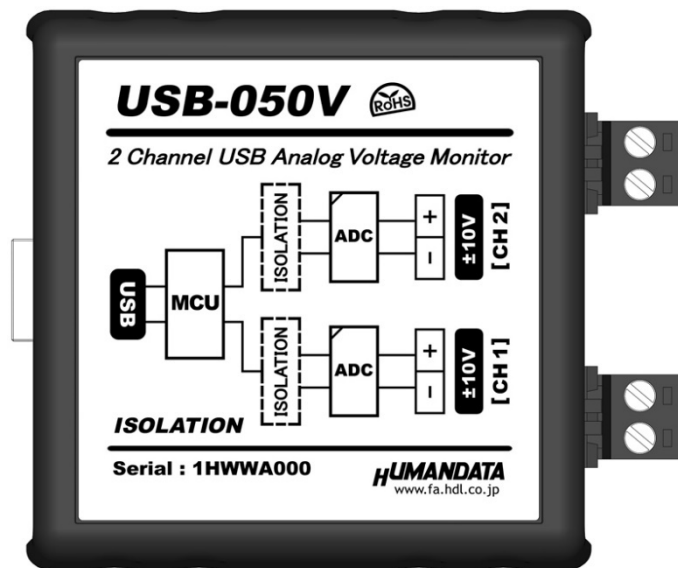


**2 Channel USB
Analog Voltage Monitor
USB-050V
User's Manual
Ver. 1.0**



HuMANDATA LTD.

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I Precautions

 Do Not	1	This product uses ordinary off-the-shelf electronic components, and is therefore inappropriate for use in applications that require special quality or reliability and are expected to protect human lives or prevent accidents, such as safety mechanisms in fields including space, aeronautics, medicine, and nuclear power.
	2	Do not be used underwater or in high-humidity environments.
	3	Do not be used in the presence of corrosive gases, combustible gases, or other flammable gases.
	4	Do not turn on power when circuit board surface is in contact with other metal.
	5	Do not apply voltage higher than rated voltage.
 Attention	6	This manual may be revised in the future without notice owing to improvements.
	7	All efforts have been made to produce the best manual possible, but if users notice an error or other problem, we ask that they notify us.
	8	Item 7 notwithstanding, HuMANDATA cannot be held liable for the consequences arising from use of this product.
	9	HuMANDATA cannot be held liable for consequences arising from using this product in a way different from the uses described herein, or from uses not shown herein.
	10	This manual, circuit diagrams, sample circuits, and other content may not be copied, reproduced, or distributed without permission.
	11	If the product emits smoke, catches fire, or becomes unusually hot, cut the power immediately.
	12	Do not install the control cables or communication cables together with the main circuit lines or power cables. In such an environment, it may result in malfunction due to noise.
	13	Be careful of static electricity.

I Revision History

Date	Revision	Description
Jul. 23, 2026	v1.0	Initial release

I Product packaging

Thank you very much for purchasing the USB-050V. In this package, you will find the following items included. If there are any shortages or issues, please contact us.

- 2 Channel USB Analog Voltage Monitor USB-050V × 1
- USB cable (1.8m) × 1

I Introduction

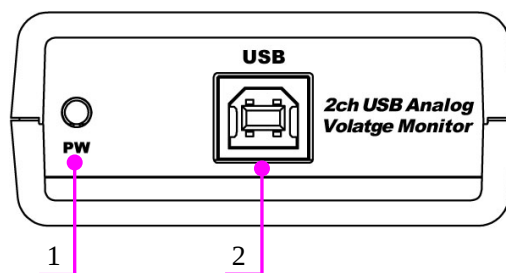
USB-050V is a voltage monitor capable of measuring two channels of analog voltage (± 10 V) via USB. The USB interface and each channel are independently isolated. An A/D converter is provided for each channel, enabling simultaneous measurement of two channels.

Power is supplied from the computer via the USB connection. When using a USB hub or similar device for branching, ensure that a stable power supply is provided to prevent voltage drops. If the voltage is insufficient, stable measurement may not be possible.

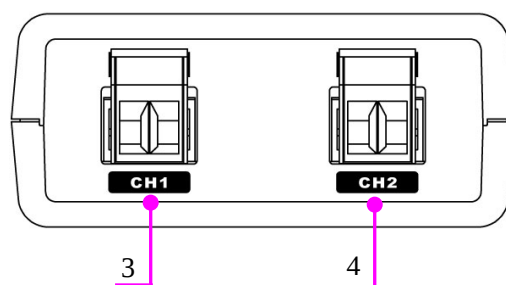
By using the included application software, USB-050V Voltage Monitor, measurement results, scaling values, and chart displays can be viewed on a computer. For details, refer to the dedicated user manual.

