location 4.
Freq1 = 440Hz	Set the frequency of function generator channel A to 440Hz.
freq2 = 2.5k	Set the frequency of function generator channel B to 2.5KHz.
Duty = 30.6	Set the duty cycle of function generator channel A to 30.6%.
AmpSS2=0.5v	Set the incremental step size of channel B amplitude to 0.5V
amp++2	Increase channel B amplitude by its step size.
Phase++	Increase channel A phase by its step size.
wf2 = square	Set the waveform of channel B to square.
Amp2 = ?	Read the amplitude of channel B.

3. Binary Mode

In binary mode commands and data are transferred frames with defined structures. A frame takes the general format as below.

General frame format

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	
1	Frame Size	2	Counted from the frame ID to the last byte of payloads
3	Command ID	1	
4	Payloads	Variable	

This format observes three rules.
1) The frame ID must not be the sync character (0xFE). It can not be 0 either.
2) If any other byte has the value of 0xFE, a 0x00 byte must be inserted right after it in transmission.
3) All multi-byte data fields are transferred in little endian order unless stated otherwise.

Please note that the 0x00 byte inserted after a 0xFE byte is not counted in the frame size. This means the actually transferred bytes could be greater than that specified in the frame size field. At receiving the inserted 0x00 bytes must be

removed to obtain correct data.

Supported commands:

1) Read oscilloscope parameters.
2) Set oscilloscope parameters.
3) Set oscilloscope parameters individually.
4) Read captured data in binary format.
5) Miscellaneous oscilloscope operations.
6) Load waveform from memory.
7) Save waveform to memory.
8) Read function generator parameters.
9) Set function generator parameters.
10) Read function generator parameter incremental step size.
11) Set function generator parameter incremental step size.
12) Miscellaneous function generator operations.

 The following are detailed explanations of all the command frames.

Read oscilloscope parameters

The frame format for this command is given in the table below.

Read oscilloscope parameters

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	4
3	Command ID	1	0x21

Return: This command returns all the oscilloscope parameters in the following format. It also returns the current HOLD state.

Returned oscilloscope parameters

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	50
3	Command ID	1	0x31
4	CH1 VSen	1	See Table 5.
5	CH1 Couple	1	See Table 6.
6	CH1 VPos	4	Floating point value for the number of divisions with respect to the vertical center point of the screen.
10	CH1 measurement	2	Bit[0]: Vmax display. 1 – ON, 0 – OFF. Bit[1]: Vmin display. 1 – ON, 0 – OFF. Bit[2]: Vavr display. 1 – ON, 0 – OFF. Bit[3]: Vpp display. 1 – ON, 0 – OFF. Bit[4]: Vrms display. 1 – ON, 0 – OFF. Bit[5]: Freq. display. 1 – ON, 0 – OFF. Bit[6]: Cycle display. 1 – ON, 0 – OFF. Bit[7]: Duty cycle display. 1 – ON, 0 – OFF. Bit[8]: 10x probe. 1 – ON, 0 – OFF. Bit[15:9]: Reserved. Must be 0's
12	Reserved	4	
16	CH2 VSen	1	See Table 5.
17	CH2 Couple	1	See Table 6.
18	CH2 VPos	4	Floating point value for the number of divisions with respect to the vertical center point of the screen.
22	CH2 measurement	2	Bit[0]: Vmax display. 1 – ON, 0 – OFF. Bit[1]: Vmin display. 1 – ON, 0 – OFF. Bit[2]: Vavr display. 1 – ON, 0 – OFF. Bit[3]: Vpp display. 1 – ON, 0 – OFF. Bit[4]: Vrms display. 1 – ON, 0 – OFF. Bit[5]: Freq. display. 1 – ON, 0 – OFF. Bit[6]: Cycle display. 1 – ON, 0 – OFF. Bit[7]: Duty cycle display. 1 – ON, 0 – OFF. Bit[8]: 10x probe. 1 – ON, 0 – OFF. Bit[15:9]: Reserved. Must be 0's
24	Reserved	4	
28	Buffer size	2	1024 (0x400)
30	HPos	4	Floating point value for the number of divisions with respect to the horizontal center point of the screen.

34	Time base	1	See Table 10.
35	Trigger mode	1	See Table 7.
36	Trigger slope	1	See Table 8.
37	Trigger source	1	See Table 9
38	Trigger level	4	Floating point value in volts.
42	Trigger position	1	50 (in percentage of buffer size) fixed.
43	Trigger sensitivity	1	10 (fixed)
44	Attribute	2	Bit[0]: Oscilloscope working mode. 0 – YT, 1 – YX. Bit[1]: Slow time base (STB) display mode. 0 – Scroll, 1 – scan. This applies when time base setting is 50ms/div or slower.
46	Auto power off time	1	In the range of 0 – 255 (in minute).
47	Reserved	1	
48	HOLD state	2	Bit[2]: 0 – running, 1 – HOLD

Set oscilloscope parameters

The frame format for this command is given in the following table.

