

# Instruction Manual for Hb133 Measurement Display Program (Windows version)

This instruction manual is for the measurement display program for Brain Activity Monitor (Hb133).

## Handling precautions

- (1) The NIRS plate is made of flexible material and curve shaped to fit the shape of forehead. **Do not fold, bend, or straighten the NIRS plate by force. It may cause damage on the internal electric circuit and result in malfunction.**
- (2) **Make sure to turn off the device when replacing batteries.** It may cause damage on the internal electric circuit if the batteries are replaced while the power is turned on. A malfunction resulted from such handling behavior shall not be covered by our warranty.
- (3) This is a non-medical device. It cannot be used for medical practices. Please get approval for use by the ethics committee of university or medical institute.
- (4) Make sure that the NIRS plate is closely attached to the examinee's forehead. Any opening or space between the plate and forehead may lead to data loss.
- (5) Near-infrared light does not permeate hair. The device measures the oxygenation status of the frontal lobe of a human by closely attaching the device to the forehead.
- (6) This device is developed for indoor use. Please refrain from using it outdoors as sunlight may interfere the measurement.
- (7) If the surface of NIRS plate got dirty, wipe it with a soft and lightly moisturized cloth. Do not use alcohol or ethanol for cleaning. The synthetic rubber material may deteriorate.
- (8) This device uses Bluetooth-LE (Bluetooth Low Energy).
- (9) Two AAA batteries are used for the device. When placing batteries in the battery box, make sure that the polarity is correctly located.
- (10) The measurement display program is for Windows-PC at this moment.
- (11) The near-infrared light used during measurement is completely harmless to human body.

## Terminology

Term	Description
NIRS plate	The measurement plate. The flexible substrate with LEDs and photodiodes for measurement is covered with synthetic rubber.
Bluetooth-LE	A standard added in Bluetooth 4.0 that is specializing in providing considerably reduced power consumption and cost.

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## 1. Preparation

### 1-1. Computer setup

Bluetooth pairing (“add a Bluetooth device”) is required for Windows-PC. Complete pairing your computer and Hb133 according to the instruction manual for the computer and Hb133 (enclosed).

## 2. Measurement

### 2-1. Start measurement

- (1) Start the measurement display program.
- (2) Click “Start” in the upper left and choose the device to connect from the pull-down list for “Connect to” (a dialog pops up in the middle of screen). The serial number is assigned to each Hb133 device (same serial number as displayed when adding a Bluetooth device) (Figure. 1).
- (3) Choose a preferred sampling rate and click “OK”. Sampling rate is an interval for sampling data. If the measurement rate is “0.1 sec”, it will take 10 data for 1 second. Measurement rate can be selected from “0.1 sec”, “0.2 sec”, “0.5 sec”, and “1.0 sec”.

\*For “Check sensors”, see 2-3 Ambient light check section for more details.

- (4) It takes up to 10 seconds for the computer and the device to reflect the setting and start measurement.
- (5) Trend graphs will be displayed when the measurement started. The arrangement of trend graphs can be switched to horizontal/vertical from “Arrangement” (Figure. 2).
- (6) Click “End” to terminate the measurement. A dialog will appear to save data. Choose a location and name for the file. You can save data also from “File” tab in the upper left (Figure. 3).

