neuroNicle FX2

neuroNicle FX2 User Manual

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Abstract – neuroNicle FX2 is a 2 channel electroencephalogram, 1 channel pulse wave measuring instrument, and it is an integrated device equipped with electrode and device in a hair band type external surface. The measured data is transmitted in real time to the host side via Bluetooth. Since the communication standard of the device is open, the user can directly develop the program. The basic viewer program that is provided with the device allows real time monitoring of EEG measurement waveform, its power spectrum, pulse wave waveform and heart rate interval, and measurement waveform can be saved as txt file. The rechargeable battery can be charged with the supplied u-USB cable and can be used continuously for 7 hours with a 2 hour charge.

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REVISION HISTORY **42**

neuroNicle FX2 summary.

neuroNicle FX2 is a real-time EEG / PPG simultaneous real-time measurement device that detects 2-channel EEG signals and 1-channel PPG and transmits them to the host side via Bluetooth (SPP) communication in real time. The EEG electrodes are placed on the left and right forehead regions, and the reference electrode and the ground electrode are attached to the right earlobe in the form of a pinch. The PPG sensor is provided together with the clamping electrode. The device is powered by a rechargeable lithium polymer battery and the remaining battery level and its under-state value are assigned and transferred to the LXSDF T2A format along with the measurement data. Charge through a USB port on your computer with a micro USB cable. The device can be used continuously for 7 hours with a 2 hour charge.

Open communication standard

Refer to the communication specification (LXSDF T2A) document and the neuroNicle FX2 data layout document (LXE141), it is possible to directly implement a host device program suitable for the user. The host device must be able to support the Bluetooth SPP.

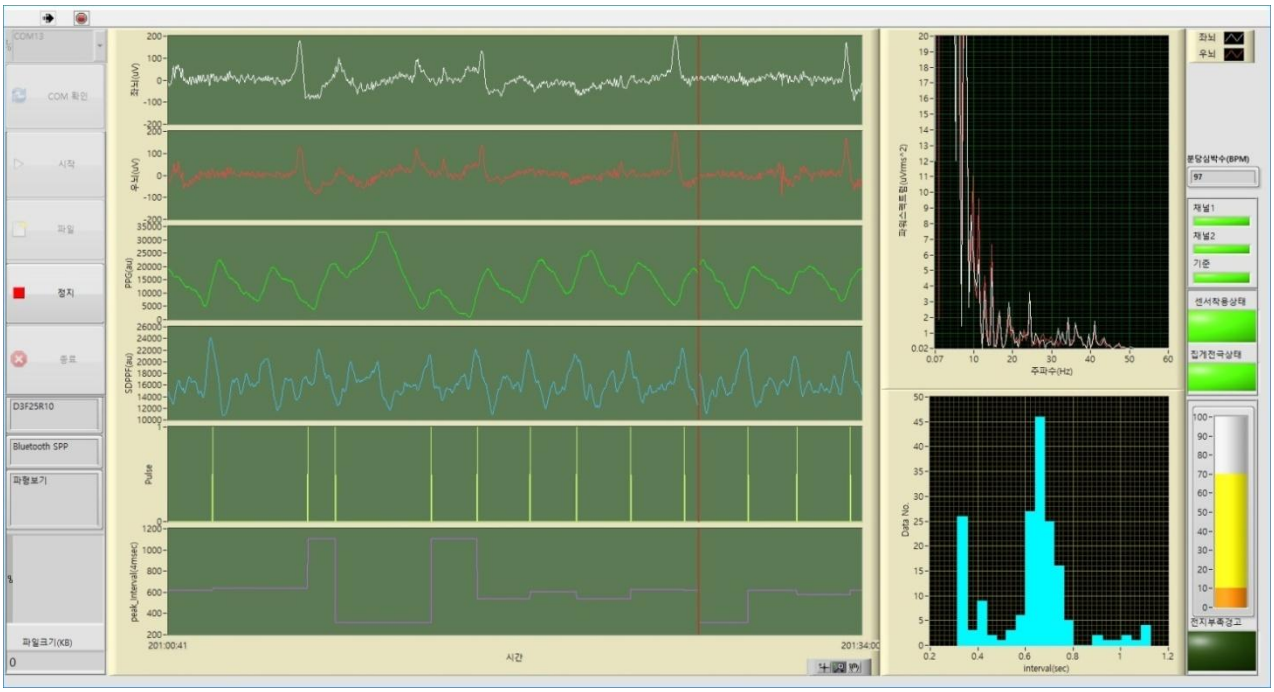
Documents for app developers: communication data specification.

Document ID: LXE141, Document Title: neuroNicle FX2 Data Communication Standard. Download:https://github.com/neuroNicle/neuroNicle-FX2/raw/master/LXE141_neuroNicle-FX2_CommunicationSpec_en.pdf
Document ID: LXE10, Document Title: LXSDF T2A communication specification. Download: https://github.com/LAXTHA/LXSDF/raw/master/LXE10_LXSDFT2A_CommunicationStandard_en.pdf

viewer S/W

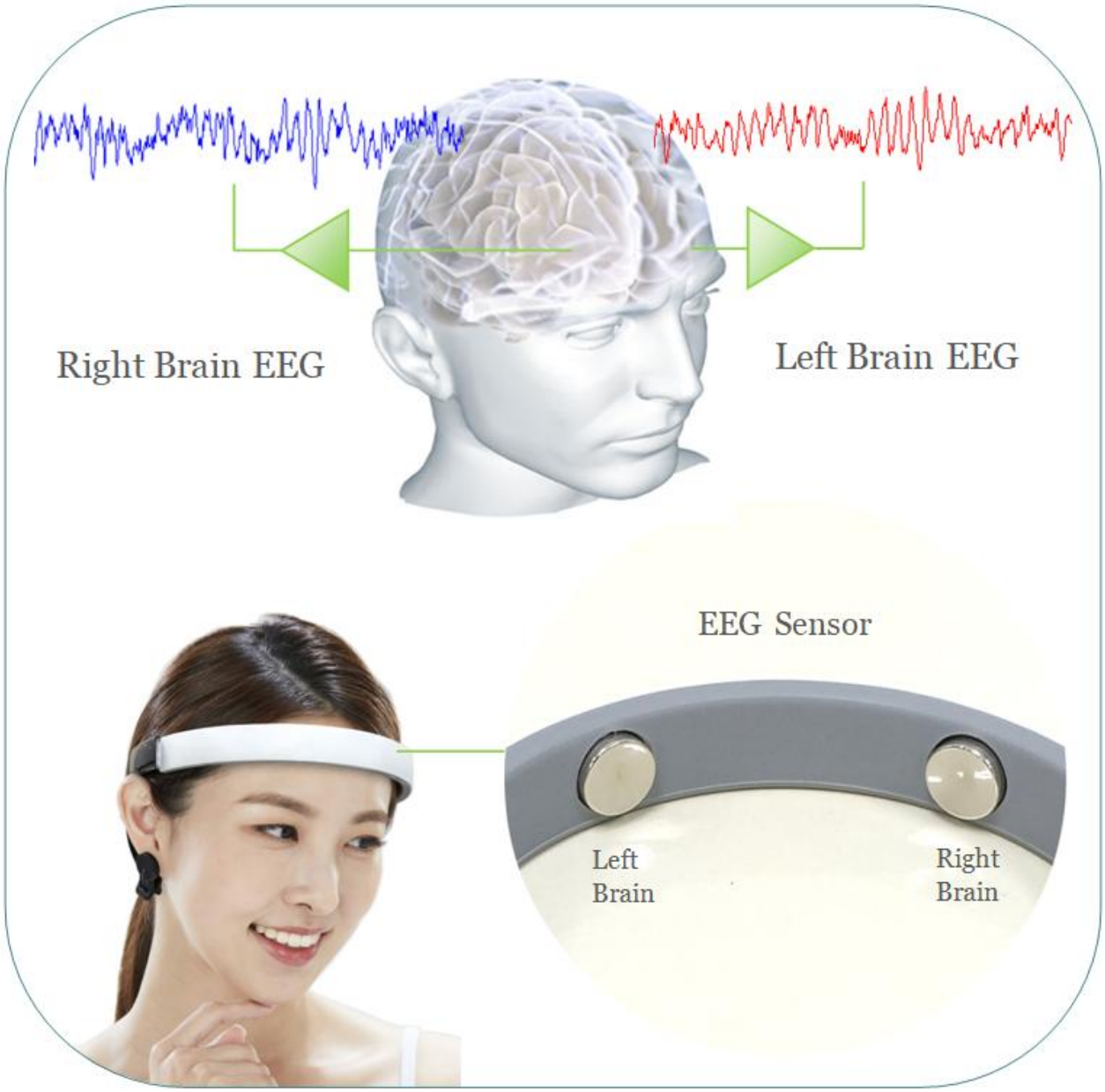
A simple data viewer program that is provided with the device allows you to view the 2-channel EEG waveform, 1-channel PPG, and related data (secondary differential PPG, heart rate pulse, heart rate interval, left brain power spectrum, heart rate interval histogram) can be monitored. The measured waveform and related data can be saved as a txt file (except power spectrum and histogram for stored data). PC-based data viewer software is available for download in the following path.