In addition, by using the dedicated control commands, analog voltage (± 10 V) measurements can also be performed from a custom application. For details of the control commands, refer to Chapter 4, "Control Commands."

1. Overview

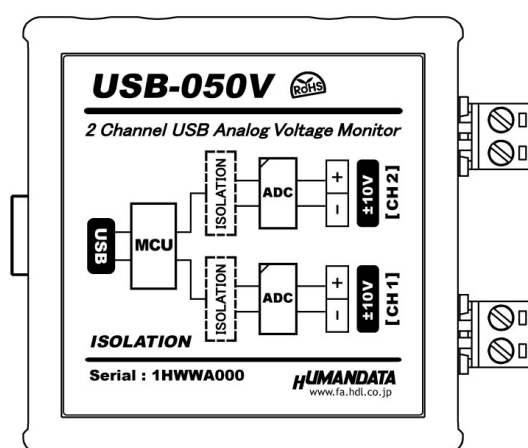


USB Host side



Analog Voltage side

No.	Name	Description
1	PW LED (Green)	Lights when the power is ON
2	USB Connector	Connect the supplied USB cable
3	CH1 Voltage Input Connector	Connect the ± 10 V analog voltage input for Channel 1
4	CH2 Voltage Input Connector	Connect the ± 10 V analog voltage input for Channel 2



Nameplate

The USB side and each channel are independently isolated.

2. Specifications

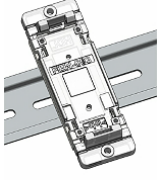
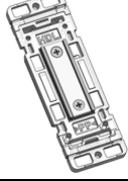
2.1. Product Specification

Item	Description	Remarks
Model	USB-050V	
Input Power	5 VDC Supplied via USB cable	no external power supply required
Current Consumption	450 mA max.	
HOST interface	USB 2.0 compliant (Full-Speed supported)	· USB 1.1 compatible · ESD protection ± 11 KV
Control Method	Communication control via virtual COM port	
USB Connector	USB-B connector	
Voltage Input Connector	Detachable terminal block, 2-pin / 5 mm pitch $\times$ 2	Molex Model: 39520-0002
Number of Channels	2	
Measurement Range	± 10 V	
Measurement Accuracy	$\leq \pm 0.05\%$ FS (-20 to 50°C) $\leq \pm 0.03\%$ FS (0 to 40°C)	
Resolution	24-bit A/D Converter (ADC)	
Isolation Method	Independent bus isolation	
Isolation Protection	2500 VDC	Designed value
Built-in LSI	General-purpose microcontroller 4-20 mA ADC	
LED	Power LED	
Operating Ambient Temp.	-20 to 50°C (-4 to 122°F)	No condensation permitted
Operating Ambient Humi.	30 to 85%RH	
Storage Ambient Temp.	-20 to 60°C (-4 to 140°F)	
Storage Ambient Humi.	30 to 85%RH	
Noise Immunity	Not specified	
Compliance Standards	Not specified	
Weight	Approx. 90 g	Only main body
Dimensions	67 x 67 x 28 mm (2.638" x 2.638" x 1.102")	Without projections

* There is a case to be changed to the parts of the compatibility.

* Power saving function (suspend, standby, sleep and others) is not supported.

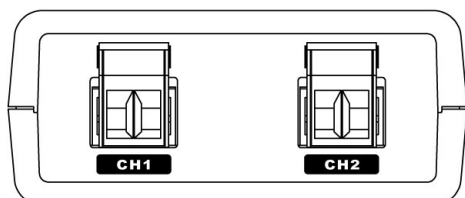
2.2. Optional Accessories

MODEL	Image	Remarks
PEN-003		Attachment with clamping screw JAN : 4937920800709
PEN-003-DIN		Attachment for 35mm DIN rail JAN : 4937920800716
PEN-003-MG		Attachment with neodymium magnet JAN : 4937920801201

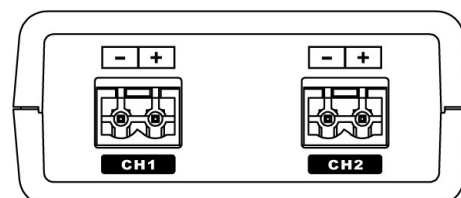
2.3. Voltage Input Connector

Do not connect/disconnect while powered.