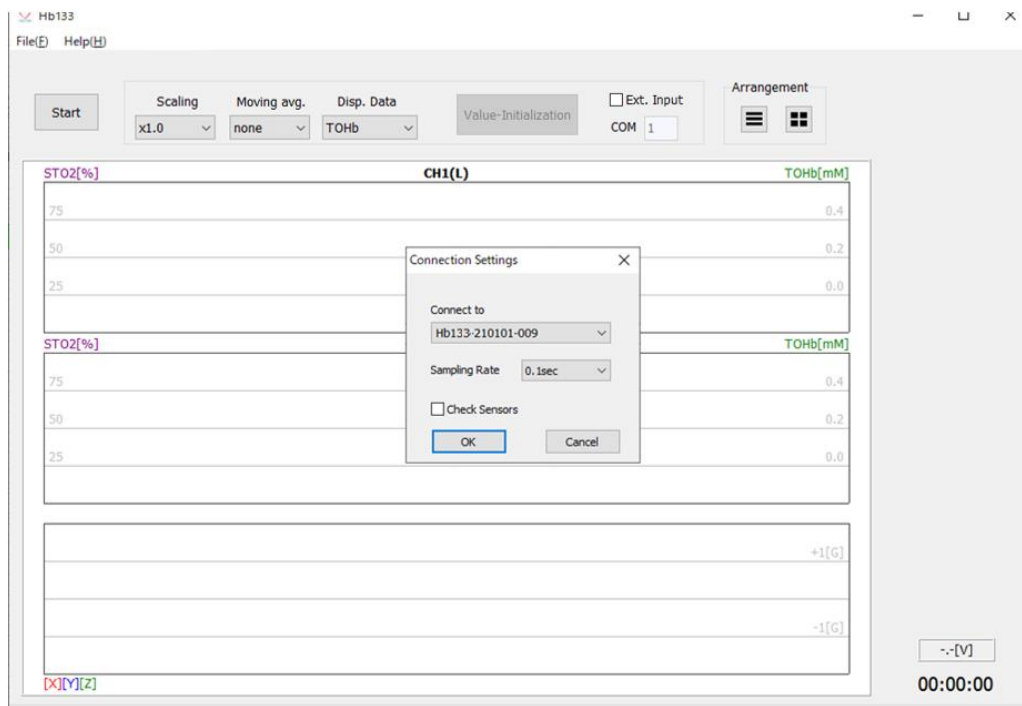


Figure 1. Connection settings



Figure 2. Trend graphs (Horizontal)

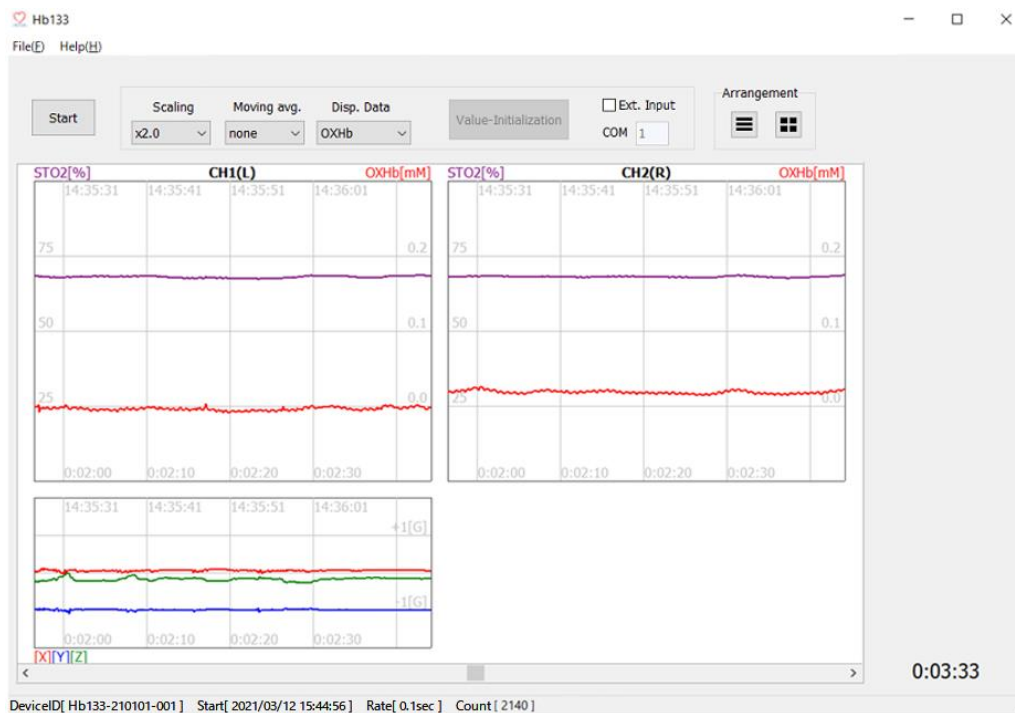


Figure 3. Trend graphs (Vertical)