Viewer S/W Download : https://drive.google.com/open?id=1BhisRMvdcWwi307naSxkcuwSlnFNEGdr



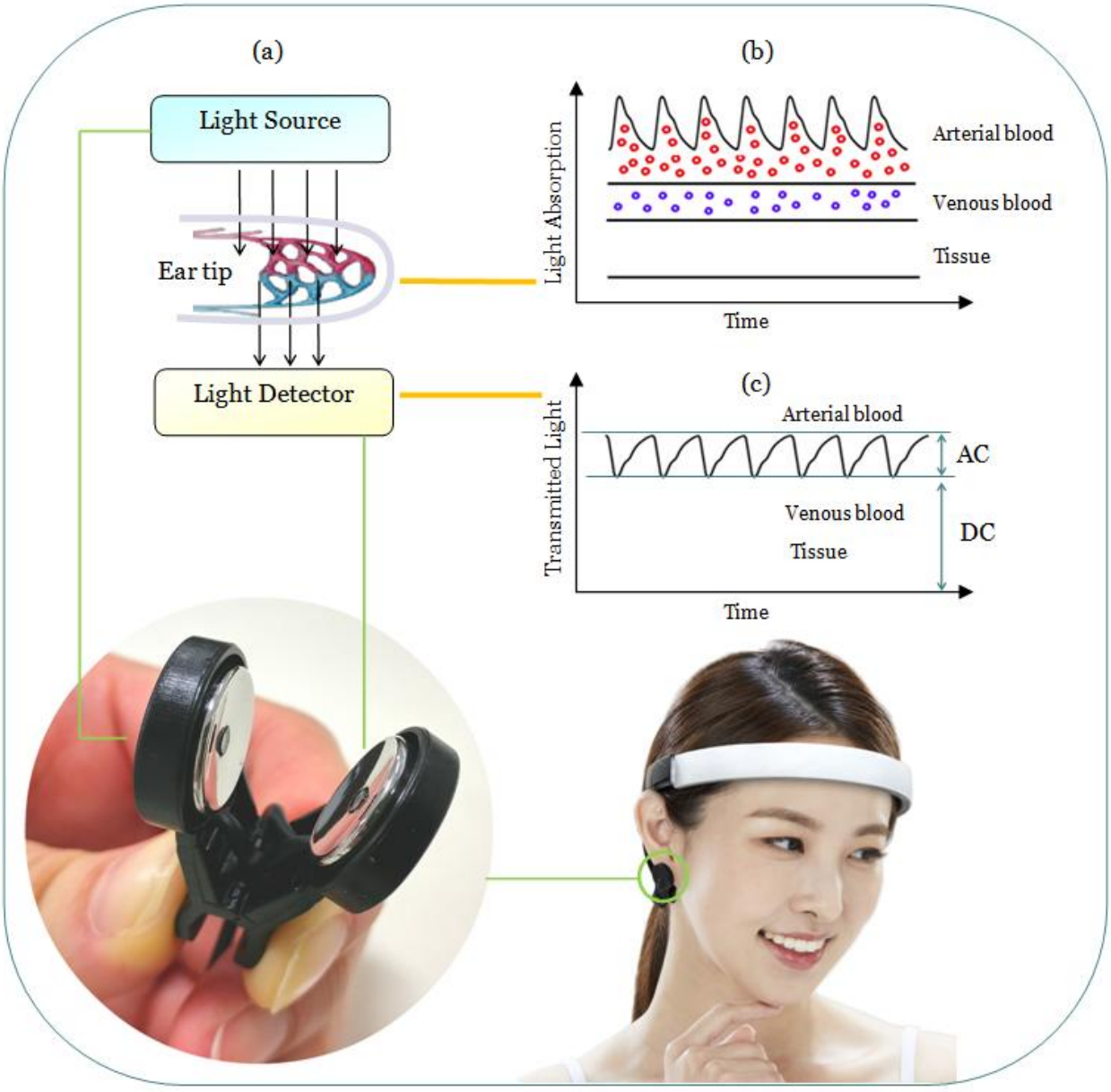
EEG measurement

neuroNicle FX2 EEG electrodes are placed on the left and right forehead, and the reference and ground electrodes are attached to the right earlobe in the form of a pinch.



PPG measurement.

neuroNicle FX2 is equipped with an optical PPG sensor with a ear clip electrode, and can measure PPG simultaneously with EEG measurement. When light is emitted from the light source to the earlobe, light is absorbed in the blood and tissue, and some light is transmitted through the light receiver (Fig. a). Absorption of light is absorbed proportionally to changes in blood flow due to heartbeat (Fig. b). Since the amount of transmitted light detected by the light receiving part is subtracted by the amount of light absorbed from the earlobe, the change in the light amount of the transmitted field reflects the change in blood flow synchronized with the heartbeat (Fig c). The pulse wave measurement on the neuroNicle FX2 detects the AC component of Figure (c).



Bluetooth Connectivity

Can communicate with any device that supports Bluetooth SPP profile.

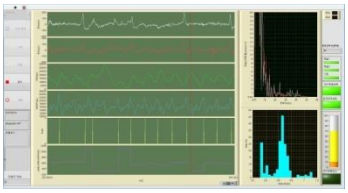
Precautions : neuroNicle FX2 Connectable Smartphone
The smartphone must support the Bluetooth SPP profile to communicate with the device.

- Communicable devices Example: All the latest Android phones.
- Non-communicable devices: All of Apple's products such as iPhone.

Real time data wireless transmission.

neuroNicle FX2 transmits the measured data to the host in real time. EEG data, as well as EEG spectrum, heart rate, heart rate interval, and device status information are transmitted in real time. Refer to the communication specification (LXSDF T2A) document and the neuroNicle FX2 data layout document (LXE141), it is possible to directly implement a host device program suitable for a user.

Components

Turn	Item	Quantity	Image	Contents
1	Device	1		Hair band type device body. Built-in rechargeable battery.
2	micro USB cable	1		Connect to the micro-USB connector on the device. Rechargeable.
3	Viewer S/W	1		neuroNicle FX2 Viewer -PC-based real-time data viewer software.

Table[1]. List of device components.

Download neuroNicle FX2 Viewer S / W installation file :
https://drive.google.com/open?id=1BhisRMvdcWwi307naSxkcuwSlnFNEGdr

Usage - Device

Power on / off

Figure[1]. Locate the power button and status LED on the device.

Power on

[1]. With the sensor band not worn, press and hold the power button for 1 second.

Figure[2]. Press the power button for more than one second.

Figure[3]. The blue LED lights up. At this time, release the power button. If you release the power button before the blue LED is lit, the unit will not turn on.

[You have to *Power on / off with no band on head.*]

[2]. The red LED and blue LED blink when the device is powered and the device is ready for use.

Figure[4]. If the red LED and the blue LED blink at the same time every 1 second, the device will operate normally (waiting state). At this time, when the device is connected to the host (computer, smart phone, etc.) via Bluetooth, only the blue LED flashes.

[*Refer to the data specification (LXE141) for the operation mode of the device.*]

Power off

If you remove the sensor band from the head after use, the unit is in the "Power On" state [2] (standby mode). At this time, power off is performed.

[1]. Press the power button (see figure [1]) in the state [2] of "Power On". If you press and hold for more than 2 seconds, the blue LED remains lit (does not blink).

Figure[5]. At this time, it is shown in Figure[1].

[2]. Release the power button after the blue LED lights up. Then, the power supply to the device is stopped.

Figure[6]. Power off is complete.

[*If standby mode lasts for 3 minutes, auto power off. When the device is operating in the measurement mode, the device power is automatically turned off even if the Bluetooth connection has been off for more than one minute. Refer to the data specification (LXE141) for device operation mode.*]

Charging

If the status LED does not light up after you press the power button, charge the device using the supplied micro USB cable (component # 2) (the device operates in charge mode).

[1]. Connect the micro USB cable to the USB port on your computer or smartphone charger.

Figure[7]. Connect the micro USB cable to the USB port on your computer.

[2]. micro USB cable Connect the connector to the device.

Figure[8]. Connect the charging micro USB cable to the micro USB cable connector on the device.

[3]. Green LED flashes every 2 seconds after USB connection.

Figure[9]. When charging, the green LED blinks every 2 seconds. When charging is complete, the green LED remains on.

Wear sensor band

Wear sensor band on head

If power is applied to the device normally (Figure [4]), wear an EEG sensor band on the head.

[1]. Attach the band to the head. Wear the measuring electrode part while rubbing it up and down so that the measuring electrode is attached well to both foreheads.

Figure[10]. Sensor band worn on the head.

[*Before worn, it is necessary to rub the surface of the measuring electrode with a finger or wipe it with a wet tissue to keep the surface of the electrode clean, and to fix it to the head so that the band does not shake after wearing it.*]

[2]. After wearing the band, attach the ear clip to the right earlobe.

그림[11]. Attach the ear clip electrodes (reference and ground electrodes) to the right earlobe.

[*When the band is correctly attached to the head and the electrode is attached to the skin, the device recognizes the wearing condition. In this case, the green LED is blinking every 2 seconds. At the same time, the red LED flashes in sync with the heartbeat pulse. See the data sheet (LXE141).*]

Remove the sensor band from your head

[1]. To remove the sensor band from your head, remove it from the earlobe first from the ear clip attached to the right earlobe.