Return: None.

Set oscilloscope parameters

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	49
3	Command ID	1	0x22
4	CH1 VSen	1	See Table 5.
5	CH1 Couple	1	See Table 6.
6	CH1 VPos	4	Floating point value for the number of divisions with respect to the vertical center point of the screen.
10	CH1 measurement	2	Bit[0]: Vmax display. 1 – ON, 0 – OFF. Bit[1]: Vmin display. 1 – ON, 0 – OFF. Bit[2]: Vavr display. 1 – ON, 0 – OFF. Bit[3]: Vpp display. 1 – ON, 0 – OFF. Bit[4]: Vrms display. 1 – ON, 0 – OFF. Bit[5]: Freq. display. 1 – ON, 0 – OFF. Bit[6]: Cycle display. 1 – ON, 0 – OFF. Bit[7]: Duty cycle display. 1 – ON, 0 – OFF. Bit[8]: 10x probe. 1 – ON, 0 – OFF. Bit[15:9]: Reserved. Must be all 0's
12	Reserved	4	
16	CH2 VSen	1	See Table 5.
17	CH2 Couple	1	See Table 6.
18	CH2 VPos	4	Floating point value for the number of divisions with respect to the vertical center point of the screen.
22	CH2 measurement	2	Bit[0]: Vmax display. 1 – ON, 0 – OFF. Bit[1]: Vmin display. 1 – ON, 0 – OFF. Bit[2]: Vavr display. 1 – ON, 0 – OFF. Bit[3]: Vpp display. 1 – ON, 0 – OFF. Bit[4]: Vrms display. 1 – ON, 0 – OFF. Bit[5]: Freq. display. 1 – ON, 0 – OFF. Bit[6]: Cycle display. 1 – ON, 0 – OFF. Bit[7]: Duty cycle display. 1 – ON, 0 – OFF. Bit[8]: 10x probe. 1 – ON, 0 – OFF. Bit[15:9]: Reserved. Must be all 0's
24	Reserved	4	
28	Buffer size	2	1024 (0x400)
30	HPos	4	Floating point value for the number of divisions with respect to the horizontal center point of the screen.

34	Time base	1	See Table 10.
35	Trigger mode	1	See Table 7.
36	Trigger slope	1	See Table 8.
37	Trigger source	1	See Table 9
38	Trigger level	4	Floating point value in volts.
42	Trigger position	1	50 (in percentage of buffer size) fixed. This is corresponding to the middle of capture buffer.
43	Trigger sensitivity	1	10 (fixed)
44	Attribute	2	Bit[0]: Oscilloscope working mode. 0 – YT, 1 – YX. Bit[1]: Slow time base (STB) display mode. 0 – Scroll, 1 – Scan. This applies when time base setting is 50ms/div or slower.
46	Auto power off time	1	In the range of 0 – 255 (in minute).
47	Reserved	1	

Set vertical sensitivity

This command sets the vertical sensitivity of the specified channel. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	7
3	Command ID	1	0x28
4	Parameter ID	1	0x00
5	Channel number	1	0x00 – Channel 1 0x01 – Channel 2
6	Sensitivity	1	See Table 5

Return: None.

Set couple

This command sets the couple of the specified channel. The frame format for this

command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	7
3	Command ID	1	0x28
4	Parameter ID	1	0x01
5	Channel number	1	0x00 – Channel 1 0x01 – Channel 2
6	Couple	1	See Table 6

Return: None.

Set vertical position

This command sets the vertical position of the specified channel. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	10
3	Command ID	1	0x28
4	Parameter ID	1	0x02
5	Channel number	1	0x00 – Channel 1 0x01 – Channel 2
6	Vertical position	4	Floating point value for the number of divisions with respect to the vertical center point of the screen.

Return: None.