Symbol	Description
-	Voltage Input (-)
+	Voltage Input (+)



Detachable terminal block, 2-pin / 5 mm pitch
 Molex 39520-0002 (×2)
 Compatible wire size:
 AWG30 (0.05 sq) to AWG12 (3.5 sq)
 Wire strip length: 6.5 mm



* Illustration showing the detachable terminal block removed.

3. CDC Class Driver Installation Guide

USB-050V uses the CDC (Communication Device Class) driver, which is included in the operating system.

Windows 10 or later:

No driver installation required. Automatically recognized as a "USB Serial Device (COM*)".

* Driver installation is required in the following cases:

- When using Windows 8.1 or earlier
- When using Windows 10 or later, so that the device is recognized by its model name in Device Manager

The device driver and installation manual can be downloaded from the product documentation page. Please refer to Chapter 6, "Additional Documentation and User Support."

4. Control Command

4.1. Overview of Control Commands

By using control commands, you can measure two channels of analog voltage (± 10 V) from your own application.

A control command consists of a command character, sequence number, parameter(s), and an end code, separated by commas. Some commands do not require parameters.

The sequence number {SQNO} is an arbitrary string (up to 5 characters).

USB-050V returns the same sequence number in its response, allowing the host to match commands with responses.

ASCII characters are assigned to the control commands, allowing operation to be verified by keyboard input using a terminal application such as Tera Term.

Use uppercase letters for command characters.

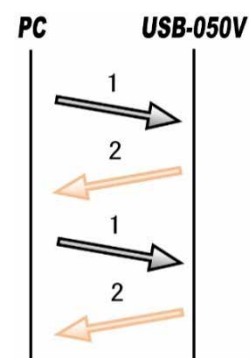
Example

	Command {CMD}	Comma {,}	Sequence number {SQNO}	Comma {,}	Parameter {PRAM}	End code <CR>
HEX	43h 52h 44h	2Ch	31h 32h 33h	2Ch	31h 30h 30h	0Dh
ASCII	CRD	,	123	,	100	CR

4.2. Control Sequence

1. The application sends a command to the USB-050V.
2. USB-050V detects the end code <CR> and returns a response. Refer to the next section, "Control Command List," for response formats.

When sending multiple commands, always wait for the response to the previous command before sending the next one.



4.3. Control Command List

No.	Command	Function	Format
1	FSS	Set output data rate	FSS,{SQNO},{PRAM}<CR>
2	TMR	Set sampling period	TMR,{SQNO},{PRAM}<CR>
3	CHS	Select measurement channel	CHS,{SQNO},{PRAM}<CR>
4	FMT	Set measurement readout format	FMT,{SQNO},{PRAM}<CR>
5	RST	Reset settings	RST,{SQNO}<CR>
6	CST	Connection check	CST,{SQNO}<CR>
7	CRD	Read CH1 & CH2 measurement values	CRD,{SQNO},{PRAM}<CR>
8	CR1	Read CH1 measurement values	CR1,{SQNO},{PRAM}<CR>
9	CR2	Read CH2 measurement values	CR2,{SQNO},{PRAM}<CR>
10	EXT	Stop measurement readout	EXT,{SQNO}<CR>

The commands are explained below. The sequence number is fixed at "123".