[2] Take the band off your head.

[3]. If you are not using the device, power off the device (see Powering Off).

[If the host and Bluetooth connection are released for more than one minute while the sensor band is worn, or if the sensor band is not worn for more than 3 minutes, the power of the device turns itself off.]

View measurement waveform

To see the measurement waveform, first put the device on the head and let the device operate in the measurement mode. The software displays the data to be output when the apparatus is driven in the measurement mode. Two types of data are displayed. One is to display the data provided by the device as it is, and the other is to process and display the data provided by the device. In the former, there are left and right brain wave waveforms (EEG-CH1, EEG-CH2), pulse wave waveform (PPG), secondary differential pulse wave waveform (sdPPG), heartbeat pulse (pulse) and heartbeat interval (peak_interval), And the latter has an EEG power spectrum and a heart rate interval histogram.

If the device is properly worn (see [11]), run the neuroNicle FX2 Viewer to check the measured waveform.

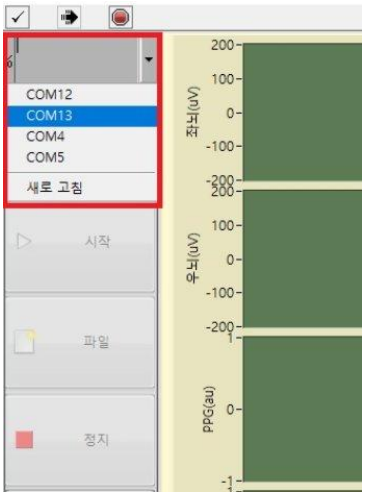
[*In order to check the measured waveform with software, the computer must have a Bluetooth communication port. If there is no Bluetooth communication port, first install the Bluetooth dongle on that computer. (Refer to the manual of the purchased dongle for installation instructions.)*]

[*If your computer is equipped with a Bluetooth communication port, you should add neuroNicle Fx2 as a Bluetooth device.* ***(See appendix 1 for how to add devices)***]

[*nnFX2_Viewer Software must be installed on your computer.* ***(See Appendix 2 for software installation instructions.)***]

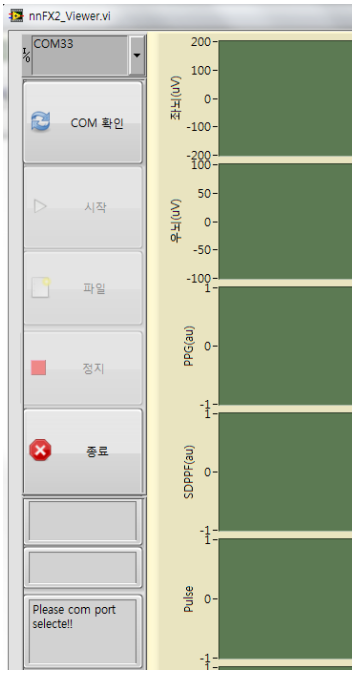
Use the following procedure to check the data.

[1]. Set the COM port of the device.

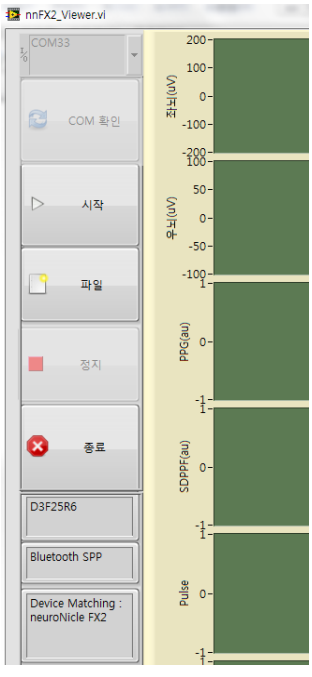


Figure[12]. Set the COM port of the device.

[2]. Click the "COM Check(COM 확인)" button.



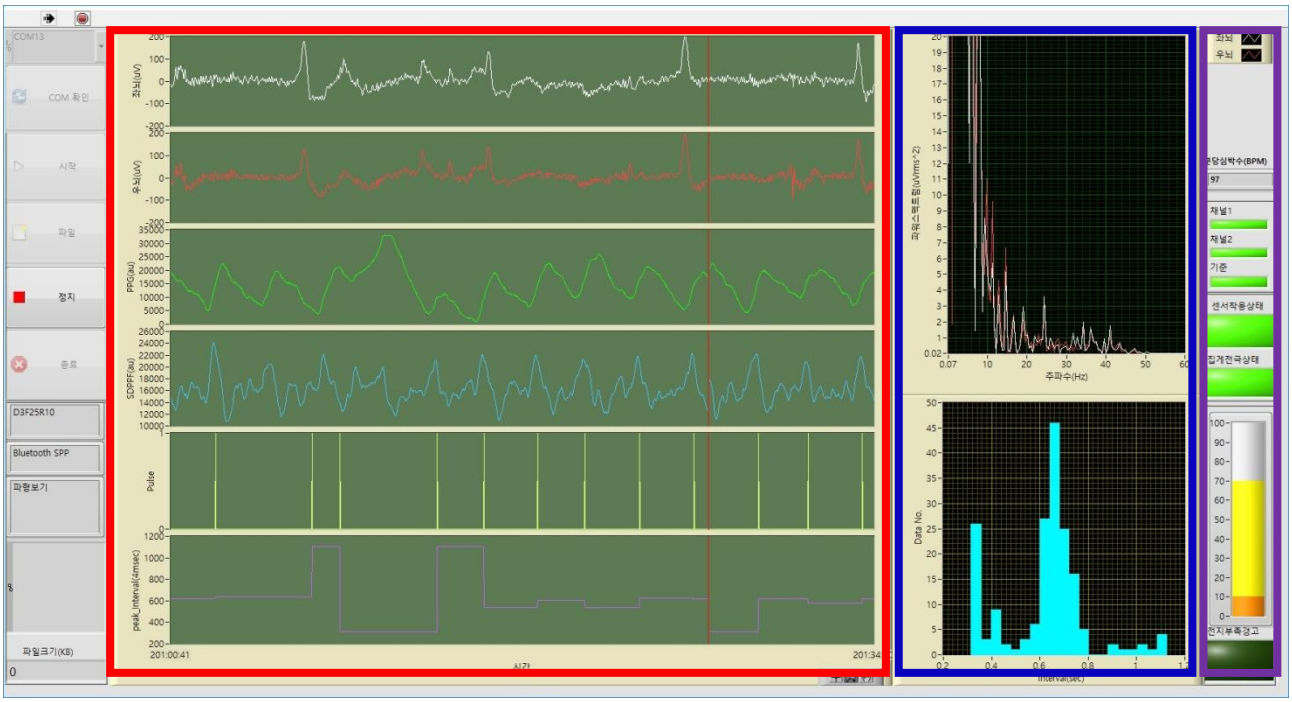
[Before COM Check]



[After COM Check]

Figure[13]. The COM Check button is disabled, and the Start and File menus are active.

[3]. Click the "Start" menu to check the measurement waveform.



Figure[14]. Measurement data that can be checked with the neuroNicle FX2 device.

You can see the direct data (red rectangle), the processed data (blue rectangle), and the device status information (purple rectangle) provided by the device. The processed data includes the EEG power spectrum obtained by software FFT from the EEG waveform and the histogram graph obtained from the heart rate interval data. We can confirm the alpha peak in the EEG power spectrum.

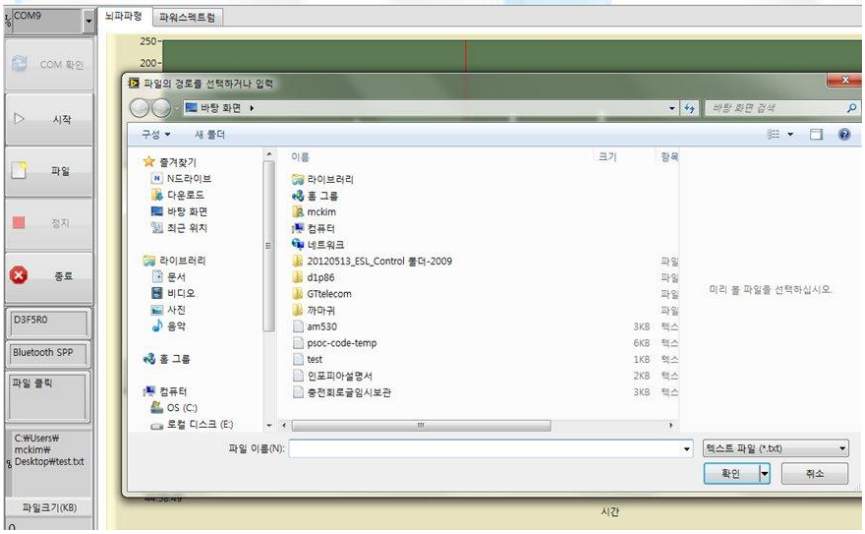
Saving the Measurement Waveform

The software can store measurement data with real-time waveform display. The data items stored are as follows : EEG-CH1, EEG-CH2, PPG, sdPPG, Pulse, peak_Interval.

The data is saved in real time txt file format at 4msec intervals, and the size of the file to be saved is displayed at the lower left of the screen.