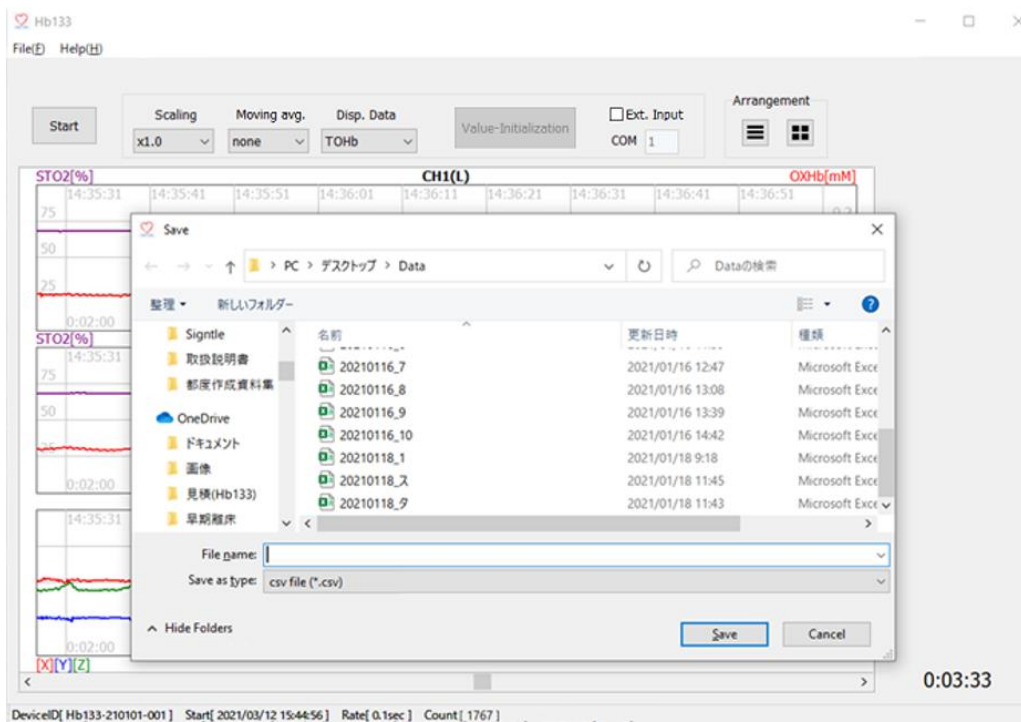


Figure 4. Save data

2-2. Setting and display items

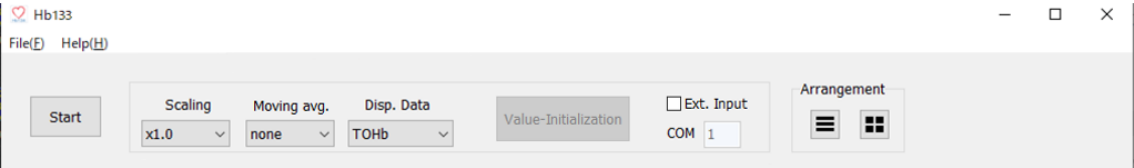


Figure 5. Display items

Start / End

Used for real-time mode.

Start

Data communication between Hb133 and the computer begins.

End

Data communication between Hb133 and the computer ends.

Scaling

Display magnification for the vertical axis can be selected from 0.5 to 8.0 times.

Moving avg.

Moving average of measured data makes the trend graphs easier to read if there is too much fluctuation in the data. The range can be selected from “none”, “3 points”, “5 points”, “7 points”, “9 points”, and “11 points”.

Disp. Data

Display items can be selected for the trend graph screen. In addition to Oxygen Saturation (StO<sub>2</sub>), Oxyhemoglobin (OXHb), Deoxyhemoglobin (DXHb), and Total hemoglobin (TOHb) can be selected. The unit for StO<sub>2</sub> is %. The rest shows variation with the unit of mM.

Value-initialization

All values except for Oxygen Saturation (StO<sub>2</sub>) will be initialized to 0. These are the value of change and may largely fluctuate when the NIRS plate slips out of position. This is a command that forcibly initializes the values.

Battery voltage

It shows the current voltage of batteries used for the device. The displayed numbers turn yellow when the battery voltage decreased to 2.5 V. It turns red when the voltage decreased to 2.2 V. In that case, please turn off the device and change batteries of the device. The device operates with the voltage lower than 2.2 V, however, the reliability of measurement may decrease (Figure. 6).

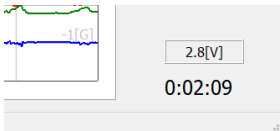


Figure 6. Battery voltage

Elapsed time

It shows the elapsed time since the measurement started.

Accelerometer

An accelerometer is embedded in the middle of NIRS plate. X axis is set for right and left, Y axis for up and down, and Z axis for front and back direction.