1. FSS Command (Set output data rate)

Format		FSS,{SQNO}<CR>																																																												
Function		Sets the output data rate and settling time. The parameter is a single hexadecimal digit. If no parameter is specified, the current setting is returned. The setting is retained even after power is turned off.																																																												
Parameter Range		0-9, none (default: 2)																																																												
		The following tables show reference values measured under these conditions:																																																												
		Sampling period: Fastest, Measurement channels: CH1 & CH2 FMT parameter: 61, Measurement command: CRD																																																												
		<table><tr><th>Para meter</th><th>Output Data Rate (Hz)</th><th>Settling Time (ms)</th><th>RMS Noise (nV), Typical</th><th>Effective Resolution (bits) Typical</th></tr><tr><td>9</td><td>4.708</td><td>212.4</td><td>250</td><td>24(22.5)</td></tr><tr><td>8</td><td>7.530</td><td>132.8</td><td>310</td><td>24(22)</td></tr><tr><td>7</td><td>10.033</td><td>99.67</td><td>330</td><td>24(22)</td></tr><tr><td>6</td><td>50.176</td><td>19.93</td><td>900</td><td>23.5(20.5)</td></tr><tr><td>5</td><td>60.205</td><td>16.61</td><td>970</td><td>23.5(20.5)</td></tr><tr><td>4</td><td>150.399</td><td>6.649</td><td>1460</td><td>22.5(20)</td></tr><tr><td>3</td><td>301.477</td><td>3.317</td><td>1900</td><td>22.5(19.5)</td></tr><tr><td>2</td><td>962.464</td><td>1.039</td><td>3000</td><td>21.5(19)</td></tr><tr><td>1</td><td>1203.369</td><td>0.831</td><td>5000</td><td>21(18)</td></tr><tr><td>0</td><td>1209.190</td><td>0.827</td><td>14300</td><td>19.5(16.5)</td></tr><tr><td>None</td><td colspan="4">Return Current Parameter Settings</td></tr></table>	Para meter	Output Data Rate (Hz)	Settling Time (ms)	RMS Noise (nV), Typical	Effective Resolution (bits) Typical	9	4.708	212.4	250	24(22.5)	8	7.530	132.8	310	24(22)	7	10.033	99.67	330	24(22)	6	50.176	19.93	900	23.5(20.5)	5	60.205	16.61	970	23.5(20.5)	4	150.399	6.649	1460	22.5(20)	3	301.477	3.317	1900	22.5(19.5)	2	962.464	1.039	3000	21.5(19)	1	1203.369	0.831	5000	21(18)	0	1209.190	0.827	14300	19.5(16.5)	None	Return Current Parameter Settings			
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None	Return Current Parameter Settings																																																													
Notes on Specifications RMS noise and effective resolution are reference values of the internal A/D converter. Values in parentheses indicate peak-to-peak (p-p) resolution.																																																														
Example	Send	FSS,123,2<CR>																																																												
	Response	OK,FSS,123,2<CR>																																																												

2. TMR Command (Set sampling period)

Format		TMR,{SQNO},{PRAM}<CR>
Function		Sets the sampling period in milliseconds. Set a value larger than the settling time configured by the FSS command. If no parameter is specified, the current setting is returned. The setting is retained even after power is turned off.
Parameter Range		0-600000, none (default: 10) 0: Fastest (settling time set by FSS command) 1: 1 ms 2: 2 ms ... 600000: 10 minutes none: Returns current value If a value smaller than the settling time set by the FSS command is specified, measurement is performed at the fastest available rate.
Example	Send	TM1,123,1000<CR> * When set to 1 second
	Response	OK,TM1,123,1000<CR>

3. CHS Command (Select measurement channel)

CHS Command (Select measurement channel)																
Format																
CHS,{SQNO}<CR>																
Function																
Selects the measurement channels. The parameter is a single hexadecimal digit. Set the bit of the channel to be measured to “1”, and channels not to be measured to “0”. If no parameter is specified, the current selection status is returned. The setting is retained even after power is turned off. BIT 1BIT 0 CH2 CH1 「1」 : ON / 「0」 : OFF																
Parameter Range																
1-3, none (default: 3) <table><tr><th>Parameter</th><th>CH2</th><th>CH1</th></tr><tr><td>1</td><td>-</td><td>Select</td></tr><tr><td>2</td><td>Select</td><td>-</td></tr><tr><td>3</td><td>Select</td><td>Select</td></tr><tr><td>None</td><td colspan="2">Return current selection status</td></tr></table>		Parameter	CH2	CH1	1	-	Select	2	Select	-	3	Select	Select	None	Return current selection status	
Parameter	CH2	CH1														
1	-	Select														
2	Select	-														
3	Select	Select														
None	Return current selection status															
Example	Send	CHS,123,1<CR> * When CH1 is selected														
	Response	OK,CHS,123,1<CR>														
	Send	CHS,123,3<CR> * When CH1 & CH2 is selected														
	Response	OK,CHS,123,3<CR>														