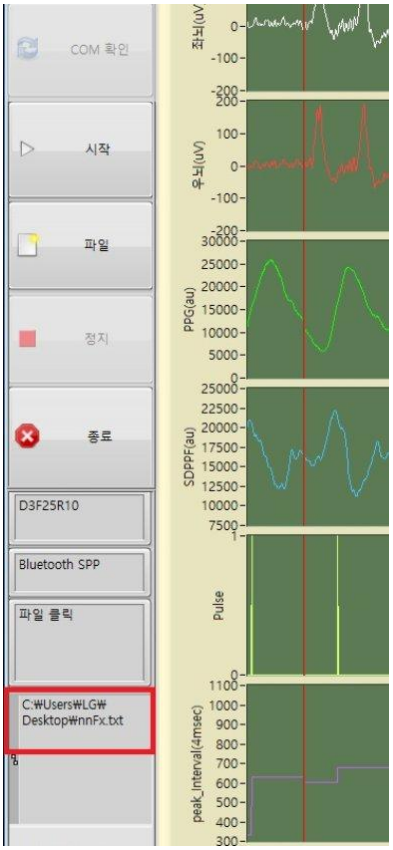
To save the waveform, follow the procedure below.

[1]. Name the file. Click on the "File" menu in the "After COM check" in the figure [13] before viewing the waveform.



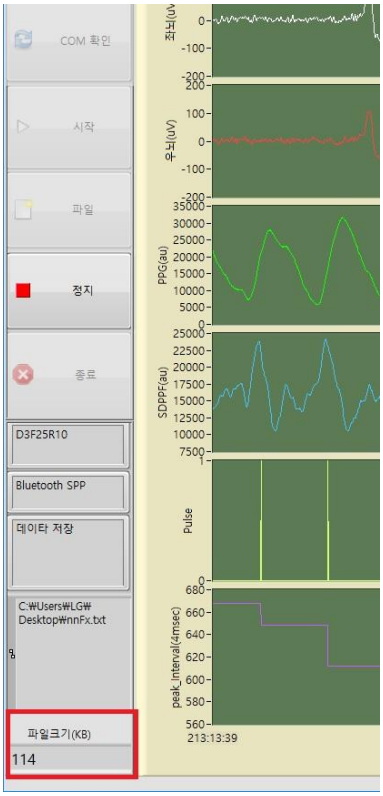
그림[15]. Clicking on the "File" menu brings up the file specification window. Here, specify the appropriate folder and filename.

[2]. Check the folder and name of the specified file.



Figure[16]. Make sure the specified folder and name are correct.

[3]. Click on the "Start" menu to get the measured waveform. At this time, it is confirmed that the " file size " increases in kB units.



Figure[17]. As the waveform view progresses, the file size increases. It is confirmed that it is currently 102kB. Even if the software stops in the middle, the stored data is safely preserved. There is no EEG power spectrum and heart rate interval histogram data in the stored data.

How to use - Viewer S/W

Menu selection order

com port Set → Start(Check data)→ Stop → End, or com port Set→ File(Specifying the data storage file)→ Start→ Stop → Follow the shutdown procedure.

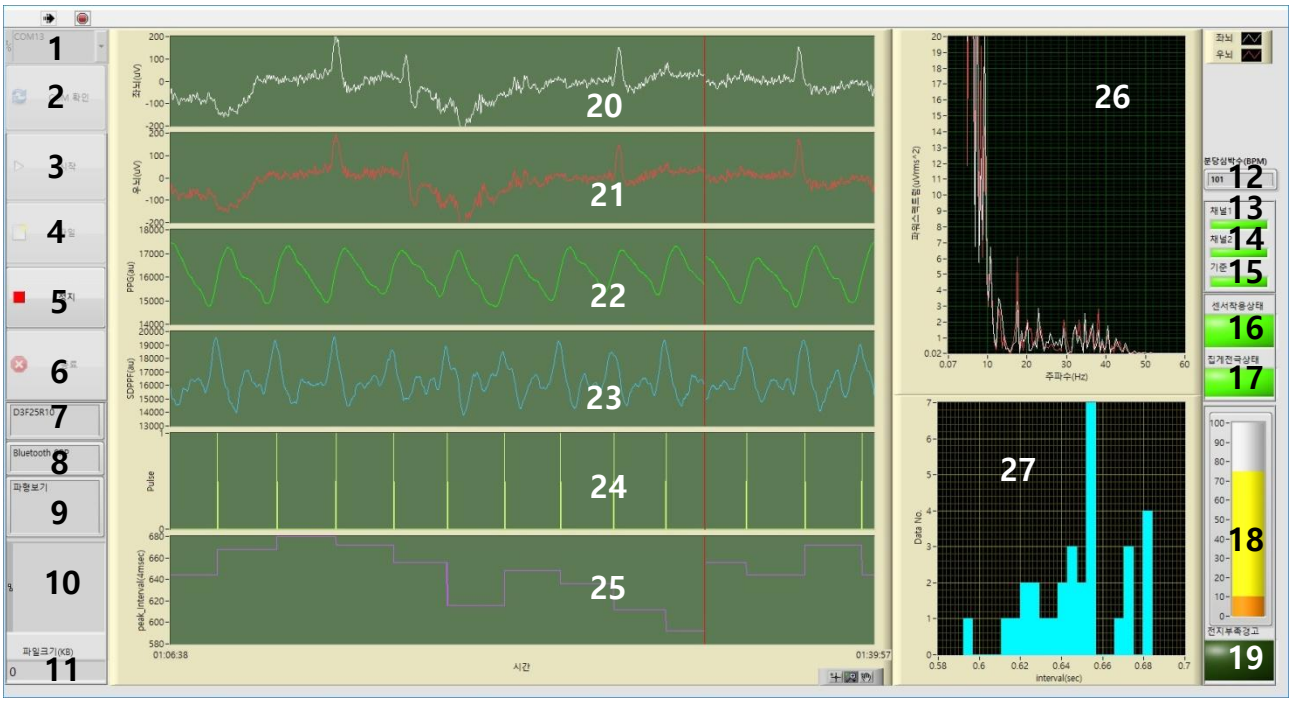
Using software	menu turn	COM port	COM Check	Start	File	Stop	End	Explanation
COM port Check	1	✓						Select the com port number of the device. The com port should be selected each time you start the software.
	2		✓					If this device is present in Com port, this menu is disabled.. If not, go back to step 1 again.
View measurement waveform	1	✓	✓					Proceed in the same way as "COM port check".
	2			✓				Identify the direct data and process data (power spectrum, histogram) provided by the device.
	3					✓		The current state stops. At this time, com port is closed. Clicking the Start button reopens the com port.
	4						✓	Software shutdown
Saving the Measurement Waveform	1	✓	✓					Proceed in the same way as "COM port check".
	2				✓			Specify folder and file name.
	3			✓				The file size increases from the time waveform view starts. At this time, although the spectrum and the histogram can be seen, the data is not stored.
	4					✓		stop. Storage session completed. You must specify the file again for a new save..
	5						✓	Software shutdown.

Table[2]. Procedures for using software.

Waveform storage may or may not be performed depending on whether "file" is specified prior to "start". Overwriting a file depends on the user's choice.

Viewer S/W Screen description

Viewer software screen configuration for neuroNicle FX2 device.



Figure[18]. neuroNicle FX2 waveform view software screen.

[1]. COM port number : If the software is correctly installed, show all com ports installed on your computer when you start the software. Select the correct number to match the com port of the device.

[2]. COM Check : Check that the com port setting in [1] matches the device. If the neuroNicle FX2 device is found on the com port, this menu will be disabled and the menu [3], [4] will be activated.

[3]. Start : If this button is active, you can check the waveform. When this menu is selected, only [5] stop button is activated.

[4]. File : Select this menu to specify the folder and name of the file to save. Waveform storage is possible only when a new file is specified. If you select an existing file when you specify a new one, you are asked if you want to "overwrite" it. If the user allows "overwrite", the new waveform data is written to the existing file.

[5]. Stop : It is activated only in the waveform view (click [3] start button). "Stop" closes com port and save file.

[6]. End : Exit the software.

[7]. Firmware information : Displays the firmware ID of neuroNicle FX2.

[8]. Communication path information : Show communication path information used by neuroNicle FX2.

[9]. Status Notification Window : Displays the current operating mode of the software.

[10]. File path : Displays the name and path of the file to be saved. The files are stored in txt format.

[11]. File size : Displays the size (in kB) of the file to be saved in real time.

[12]. Real-time heart rate per minute : Displays the real-time heart rate in bpm.

[13]. Channel 1 electrode connection state : Indicates whether the channel 1 electrode (left forehead electrode) is in contact with the skin. When contacted, it turns green.

[14]. Channel 2 electrode connection : Indicates whether the channel 2 electrode (right forehead electrode) is in contact with the skin. When contacted, it turns green.

[15]. Reference electrode connection status : It indicates whether or not the reference electrode (ear clip electrode) is in contact with the skin. When contacted, it turns green.

[16]. Sensor wearing state : Indicates whether the sensor band is worn on the head. If correctly worn, it is green, otherwise it is red.

[17]. Ear clip electrode state : Check that the electrodes are in contact with each other on the clamp structure with the ground and reference electrodes. If the electrodes are stuck together, they are displayed in green. If it is not in contact, it is displayed in red.