Set measurements

This command sets the measurements of the specified channel. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	8
3	Command ID	1	0x28
4	Parameter ID	1	0x03
5	Channel number	1	0x00 – Channel 1 0x01 – Channel 2
6	Measurements	2	Bit[0]: Vmax display. 1 – ON, 0 – OFF. Bit[1]: Vmin display. 1 – ON, 0 – OFF. Bit[2]: Vavr display. 1 – ON, 0 – OFF. Bit[3]: Vpp display. 1 – ON, 0 – OFF. Bit[4]: Vrms display. 1 – ON, 0 – OFF. Bit[5]: Freq. display. 1 – ON, 0 – OFF. Bit[6]: Cycle display. 1 – ON, 0 – OFF. Bit[7]: Duty cycle display. 1 – ON, 0 – OFF. Bit[8]: 10x probe. 1 – ON, 0 – OFF. Bit[15:9]: Reserved. Must be all 0's

Return: None.

Set time base

This command sets the oscilloscope time base. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	7
3	Command ID	1	0x28
4	Parameter ID	1	0x10
5	Reserved	1	
6	Time base	1	See Table 10

Return: None.

Set horizontal position

This command sets the horizontal position of waveform display. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	10
3	Command ID	1	0x28
4	Parameter ID	1	0x11
5	Reserved	1	
6	Horizontal position	4	Floating point value for the number of divisions with respect to the horizontal center point of the screen.

Return: None.

Set trigger mode

This command sets the oscilloscope trigger mode. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	7
3	Command ID	1	0x28
4	Parameter ID	1	0x12
5	Reserved	1	
6	Trigger mode	1	See Table 7

Return: None.

Set trigger slope

This command sets the oscilloscope trigger slope. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	7
3	Command ID	1	0x28
4	Parameter ID	1	0x13
5	Reserved	1	
6	Trigger slope	1	See Table 8

Return: None.

Set trigger source

This command sets the oscilloscope trigger source. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	7
3	Command ID	1	0x28
4	Parameter ID	1	0x14
5	Reserved	1	
6	Trigger source	1	See Table 9

Return: None.

Set trigger level

This command sets the oscilloscope trigger level. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	10
3	Command ID	1	0x28
4	Parameter ID	1	0x15
5	Reserved	1	
6	Trigger level	4	Floating point value in volts.

Return: None.

Set auto power off time

This command sets the auto power off time when being powered on battery. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	7
3	Command ID	1	0x28
4	Parameter ID	1	0x18
5	Reserved	1	
6	Auto off time	1	Number in the range of 0 – 255 (minute).

Return: None.

Select Roll or Scan mode

When time base is set to 50ms/div or slower the waveform display can be set to Roll mode or Scan mode. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	7
3	Command ID	1	0x28
4	Parameter ID	1	0x19
5	Reserved	1	
6	STB mode	1	Bit[1]: 0 – Roll, 1 – Scan All the rest bits should be set to 0's.

Return: None.

Select YT or YX mode

This command set the oscilloscope to Y-T or Y-X display mode. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	7
3	Command ID	1	0x28
4	Parameter ID	1	0x1A
5	Reserved	1	
6	Display mode	1	Bit[0]: 0 – YT mode, 1 – YX mode All the rest bits should be set to 0's.

Return: None.

Read captured data in binary format

This command reads the whole captured data in the current waveform buffer from the oscilloscope. The frame format for this command is given in the table below.

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	4
3	Command ID	1	0x23

Return: The data are returned in the following format.

Output of captured data in binary format

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	4100
3	Command ID	1	0x32
4	CH1 1st sample	2	
…	…	…	
2050	CH1 1024th sample	2	
2052	CH21st sample	2	
…	…	…	
4098	CH2 1024th sample	2	

Notes:
1) Each sample is a 12-bit unsigned integer.
2) The value of 0x0800 is corresponding to 0V input (assuming the operation of clearing VPos offset has been correctly performed. Otherwise there could be a mismatch).
3) The actual voltage that each sample represents can be calculated by the corresponding vertical sensitivity setting. See Table 5 for the gain of each sensitivity setting.

Miscellaneous oscilloscope operations

This command is equivalent to touching the corresponding buttons in the menu screen on the device. The command format is given in the table below.

Command of miscellaneous oscilloscope operations

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	6
3	Command ID	1	0x24
4	Operations	2	Bit[0]: 0 – no action. 1 – Output data (in text format) Bit[1]: 0 – no action. 1 – Toggle HOLD/RUN. Bit[2]: 0 – no action. 1 – Clear VPos offset. Bit[3]: 0 – no action. 1 – Restore factory default. Bit[4:13]: Reserved. Must be zero. Bit[14]: 0 – no action. 1 – Reboot. Bit[15]: 0 – no action. 1 – Power off.

Return: None.

Load waveform from memory

This command loads the waveform from the specified memory location and displays it on screen in HOLD state. The frame format for this command is given in the table below.

Load waveform from memory

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	6
3	Command ID	1	0x26
4	Memory location	2	0 – 3

Return: None.