The accelerometer is located in the middle of NIRS plate.

Max. 2G

Left	X	–	Right	X'
Up	Y	–	Down	Y'
Front	Z	–	Back	Z'

' (apostrophe) stands for negative signals

Figure 7. Accelerometer

### 2-3. Ambient light check (Check sensors)

The ambient light check mode begins if “Check sensors” box is checked at “Connection settings”. This mode tests the measurement environment and checks whether the NIRS plate is correctly attached. All LEDs used for measurement are turned off in this mode. Therefore, detected data at photodiodes reflect the ambient light in the measurement environment and will be displayed with a trend graph.

Even the photodiodes detect high values (the degree of ambient light is high), the device can normally measure oxygen saturation as long as it (the ambient light) is stable. If there are fluctuations, it may influence measurement. Therefore, it is better and more accurate to take measurement in the environment with less ambient light. If the value stays high and unstable, turn off the room light or cover the head with e.g. a light-blocking cloth.

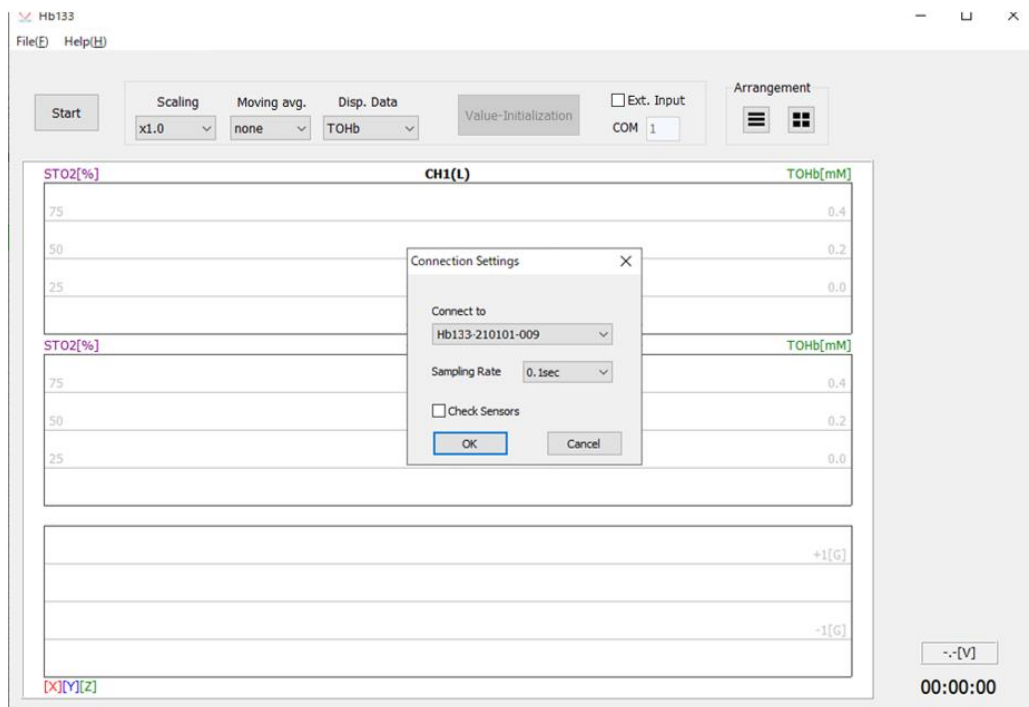


Figure 8. Connection settings screen



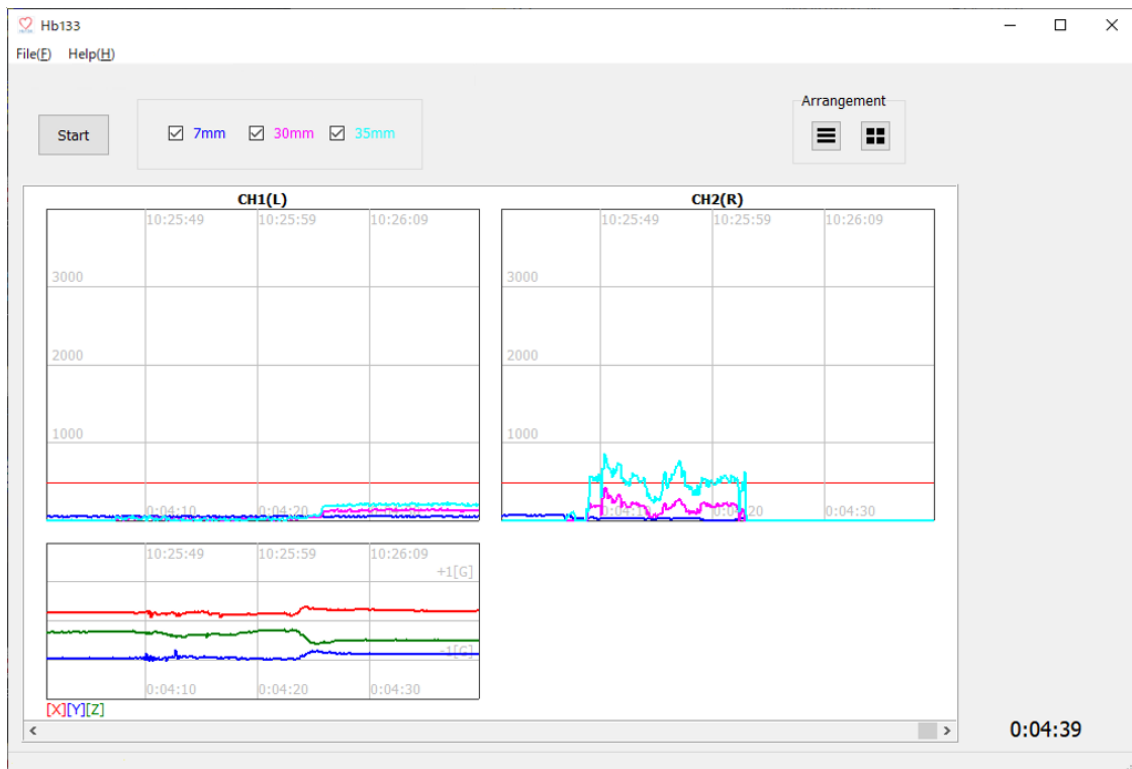


Figure 9. Connection settings screen (CH2 has ambient light)

The trend graph of each photodiode can be displayed/hidden by checking/unchecking the check boxes of 7 mm, 30 mm, or 35 mm (Figure. 10). This function is used for troubleshooting. Photodiodes are located at 7 mm, 30 mm, and 35 mm from LED as the measurement algorithm uses space - resolved spectroscopy.

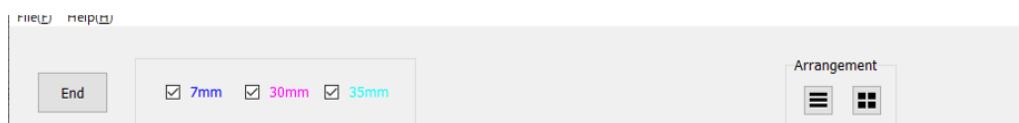