[*If the ear clip are stuck together but not stuck, the device is in a broken state.*]

[18]. Battery remaining : Displays the remaining battery level (in%). The value changes by 5%. The remaining amount is displayed in yellow, and the lower limit (10%) is indicated in orange. If the current level is below the lower limit, a low battery warning ([19]) occurs. The value can be varied at the boundary value.

[19]. Low battery warning : If the current battery level is less than 10%, a low battery warning occurs and turns red. If a low-battery warning occurs, stop using it and charge the battery.

[20]. Left brain waveform (EEG-CH1) : It shows the EEG detected by the left forehead electrode. The signal size unit is uV. The maximum and minimum values of the graph can be changed by double-clicking the value.

[21]. Right brain waveform (EEG-CH2) : It shows the EEG detected by the right forehead electrode. The signal size unit is uV. The maximum and minimum values of the graph can be changed by double-clicking the value.

[22]. PPG: The PPG detected by the sensor provided on the ear clip electrode is displayed. Automatic gain control (AGC) of the PPG is performed once when the initial sensor is worn. During the measurement, the pulse wave signal can be changed according to the size of the original signal. If the PPG is not measured correctly, remove the ear clip and try again.

[23]. Second Differential PPG (sdPPG): It is the data provided by the device as a pulse waveform obtained by differentiating the PPG by a second time. A heartbeat pulse is detected at the apex of this waveform. The magnitude of this signal varies with the size of the PPG.

[24]. Heartbeat pulse (pulse): It is the heartbeat pulse detected at the apex of the sdPPG signal. This data is from PUD0.bit7.

[25]. Heart rate interval (peak_interval): It is the time interval between heartbeat pulses displayed in msec. This data can be used as raw data for HRV analysis. The accuracy of this value is 4 msec.

[26]. EEG power spectrum : The power spectrum of left and right brain EEG waveforms is shown. This is the power spectrum obtained by FFTing the sampling interval data of 4 msec for 2 seconds of waveform. It is obtained by real-time FFT by pushing single data. The frequency resolution is 0.5 Hz and the maximum frequency is 125 Hz. The frequency value of the horizontal axis can be adjusted by changing the boundary value by double-clicking.

[27]. Heart rate interval histogram : The heart rate interval data of [25] is expressed as a histogram graph. The number of data used is 180, and the class interval is set to 20. At approximately 3 minutes, the first data is excluded from the histogram graph.

Device Specifications

Device Configuration

그림[19]. neuroNicle FX2 Device Configuration

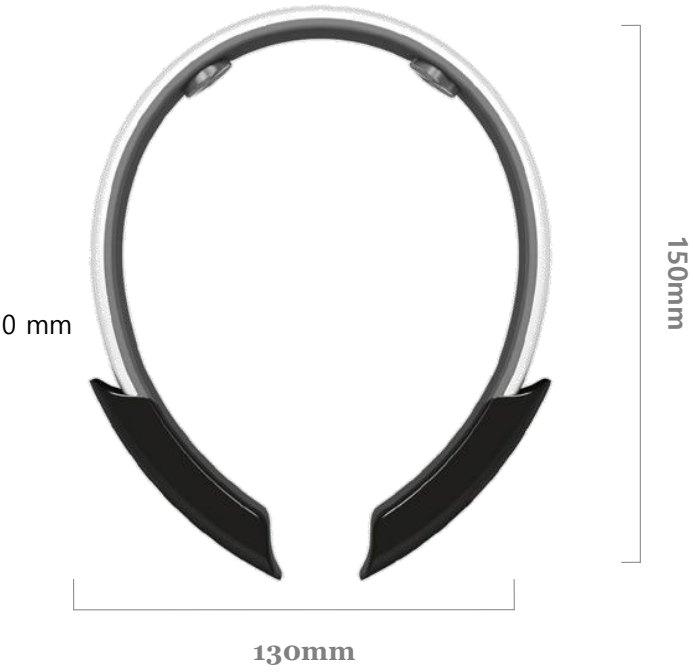
번호	명칭	설명
1	Measuring electrode _CH1	A CH1 electrode attached to Fp1 (left forehead)
2	Measuring electrode _CH2	A CH2 electrode attached to Fp2 (Right forehead)
3	Ear clip electrode (reference / ground electrode)	Reference / ground electrode attached to the right earlobe
4	Power button	Power button for device ON / OFF
5	Charging terminal	MicroUSB terminal for charging
6	Status LED	Status information LED
7	PPG sensor	Sensor for PPG measurement

Table[3]. neuroNicle FX2 Device Configuration

Shape and Structure - Dimensions

1. main body

- horizontal: 130 mm
- Vertical: 150 mm
- width: 20 mm
- Ear clip electrode Cable length: 80 mm
- weight: 67 g



2. Components

micro USB cable

- Length: 50 cm

- weight: 18 g

General

Item	Contents
Measuring signal	EEG: 2 Channel PPG: 1 Channel
Measuring method	EEG: Mono-polar(Reference electrode attached to right earlobe) PPG: Transmission-type optical pulse drive method
EEG Internal Noise	0.8 uVrms Below
EEG Band-Pass (-3dB)	3Hz ~ 41Hz
Measuring range of pulse rate	30 ~ 200bpm
Heart rate interval accuracy	4msec.
EEG input range	+/-590uV
EEG signal precision	0.036uV
Sampling frequency	250Hz
power	3.7V Li-Polymer battery (300mAh)
Charging time	About 2 hours (500mA USB port)
usage time	7 hours or more (continuous use)
Weight	67g Below
Dimension	Height 150mm: Width 130mm Depth 20mm
Temperature. (Normal operation)	10 ℃ ~ 40 ℃
Temperature. (Storage)	-40 ℃ ~ 70 ℃

Table[4]. neuroNicle FX2 device specification.

Bluetooth

Item	Description
Bluetooth version	Bluetooth Spec. V3.0 EDR(Enhanced Data Rate)
Profile	SPP (Serial Port Profile)
Pairing Password	1234
Serial Port Setting	Baud rate : 115,200 bps Data bits : 8bit Stop bit : 1bit Parity : None

Table[5]. Wireless communication specification of neuroNicle FX2 device.

Usage notes

Precautions for handling the device

[1]. Do not stretch both ends of the band excessively.

[2]. Be careful not to be exposed to direct sunlight.

[3]. When worn, be careful not to change the left and right sides of the band..

[4]. Care should be taken not to hold the ear clip clamp too tightly.

[5]. The surface of the metal electrode should be kept clean.

[6] Store in a suitable place except for dust, liquid, temperature, moisture and humidity levels outside the range of use.

Notes on EEG / PPG measurement

[1]. The surfaces of the electrodes (channel 1, channel 2, reference, ground) on the sensor band should be kept clean.

[2]. When wearing the band on the head, the skin to which the electrode is attached should be free of color makeup. There should be no skin makeup that forms an electrical insulating film on the skin surface.

[3]. It may take several minutes until the device is put on the head and the EEG signal appears stable.

[4]. When attaching the ear clip to the earlobe, attach them to the earlobe-free, relatively thick area.

[5]. If the PPG signal is not clear during the measurement, remove the ear clip and reattach them.

[6]. The band should be firmly attached to the head so that it does not move from the head, and the ear clip electrode should preferably be mounted deep into the earlobe.

[7]. The ear clip can cause pain depending on the user. Wear it where there is less pain during installation.

[8]. In environments where static may occur, there may be EEG noise during measurement.

[9]. Electroencephalogram signals may be introduced into the signal during EEG measurement. If you sit on a chair and measure it, you can significantly reduce the EMG influx, Leaning your head against the chair head restraint. Also, be careful not to move your head or jaw unless it is intentional, because EMG signals may flow.

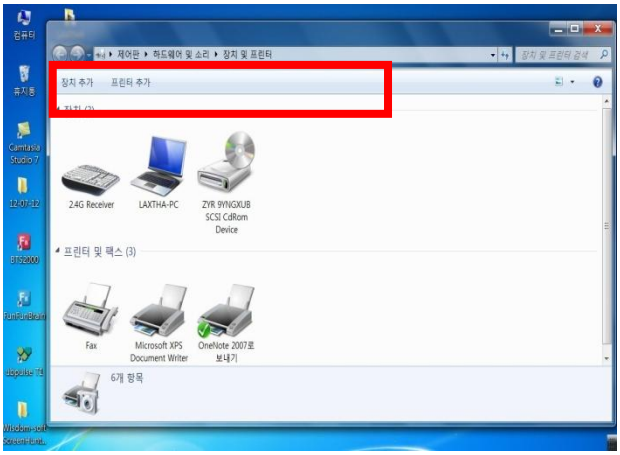
Appendix 1. neuroNicle FX2's Bluetooth device Connecting

For example, the setting for the Bluetooth communication port built into the notebook is taken as an example. Since different programs are used in accordance with the Bluetooth dongle used for each notebook, the overall setting method is similar, though not completely identical to the setting method presented in this example. Once the Bluetooth setting is done for the first time, you can use the Bluetooth connection directly with the device without additional setting. For Windows 7, the connection method is presented.

