APG7305A　USB-MCA-AMP

Command Manual

Version 1.0

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1 Safety Precautions / Disclaimer

Thank you very much for purchasing this product from TechnoAP Co., Ltd. Before using this product, please read this "Safety Precautions and Disclaimer" and be sure to observe the contents and use the product properly.

We are not responsible for any damage caused by abnormality of device, detector, connected device, application, damage to failure, other secondary damage, even if accident caused by using this device.

Prohibited matter

- Cannot be used for applications requiring special quality and reliability related to human life or accidents.
- Cannot be used in environments with high temperature, high humidity, or strong vibration.
- Do not apply strong impact or vibration.
- Do not disassemble or modify.
- Do not expose to water or condensation. Do not operate with wet hands.
- If heat generation, deformation, discoloration, or abnormal odor is observed, stop use immediately and contact our company.

Note

- Use this device within the room temperature range and ensure that no condensation occurs.
- If smoke or abnormal heat generation occurs, turn off the power immediately.
- This device is a high-precision electronic instrument. Be careful of static electricity.
- Do not store this device in dusty locations or in high-temperature or high-humidity environments.
- Do not bring devices that emit strong radio waves, such as mobile phones or transceivers, close to this device.
- Malfunctions may occur in environments with high levels of electrical noise.
- The specifications of this device and the contents of this document and related materials are subject to change without notice.

2 Overview

2.1 Overview

This device can be connected to a PC via a USB cable, and measurement and control can be performed by sending and receiving commands from Microsoft Visual Studio, National Instruments LabVIEW, Linux environments, and others.

This document explains the handling of measurement and control commands for this device.

※ The contents of this document are subject to change without notice.

2.2 Revision History

March 15, 2024　Version 1.0　First edition

1.3. Environment

The following environment is assumed to be in place.

(1) FTDI D2XX Drivers are installed.

(2) Our sample programs can be executed.

3 Commands

3.1 Overview

Settings and data acquisition for this device are performed via USB communication.

The types of commands are broadly classified into settings, status, histogram, and list. Details of each type are described below.

(1) Setting Commands

For setting commands, when 8 bytes are transmitted from the PC, the device returns an 8-byte response. After transmitting the 8 bytes, it is necessary to immediately read the 8 bytes.

Example: Setting the histogram mode

PC → This device	Command section (4 bytes) ASCII character string 4D4F4457 (MODW)	Parameter section (4 bytes) Binary 0x00000000		
This device → PC			Command section (4 bytes) ASCII character string 4D4F4457 (MODW)	Parameter section (4 bytes) Binary 0x00000000

[Settings from the PC]

The “command section” is 4 bytes and consists of an ASCII character string. For example, in the case of mode setting, it is “MODW”, which corresponds to “4D4F4457” when represented as an ASCII character string.The “parameter section” is 4 bytes in binary format (big-endian, network byte order, MSB first) and contains the value to be set.

[Response from the Device]

If the setting is executed correctly, a response is returned with the same content as the setting. By comparing the setting content with the response content, it is possible to confirm whether the setting command was executed normally.

(2) Status Commands

For status commands, when 4 bytes are transmitted from the PC, the device returns a 94-byte response. After transmitting the 4 bytes, it is necessary to immediately read the 94 bytes.

PC → This device	Command section (4 bytes) ASCII character string 53545557 (STUW)	Parameter section (4 bytes) Binary 0x00000000	
This device → PC			Data section (94 bytes) Binary Real time, live time, etc.

[Settings from the PC]

The “command section” is 4 bytes and consists of an ASCII character string. It is “STUW”, which corresponds to “53545557” when represented as an ASCII character string. The “parameter section” is 4 bytes in binary format, and 0 is set.

[Response from the Device]

If the setting is executed correctly, real time, live time, dead time, throughput count rate, and input count rate can be received.

(3) Histogram Commands

*The following processing should be performed after starting measurement in histogram mode using the previously described setting commands.

Histogram data is up to a maximum of 65,536 bytes per channel (65,536 bytes = 16,384 channels × 4 bytes per channel), but since it is read in units of one block (2,048 bytes), it is necessary to read the data in segments while specifying the block number to be read.

When the PC sends a histogram read command (8 bytes including block number information), the device returns a 2,048-byte response. After sending the read command, it is necessary to immediately read the 2,048 bytes.

The 2,048-byte response here does not include a header and consists only of the histogram data for the specified one block. Each block corresponds to 512 channels (512 = 2,048 bytes / 4 bytes). To acquire up to 16,384 channels, it is necessary to execute the operation 32 times (32 = 16,384 channels / 512 channels).