Figure 10. Distance of photodiodes from LED

## 2-4 Event mark insertion

The program has a function to insert a mark into the trend graphs when a task was given to the examinee during the measurement. There are two ways to add a mark:

### Numeric keypad on computer (that is connected to the device)

A vertical line will be inserted in the trend graph by inputting a number on numeric keypad. If input key "1", a line with "1>" will be inserted. This can add only "start" mark.

### An input from external input

It is possible to add a mark from an external input by checking “Ext. input” box in the upper right corner and set a COM number. This can add both “start” and “end” mark (start: n>, end: <n). For more information on this, see “Hb133Measurement App External Input Communication Specifications”.

## 2-5 Finishing the measurement

When you end the measurement, you can check the measurement data from the beginning. By sliding the slide bar located at the bottom of the trend display screen, you can check the measurement data from the start of measurement.



Figure 11. The slide bar

### 3. Menu

#### 3-1. File menu

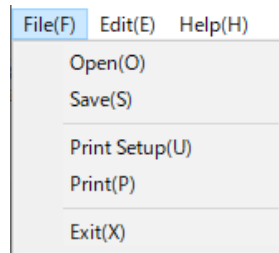


Figure 12. File menu

Open (O)	Import CVS file and display trend graphs
Save (S)	Save displayed trend graph data as CVS file
Print Setup (U)	Setup for printing
Print (U)	Print the display image
Exit (X)	Exit the program

#### 3-2. Help menu

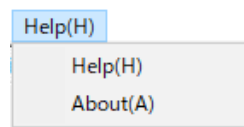


Figure 13. Help menu

Help (H)	This document will open.
About (A)	The information of the program will be displayed.