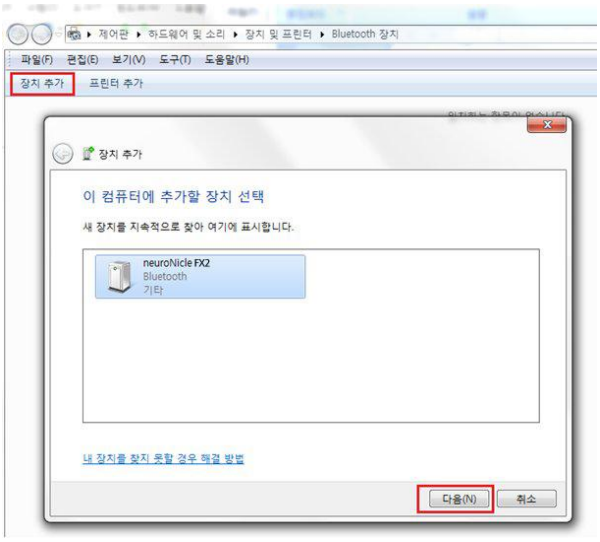
First, turn on the device and follow the procedure below.

Example of Bluetooth connection in Windows 7.

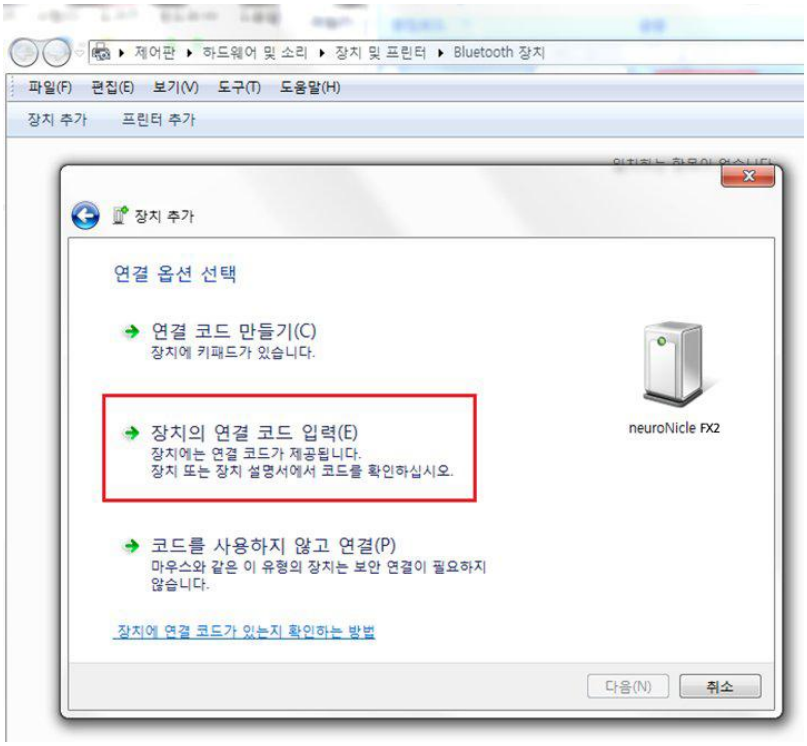
1. [control panel] – [Hardware and Sound] – [Devices and printers] Click



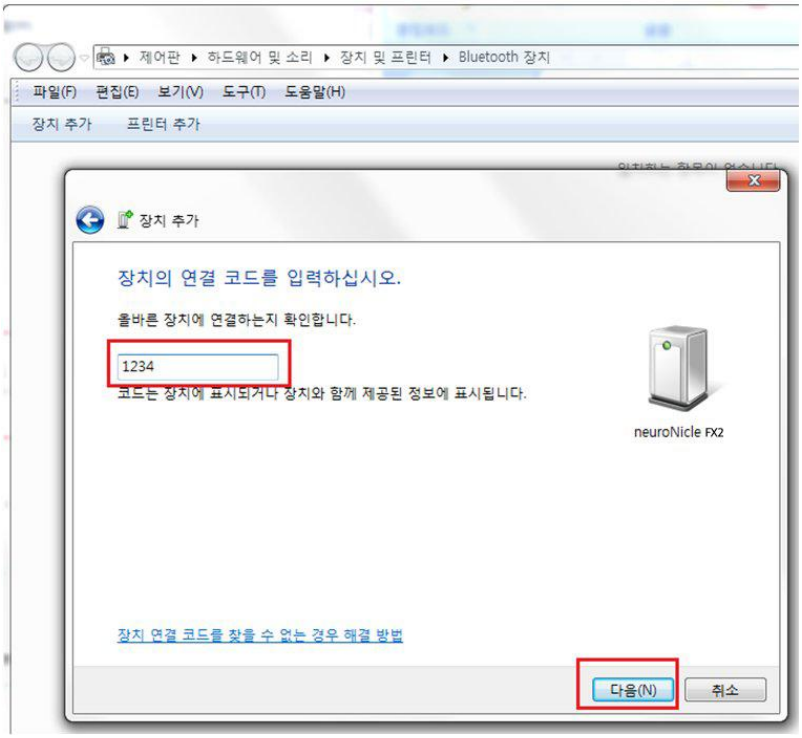
2. Click the [Add a device] button and neuroNicle FX2 will appear. Select this item. Click [Next]



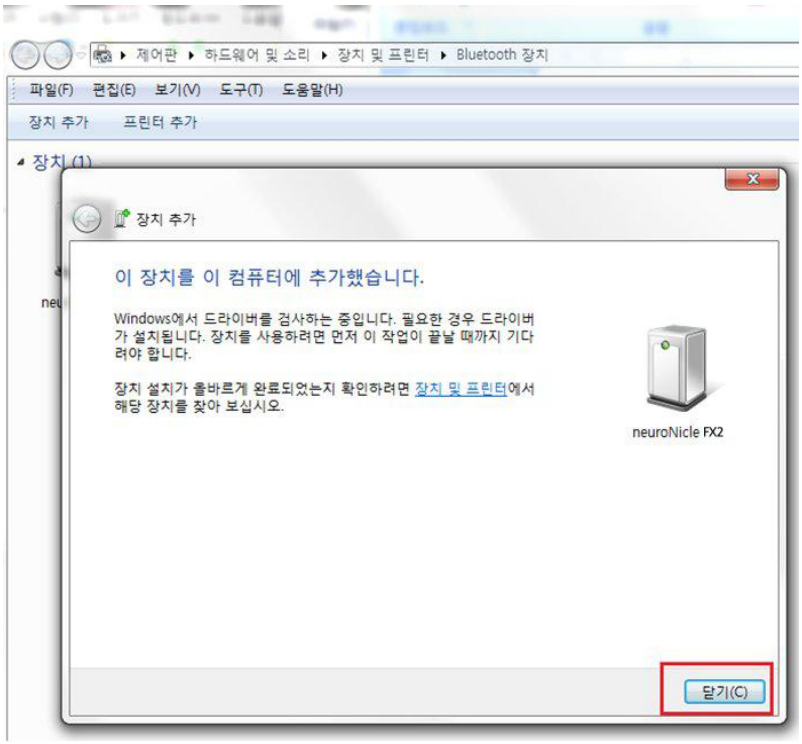
3. When the Bluetooth pairing is completed, the following screen will appear. Click [Enter link code]



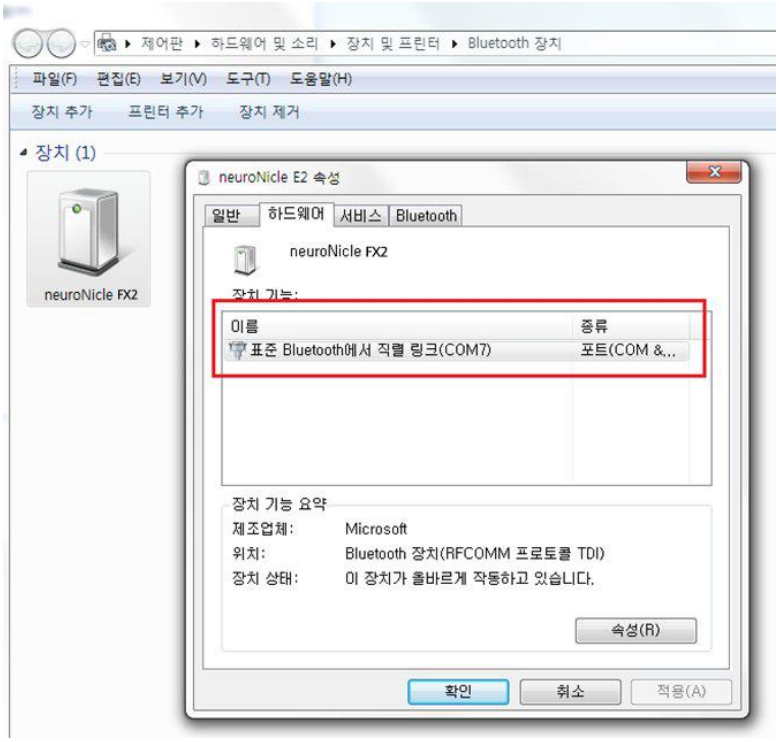
4. Enter [1234] in the connection code and click [Next].