4. FMT Command (Set measurement readout format)

Format	FMT,{SQNO}<CR>
Function	Configures the measurement data readout format. The parameter consists of two hexadecimal digits. If no parameter is specified, the current setting is returned. The setting is retained even after power is turned off.
	BIT 7 BIT 6 BIT 5 BIT 4 BIT 3 BIT 2 BIT 1 BIT 0
	- Zero DP_1 DP_0 CH_No S/ms Count Value
	BIT Name Description Value
	7 - - -
	6 Zero Zero padding for voltage values 0: Disabled / 1: Enabled
	5 DP_1 Decimal places for voltage values
	4 DP_0 0: 3 digits / 1: 4 digits 2: 5 digits
	3 CH_No Channel number 0: Included / 1: Not included
	2 S/ms Sampling period (ms) 0: Included / 1: Not included
	1 Count Measurement count 0: Included / 1: Not included
	0 Value Measurement value format 0: A/D value 1: Voltage value (V)
	· Readout Format Example (Parameter = 00) CH1,288721,CH2,287F6A,000002,000050<CR>
	① ② ③ ④ ⑤ ⑥
	· Each value is separated by commas “,”. 1. Channel number: CH1 2. CH1 A/D value 3. Channel number: CH2 4. CH2 A/D value 5. Measurement count (000001–999999, fixed 6 digits) 6. Sampling period counted by the unit (fixed 6 digits, unit: ms) The sampling period accuracy is within ±2 ms. The first sample after measurement starts is always fixed to 000000. This value can be used by the host application for logging timestamp calculations.
* Only channels selected by the CHS command are included in the readout. Example: Readout Format When Only CH1 Is Selected CH1,288721,000002,000050<CR>	
The voltage value can be calculated using the following formula. Voltage (V) = -4.444444 × ((Vdec × 0.2682209) / 1,000,000) + 10 Vdec = received A/D value converted to decimal	
· Readout Format Example (Parameter: 01) CH1, 3.957,CH2, 3.956,000002,000050<CR>	

FMT Command (Set measurement readout format) Continued

Parameter Range	00-FF, none (default: 00)	
	Parameter	Example of reading measurement data using the CRD command
	00	CH1,3FFC5B,CH2,3FFA51,000002,000010<CR>
	01	CH1,5.001,CH2,5.002,000002,000010<CR>
	02	CH1,3FFC66,CH2,3FFA4F,000010<CR>
	03	CH1,5.001,CH2,5.002,000010<CR>
	04	CH1,3FFC5A,CH2,3FFA95,000002<CR>
	05	CH1,5.001,CH2,5.002,000002<CR>
	06	CH1,3FFC72,CH2,3FFA78<CR>
	07	CH1,5.001,CH2,5.002<CR>
	08	3FFC80,3FFA9D,000002,000010<CR>
	09	5.001,5.002,000002,000010<CR>
	0A	3FFCB5,3FFA82,000010<CR>
	0B	5.001,5.002,000010<CR>
	0C	3FFC94,3FFA66,000002<CR>
	0D	5.001,5.002,000002<CR>
	0E	3FFCA2,3FFA94<CR>
	0F	5.001,5.002<CR>
	11	CH1,5.0010,CH2,5.0016,000002,000010<CR>
	21	CH1,5.00102,CH2,5.00166,000002,000010<CR>
	41	CH1,005.001,CH2,005.002,000002,000010<CR>
	51	CH1,005.0010,CH2,005.0017,000002,000010<CR>
	61	CH1,005.00098,CH2,005.00169,000002,000010<CR>
	13	CH1,5.0010,CH2,5.0017,000010<CR>
	23	CH1,5.00105,CH2,5.00166,000010<CR>
	43	CH1,005.001,CH2,005.002,000010<CR>
	53	CH1,005.0010,CH2,005.0016,000010<CR>
	63	CH1,005.00097,CH2,005.00162,000010<CR>
	15	CH1,5.0010,CH2,5.0016,000002<CR>
	25	CH1,5.00101,CH2,5.00169,000002<CR>
	45	CH1,005.001,CH2,005.002,000002<CR>
	55	CH1,005.0010,CH2,005.0016,000002<CR>
	65	CH1,005.00095,CH2,005.00170,000002<CR>
	17	CH1,5.0010,CH2,5.0016<CR>
	27	CH1,5.00100,CH2,5.00166<CR>
	47	CH1,005.001,CH2,005.002<CR>
	57	CH1,005.0010,CH2,005.0016<CR>
	67	CH1,005.00104,CH2,005.00159<CR>
	19	5.0011,5.0017,000002,000010<CR>
	29	5.00103,5.00169,000002,000010<CR>
	49	005.001,005.002,000002,000010<CR>
	59	005.0011,005.0017,000002,000010<CR>
	69	005.00102,005.00167,000002,000010<CR>