Save waveform to memory

This command saves the currently displayed waveform to the specified memory location. The frame format for this command is given in the table below.

Save waveform to memory

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	6
3	Command ID	1	0x27
4	Memory location	2	0 – 3

Return: None.

Read function generator parameters

This command reads the function generator parameter of the specified channel. The frame format for this command is given in the table below.

Read function generator parameters

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	6
3	Command ID	1	0x41
4	Channel number	2	0 (for Channel A) or 1 (for Channel B)

Return: Function generator parameters are return in the following format.

Returned function generator parameters

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	28
3	Command ID	1	0x51
4	Channel number	1	0 or 1
5	Reserved	1	
6	Waveform type	2	See Table 22.
8	Frequency	4	Floating point number in Hz
12	Amplitude	4	Floating point number in volt
16	Offset	4	Floating point number in volt
20	Duty cycle	4	Floating point number in percentage
24	Phase	4	Floating point number in degree

Set function generator parameters

This command sets the function generator parameter of the specified channel. The frame format for this command is given in the table below.

Set function generator parameters

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	28
3	Command ID	1	0x42
4	Channel number	2	0 or 1
6	Waveform type	2	See Table 22.
8	Frequency	4	Floating point number in Hz
12	Amplitude	4	Floating point number in volt
16	Offset	4	Floating point number in volt
20	Duty cycle	4	Floating point number in percentage
24	Phase	4	Floating point number in degree

Return: None.

Read function generator incremental step size

This command reads the function generator incremental step size for each parameter of the specified channel. The frame format for this command is given in the table below..

Read function generator incremental step size

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	6
3	Command ID	1	0x43
4	Channel number	2	0 (for Channel A) or 1 (for Channel B)

Return: Parameter step sizes are returned in the following format.

Returned function generator incremental step sizes

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	32
3	Command ID	1	0x52
4	Channel number	1	0 or 1
5	Reserved	1	
6	Reserved	2	
8	Frequency step size	4	Floating point number in Hz
12	Amplitude step size	4	Floating point number in volt
16	Offset step size	4	Floating point number in volt
20	Duty cycle step size	4	Floating point number in percentage
24	Phase step size	4	Floating point number in degree
28	Cycle step size	4	Floating point number in second

Set function generator incremental step size

This command sets the function generator incremental step size for each parameter of the specified channel. The frame format for this command is given in the table below..

Set function generator incremental step size

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	32
3	Command ID	1	0x44
4	Channel number	2	0 or 1
6	Reserved	2	
8	Frequency step size	4	Floating point number in Hz
12	Amplitude step size	4	Floating point number in volt
16	Offset step size	4	Floating point number in volt
20	Duty cycle step size	4	Floating point number in percentage
24	Phase step size	4	Floating point number in degree
28	Cycle step size	4	Floating point number in second

Return: None.

Miscellaneous function generator operations

This command performs specified operations on the specified channel. The frame format for this command is given in the table below..

Miscellaneous function generator operations

Offset	Field Name	Size	Value
-1	Sync character	1	0xFE
0	Frame ID	1	0xC0
1	Frame Size	2	10
3	Command ID	1	0x45
4	Channel number	2	0 or 1
6	operations	2	Bit[0]: 0 – no action. 1 – Freq increase Bit[1]: 0 – no action. 1 – Amp increase Bit[2]: 0 – no action. 1 – Offset increase Bit[3]: 0 – no action. 1 – Duty cycle increase Bit[4]: 0 – no action. 1 – Phase increase Bit[5]: 0 – no action. 1 – Cycle increase Bit[6:15]: Reserved. Must be 0's.

| 8 | operations | 2 | Bit[0]: 0 – no action. 1 – Freq decrease
Bit[1]: 0 – no action. 1 – Amp decrease
Bit[2]: 0 – no action. 1 – Offset decrease
Bit[3]: 0 – no action. 1 – Duty cycle decrease
Bit[4]: 0 – no action. 1 – Phase decrease
Bit[5]: 0 – no action. 1 – Cycle decrease
Bit[6:15]: Reserved. Must be 0's. |

Revision History

Version	Date	Summary
v01	2020.06.11	Draft
V02	2020.08.29	1. Modified the frame format of GetParam and SetParam commands. 2. Added the format descriptions for the commands that individually set oscilloscope parameters. 3. Trigger level setting is changed to be specified in V or mV. 4. VPos and HPos settings are changed to be specified in division. 5. Added the note for the repeat command "R" (or "r"). 6. Added the description for command SendFV. 7. Added an example column to text command lists.