### 4. Troubleshooting

“ERR” will be displayed on a corresponding trend graph of the channel if any errors are caused. Place the cursor on the trend graph displaying ERR for details of the error. Details of the ERR will be displayed in “Error status” box. Read the details and take appropriate actions.

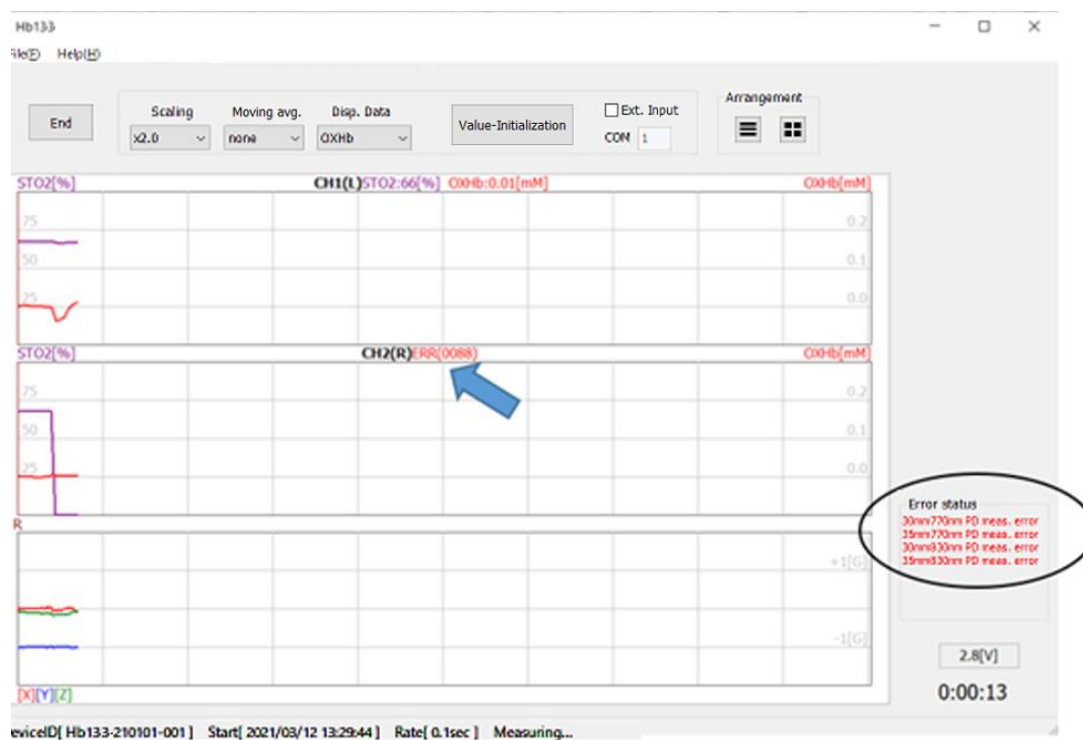


Figure 14. Error messages

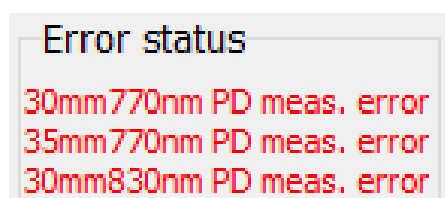


Figure 15. Details of the error

7mm770nm PD meas. error
30mm770nm PD meas. error
35mm770nm PD meas. error
35/30 770nm ratio error
7mm830nm PD meas. error
30mm830nm PD meas. error
35mm830nm PD meas. error
35/30 830nm ratio error
OXHb,DXHb calc. error
STO2 calc. error

Table 1. List of error messages

## 5. External input communication specifications

Communication specifications for external input of events into Hb133 application by serial communication are as follows:

### 1. Command

(1) Start event (External device → measurement application)

[STX] Sn[ETX]

n: Event number 1 to 9 (ASCII decimal 1 digit)

(2) End event (External device → measurement application)

[STX] En[ETX]

n: Event number 1 to 9 (ASCII decimal 1 digit)

### 2. Communication conditions

Communication method	RS-232C
Communication speed	9600 bps
Character length	8 bit
Parity	None
Stop bit length	1 bit

Product designs and specifications are subject to change or be improved without prior notice. Please check the version of the software you are using.

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