FMT Command (Set measurement readout format) Continued

Parameter Range		Parameter	Example of reading measurement data using the CRD command
		1B	5.0010,5.0017,000010<CR>
		2B	5.00098,5.00163,000010<CR>
		4B	005.001,005.002,000010<CR>
		5B	005.0010,005.0017,000010<CR>
		6B	005.00099,005.00175,000010<CR>
		1D	5.0010,5.0016,000002<CR>
		2D	5.00099,5.00165,000002<CR>
		4D	005.001,005.002,000002<CR>
		5D	005.0011,005.0017,000002<CR>
		6D	005.00102,005.00165,000002<CR>
		1F	5.0010,5.0017<CR>
		2F	5.00095,5.00166<CR>
		4F	005.001,005.002<CR>
		5F	005.0010,005.0017<CR>
		6F	005.00097,005.00165<CR>
Example	Send	FMT,123,03<CR>	
	Response	OK,FMT,123,03<CR>	

5. RST Command (Reset settings)

Format		RST,{SQNO}<CR>
Function		Resets all settings configured by the FSS, TMR, FMT, and CHS commands to their default values.
Example	Send	RST,123<CR>
	Response	OK,RST,123<CR>

6. CST Command (Connection check)

Format		CST,{SQNO}<CR>
Function		This command is used to verify the connection between the PC and the USB-050V. The connection is confirmed by receiving a response.
Example	Send	CST,123<CR>
	Response	OK,CST,123<CR>

7. CRD Command (Read CH1 & CH2 measurement values)

Format		CRD,{SQNO},{PRAM}<CR>
Function		Reads measurement values from channels selected by the CHS command. The output format is determined by the FMT command. PRAM: number of measurements PRAM: 0 → continuous measurement until EXT command is received.
Parameter Range		0-999,999 (default: 0)
Example	Send	CRD,123,100<CR> * When 100 count read
	Response	OK,CRD,123<CR> CH1,288CD4,CH2,288908,000001,000000<CR> CH1,288CBA,CH2,2888FA,000002,000050<CR> CH1,288CD6,CH2,2888E5,000003,000050<CR> ... CH1,288CCE,CH2,2888DD,000099,000050<CR> CH1,288CB2,CH2,2888C2,000100,000050<CR> * When CH1 and CH2 are selected and the measurement data readout format is set to 00
	Send	CRD,123,0<CR> * When continuous read
	Response	OK,CRD,123,0<CR> CH1,5.957,000001,000000<CR> CH1,5.957,000002,000050<CR> ... * When only CH1 is selected and the measurement data readout format is set to 01

8. CR1 Command (Read CH1 measurement values)

Format		CR1,{SQNO},{PRAM}<CR>
Function		Reads CH1 measurement values only. The output format is determined by the FMT command. PRAM: number of measurements PRAM: 0 → continuous measurement until EXT command is received.
Parameter Range		0-999,999 (default: 0)
Example	Send	CR1,123,100<CR> * When 100 count read
	Response	OK,CR1,123,100<CR> CH1,004F15,000001,000000<CR> CH1,004F17,000002,000050<CR> CH1,004F18,000003,000050<CR> ... CH1,004F18,000099,000050<CR> CH1,004F15,000100,000050<CR> * When the measurement data readout format is set to 00
	Send	CR1,123,0<CR> * When continuous read
	Response	OK,CR1,123,0<CR> CH1,5.990,000001,000000<CR> CH1,5.990,000002,000050<CR> ... * When the measurement data readout format is set to 01

9. CR2 Command (Read CH2 measurement values)

Please read all references to CR1, CH1, and Channel 1 in the CR1 command description as CR2, CH2, and Channel 2, respectively.

10. EXT Command (Stop measurement readout)

Format		EXT,{SQNO}<CR>
Function		Stops continuous measurement readout.
Example	Send	EXT,123<CR>
	Response	OK,EXT,123<CR>

4.4. Error Codes

If a control command cannot be processed successfully, an error code is returned.