5. Added neuroNicle FX2 device.



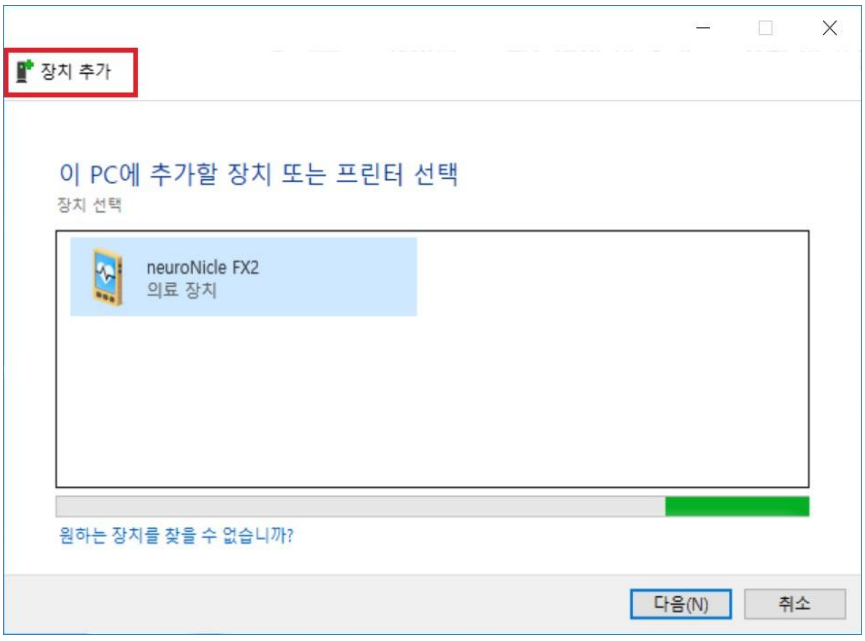
6. Check the COM port of the neuroNicle FX2 device. Use this port number in waveform display software.



Example of Bluetooth connection in Windows 10.

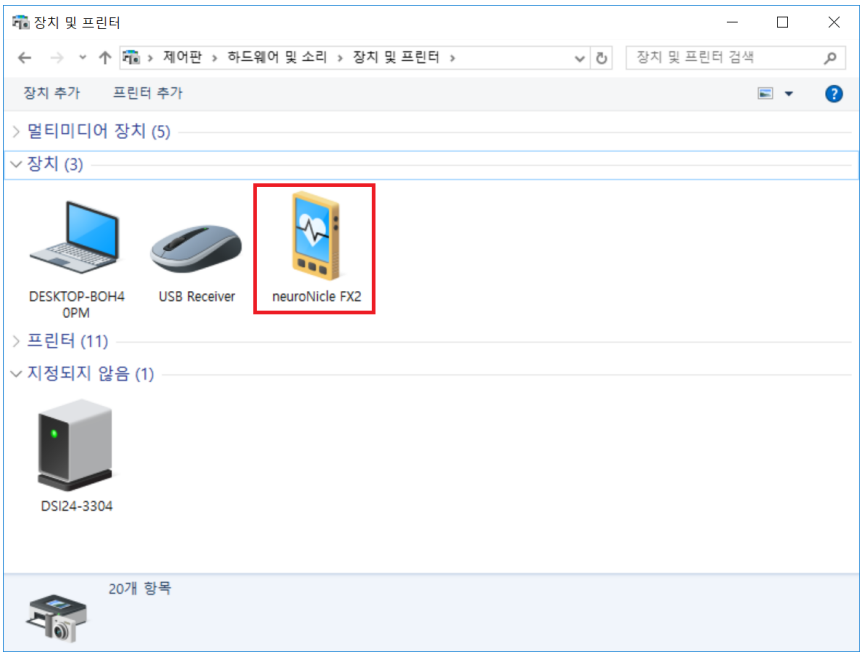
1. [control panel] – [Hardware and Sound] – [Devices and printers] Click

2. Click the [Add Device] button to display neuroNicle FX2. Select this item. Click [Next]

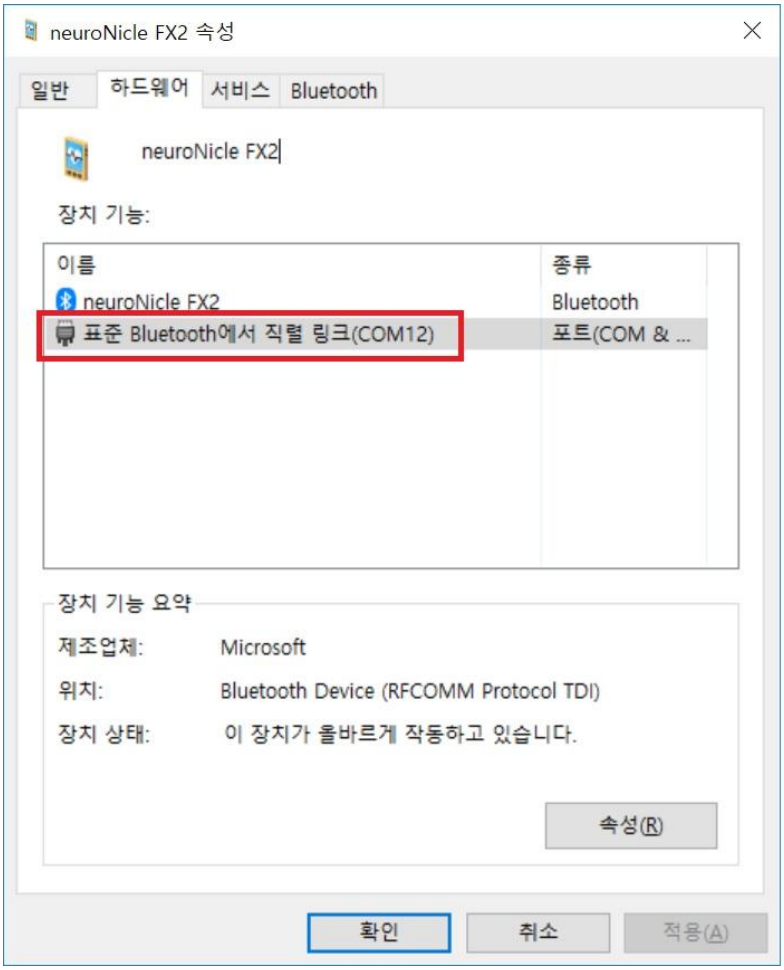


3. When Bluetooth pairing is completed, [Enter password] is displayed as below.
4. Enter the password [1234] and click [Next].

5. Added neuroNicle FX2 device.



6. Check the COM port of the neuroNicle FX2 device. Use this port number in waveform display software.

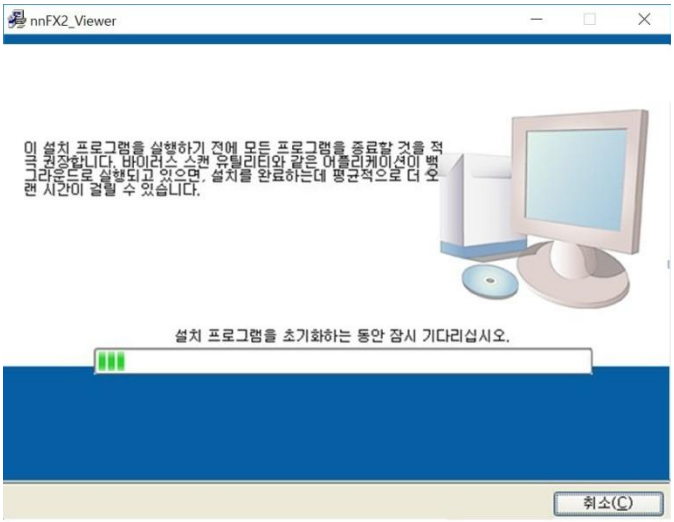


Appendix 2. Install neuroNicle FX2_Viewer software

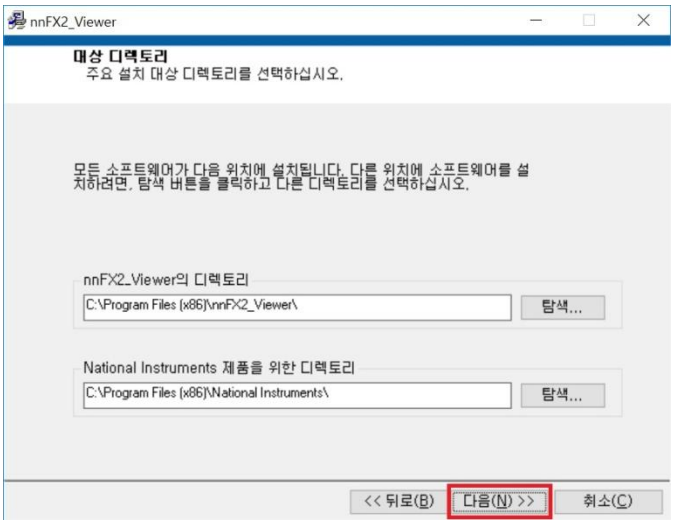
Download : https://drive.google.com/open?id=1BhisRMvdcWwi307naSxkcuwSlnFNEGdr

Double-click the setup file in the downloaded file to run the installation software (you do not need to turn on the device).