Example: Acquiring 16,384 channels of histogram data for CH1

Histogram CH setting

PC → This device	Command section (4 bytes) ASCII character string 48434857 (HCHW)	Parameter section (4 bytes) Binary 0x00000000		
This device → PC			Command section (4 bytes) ASCII character string 48434857 (HCHW)	Parameter Section (4 Bytes) Binary 0x00000000

Histogram Data Readout

PC → This device	Command section (4 Byte) ASCII string 48493030 (HI00) Block number 0	Parameter section (4 Byte) Binary 0x00000000	
This device → PC			Data section (2048 Byte) Binary Histogram data for channels 0 to 511

* Subsequently, execute block numbers 1 to 31 in the same manner.

PC → This device	Command Section (4 Byte) ASCII string 48493146 (HI1F) Block number 0	Parameter Section (4 Byte) Binary 0x00000000	
This device → PC			Data Section (2048 Byte) Binary Histogram data for channels 15872–16383

[CH Number Setting from PC]
First, set the CH number to be read using the “HCHW” command.
The “Command section” is 4 bytes and is the ASCII string “48434857”.
The “Parameter section” is 4 bytes in binary format and is always set to 0.

[Response to CH Number Setting from the Device]
If the setting is executed correctly, the device responds with the same content as the setting.
By comparing the setting content with the response content, you can confirm whether the setting command was executed successfully.

[Histogram Readout and Block Number Setting from PC]
The “Command section” is 4 bytes and sets the block number to be read in the ASCII string format “HIXX”. “XX” is the hexadecimal block number.
To acquire channels 0–511, the ASCII string is “HI00”.
To acquire channels 15872–16383, the ASCII string is “HI1F”.
The “Parameter section” is 4 bytes in binary format and is set to 0.
Histogram data of the specified channel and channel range, totaling 2048 bytes (512 channels), is sent from the device.

(4) Waveform Command
*The following procedure should be performed after starting measurement in waveform mode using the previously described setting command.

The waveform command is basically the same as the histogram command described above.
The difference is only the value set in the 4-byte “Parameter section” of the “HCHW” command.
Specify the following values according to the type of waveform to be acquired:
1: SLOW filter signal
2: Differentiated signal of the preamplifier output
3: FAST filter signal

3.2 Command List

No.	Command				Description	Remarks
	Category		Abbrev.	ASCII		
1	レジスタ設定	CH1(ch.0)	PORW	504F5257	CH1 polarity	
2			ACGW	41444757	CH1 analog coarse gain	
3			ADGW	41444757	CH1 ADC Gain	
4			SSTW	53535457	CH1 shaping time	
5			STRW	53545257	CH1 threshold	
6			PZLW	505A4C57	CH1 pole-zero	
7			LLDW	4C4C4457	CH1 LLD	
8			ULDW	554C4457	CH1 ULD	
9			GAMW	47414D57	CH1 analog fine gain	Upper 5 bits
10			GALW	47414C57		Lower 32 bits
11		Common	MODW	4D4F4457	Measurement mode	0: Histogram, 1: Waveform
12			MMDW	4D4D4457	Measurement time mode	0: Real time, 1: Live time
13			MT0W	4D543057	Measurement time	Upper 13 bits
14			MT1W	4D543157		Lower 32 bits
15			MONW	4D4F4E57	DAC output signal selection	0: input, 1: slow, 2: fast
16			AQSW	41515357	Start measurement	
17			AQEW	41514557	Stop measurement	
18			CLRW	434C5257	Clear	
19			HCHW	48434857	Histogram / waveform request	
20	Status		STUW	53545557	Status	Real time, etc.
21	Histogram, Waveform		HI00	48493030	Readout of histogram or waveform data Readout is performed in units of 512 points × 4 bytes	0～511 channels
22			HI01	48493031		512～1023 channels
23			HI02	48493032		1024～1535 channels
24			HI03	48493033		1536～2047 channels
25			HI04	48493034		2048～2559 channels
26			HI05	48493035		2560～3071 channels
27			HI06	48493036		3072～3583 channels
28			HI07	48493037		3584～4095 channels
29			HI08	48493038		4096～4607 channels
30			HI09	48493039		4608～5119 channels
31			HI0A	48493041		5120～5631 channels
32			HI0B	48493042		5632～6143 channels
33			HI0C	48493043		6144～6655 channels
34			HI0D	48493044		6656～7167 channels
35			HI0E	48493045		7168～7679 channels
36			HI0F	48493046		7680～8191 channels
37			HI10	48493130		8192～8703 channels
38			HI11	48493131		8704～9215 channels
39			HI12	48493132		9216～9727 channels
40			HI13	48493133		9728～10239 channels
41			HI14	48493134		10240～10751 channels
42			HI15	48493135		10752～11263 channels
43			HI16	48493136		11264～11775 channels
44			HI17	48493137		11776～12287 channels
45			HI18	48493138		12288～12799 channels
46			HI19	48493139		12800～13311 channels
47			HI1A	48493141		13312～13823 channels
48			HI1B	48493142		13824～14335 channels
49			HI1C	48493143		14336～14847 channels