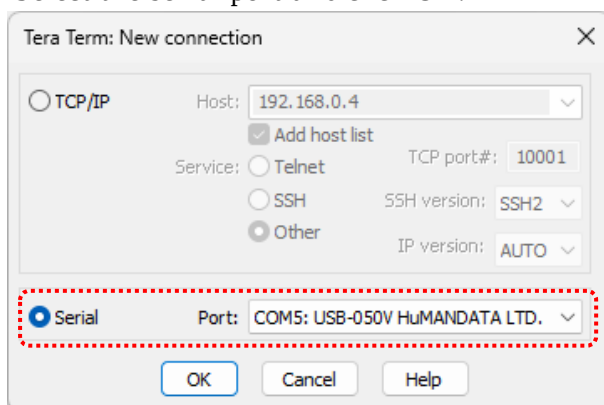
ER001	Command error	Invalid or unsupported command
	Response	ER001<CR>
ER002	Sequence number error	SQNO is missing or exceeds 5 characters
	Response	ER002<CR>
ER003	Parameter setting error	The parameter is outside the allowed range or the parameter data is missing.
	Response	ER003<CR>
ER004	Continuous read active	Stop continuous read before sending a new command
	Response	ER004<CR>

4.5. Example of Command Verification Using Communication Software

The communication software Tera Term is a terminal application for Microsoft Windows that sends characters entered from the keyboard to the connected device and displays the characters returned from the device.

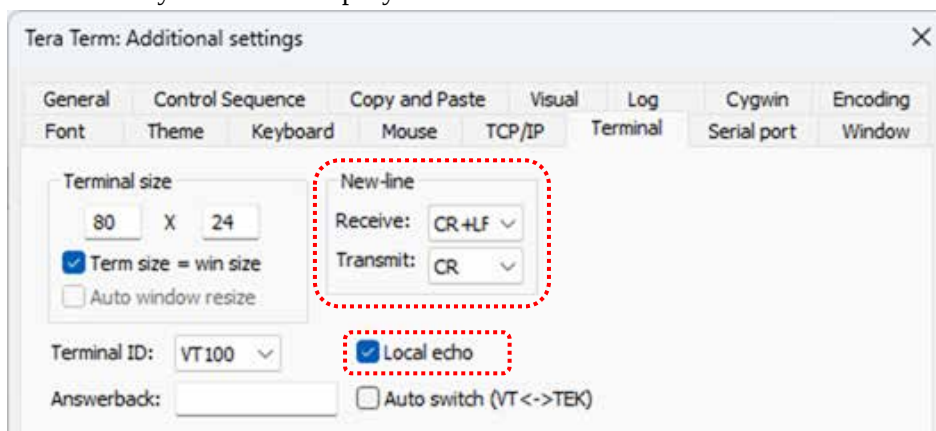
1. Connect the Device

Connect the USB-050V to the PC. Start Tera Term and select “New connection”
Select the serial port and click OK.



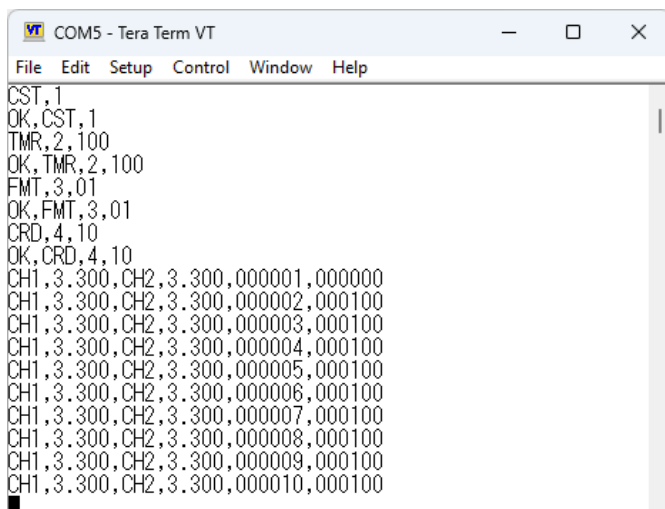
2. Enable Local Echo

Open Terminal Setup > Terminal... and check Local echo so that the characters entered from the keyboard are displayed on the screen. Click OK.



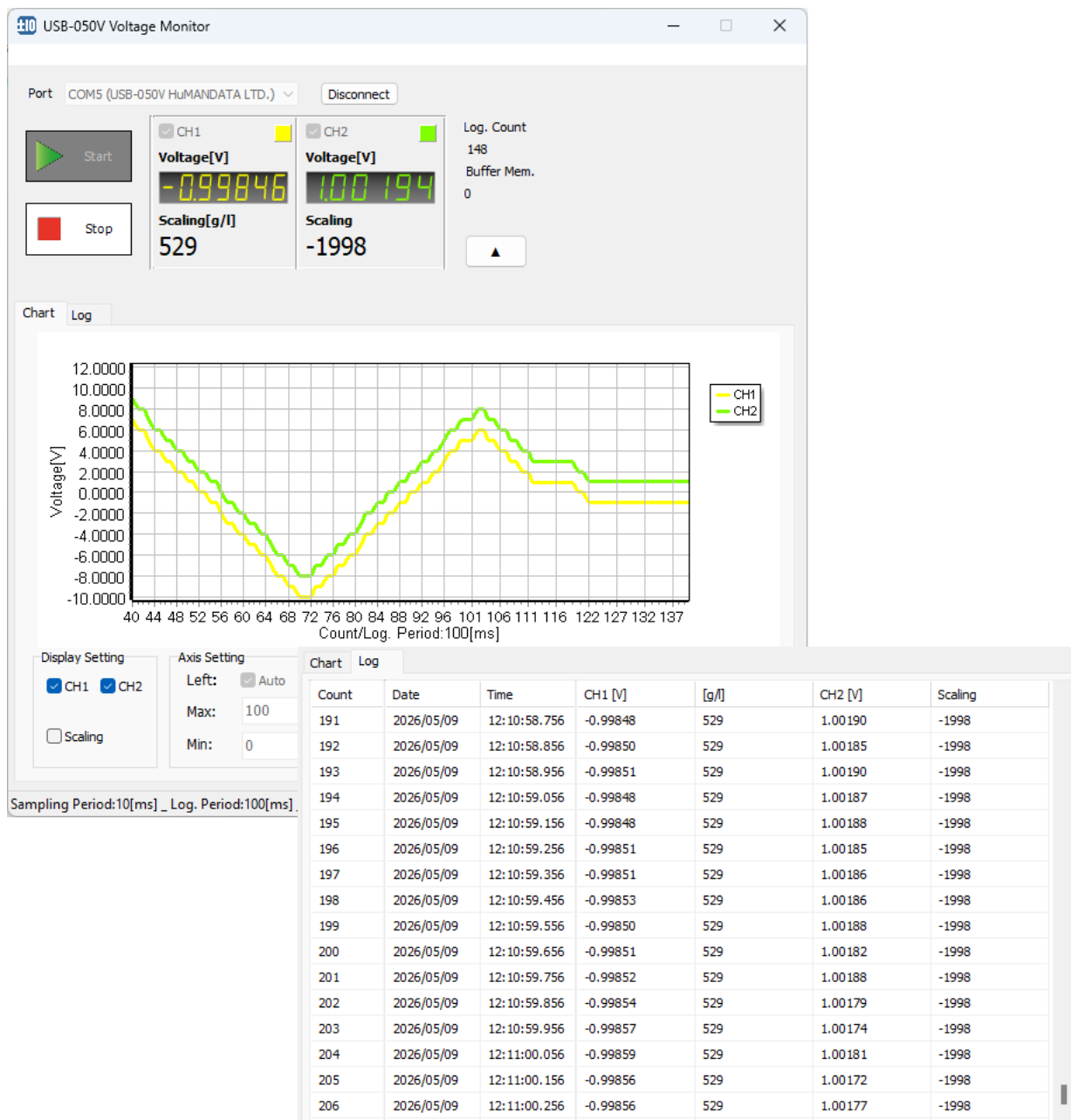
3. Enter Commands

Enter commands in the terminal and confirm the operation of the USB-050V.



5. Dedicated Application (USB-050V Voltage Monitor)

The dedicated application, USB-050V Voltage Monitor, can be used with the USB-050V. It can send control commands to the USB-050V, display measurement results, and perform data logging. This application software and the user's manual can be downloaded from the documentation page. Please refer to Chapter 6, "Additional Documentation and User Support."



6. Additional Documentation and User Support

The following documents and other supports are available at

<https://www.hdl.co.jp/en/faspc/USB/usb-050v>

- | Dedicated Application (USB-050V Voltage Monitor)
 - | User's Manual
 - | Outline Drawing
 - | Device Driver
- ... and more.

7. Warranty and Compensation

Please refer to the following URL for the warranty.

<https://www.fa.hdl.co.jp/en/fa-warranty.html>

2 Channel USB Analog Voltage Monitor

USB-050V

User's Manual

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