50		HI1D	48493144		14848～15359 channels
51		HI1E	48493145		15360～15871 channels
52		HI1F	48493146		15872～16383 channels

3.3 Command Descriptions

*For details of each setting, refer to the “USB-MCA-AMP User Manual” supplied with this device.

(1) CH1 Polarity

Description: Polarity of the preamplifier output signal input to CH1

Range: 0: Positive polarity, 1: Negative polarity

(2) CH1 Analog Coarse Gain

Description: Coarse gain of the CH1 analog amplifier

Range: 0: ×1, 1: ×2, 2: ×5, 3: ×10

(3) CH1 ADC Gain

Description: CH1 ADC gain (number of channels, bin size)

Range:

0: 16384 channels, 1: 8192 channels, 2: 4096 channels,
3: 2048 channels, 4: 1024 channels, 5: 512 channels

(4) CH1 Shaping Time

Description: CH1 shaping time (time constant)

Range:

2: 0.25 μs, 3: 0.375 μs, 4: 0.5 μs, 5: 0.75 μs, 6: 1 μs,
7: 1.5 μs, 8: 2 μs, 9: 3 μs, 10: 4 μs, 11: 5 μs,
12: 6 μs, 13: 8 μs, 14: 10 μs, 15: 16 μs

(5) CH1 Threshold

Description: Threshold for starting waveform acquisition on CH1.
Set to a value equal to or lower than the LLD.

Range: 0 to 16383

(6) CH1 Pole-Zero Cancellation

Description: Pole-zero adjustment for CH1

Range: 0 to 20000

(7) CH1 LLD

Description: CH1 energy LLD (Lower Level Discriminator), unit: channel.
Set to a value equal to or higher than the threshold and lower than the ULD.

Range: 0 to 16383

(8) CH1 ULD

Description: CH1 energy ULD (Upper Level Discriminator), unit: channel.
Set to a value higher than the LLD.

Range: 0 to 16383

(9) CH1 Analog Fine Gain

Description: CH1 analog fine gain. Since the maximum per setting is 32 bits, the value is set in two steps using a 5-bit upper register and a 32-bit lower register.

Range: 1 to 1,700,000
For the maximum value of 1,700,000 (0x19F0A0), set 0x19 to the upper register and 0xF0A0 to the lower register.

(10) Measurement Mode

Description: Measurement mode setting

Range: 0: Histogram, 1: Waveform

(11) Measurement Time Mode

Description: Time mode used to determine the measurement time

Range: 0: Real time, 1: Live time

(12) Measurement Time

Description: Measurement time setting. Since this device operates with a 50 MHz internal clock, set the value equal to the measurement time (seconds) multiplied by 50,000,000. Because the maximum per setting is 32 bits, the value is set in two steps using a 13-bit upper register and a 32-bit lower register.

Range: Maximum 192 hours. In this case,
60 s × 60 min × 192 h × 50,000,000 = 34,560,000,000,000 (0x1F6EA0860000).
Set 0x1F6E to the upper register and 0xA0860000 to the lower register.

(13) DAC Output Signal Selection

Description: Selection of the signal output from the OUTPUT terminal

Range: 0: input, 1: slow, 2: fast

(14) Start Measurement

Description: Starts measurement

Range: 1: Start

(15) Stop Measurement

Description: Stops measurement

Range: 1: Stop

(16) Clear

Description: Resets the measurement time and clears measurement data

Range: 0: Clear

(17) Histogram / Waveform Request

Description: Sets the target data type before reading histogram or waveform data

Range:

0: Histogram

1: Waveform (SLOW filter signal)

2: Waveform (differentiated preamplifier output signal)

3: Waveform (FAST filter signal)

(18) Status

Description: Retrieves the values shown in the table below

No.	Item	Size (Byte)
1	Real time (20 ns/count)	6
2	Live time (20 ns/count)	6
3	Dead time (20 ns/count)	6
4	Throughput count rate	3
5	Reserved area	73
合計		94