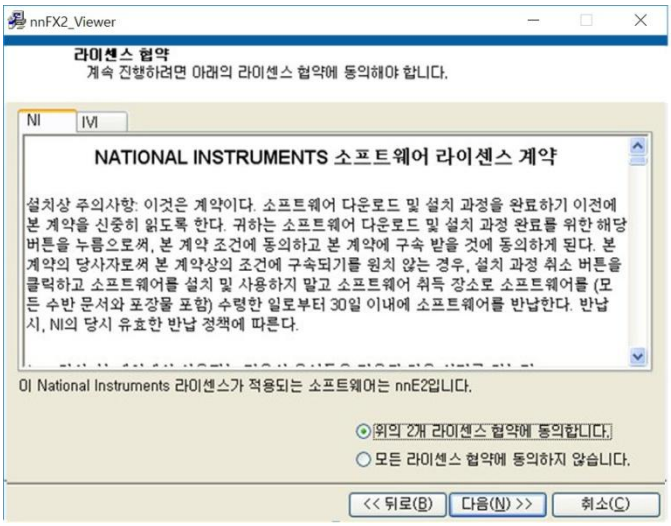
1. The installation software start screen appears.



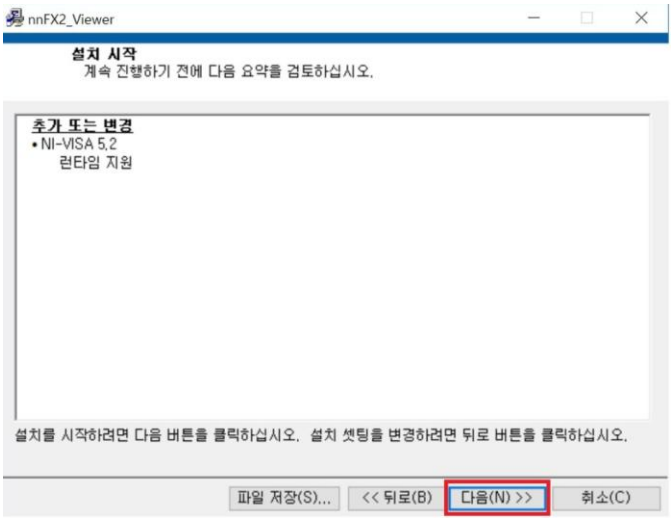
2. Specify the software installation folder.



3. Follow the NI Software License Agreement (this software is implemented in NI Labview).



4. Show the contents of the installation file. Click [Next].



5. Installation is complete. Click Finish.

Appendix 3. how to develop neuroNicle FX2 communication program

Host device capable of communicating with neuroNicle FX2

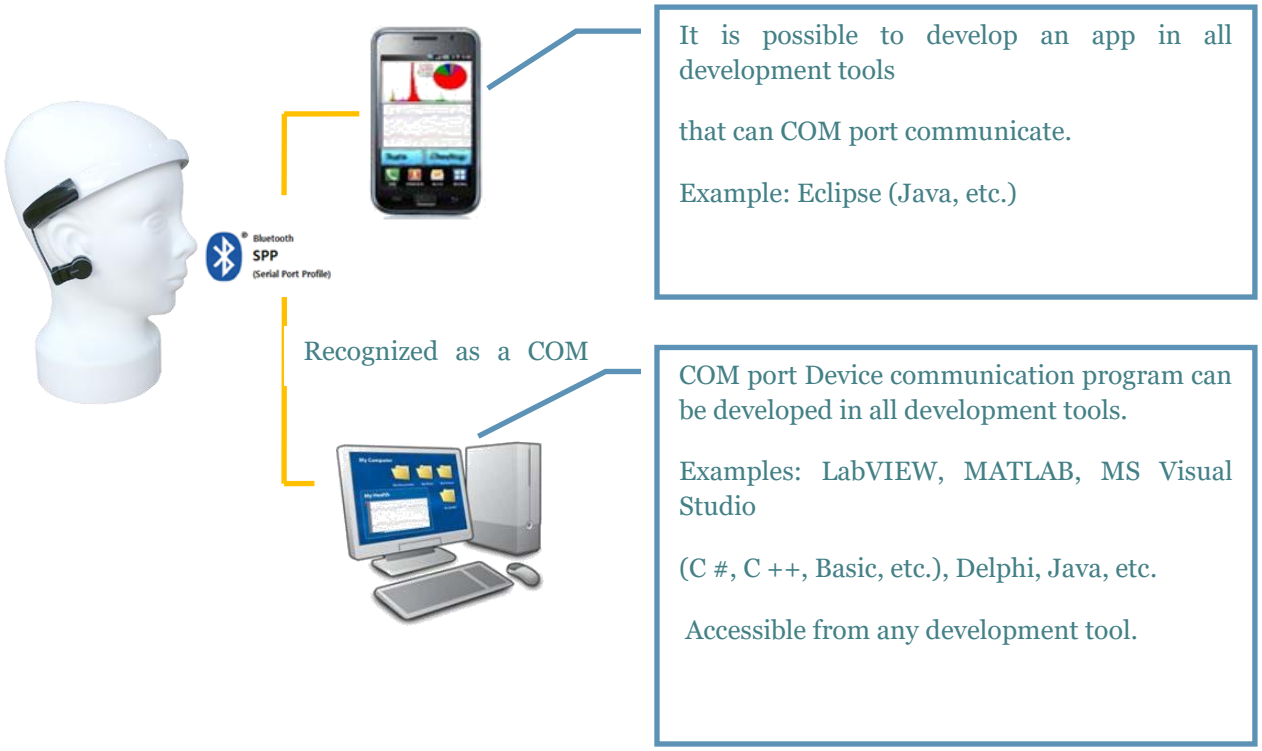
The neuroNicle FX2 supports communication via the Bluetooth (SPP) interface and can also be connected to a smart phone or a general PC (equipped with a Bluetooth dongle) via a Bluetooth connection.

Precautions – Smartphone needs to support Bluetooth profile SPP for communication connection.

(Most of the latest Android phones support Bluetooth SPP. Not all products from Apple are capable of communicating with devices because Bluetooth SPP is not supported.)

neuroNicle FX2 is recognized as a serial port on the host device.

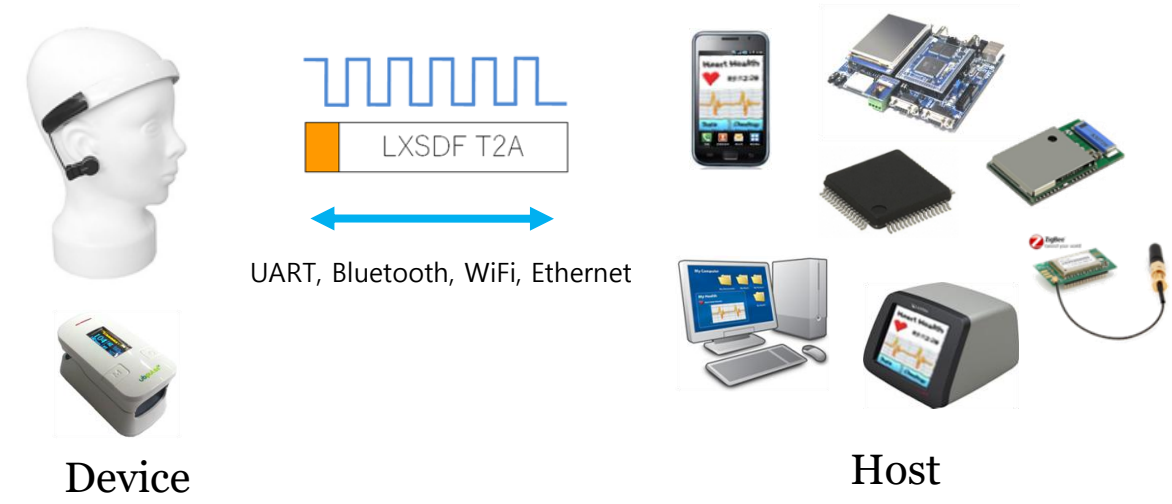
Since the Bluetooth uses the SPP profile, it is automatically recognized as a serial port (com port) on the host device. On the communication software side, the device connection establishes com port communication, and communication with the device is started.

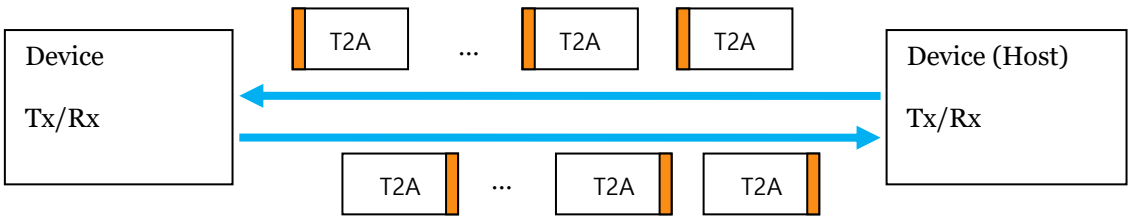


neuroNicle FX2's communication-based format - LXSDF T2A

neuroNicle FX2 complies with the serial port (com port) communication standard and transmits the measured data and status information of the device in real time. Since the serial port (com port) communication standard is a format in which the basic transmission data is repeatedly transmitted 1 byte (8 bits), it is necessary to have a separate data format (packet) grouped with several tens of bytes in order to transmit various types of data. The data packet used in neuroNicle FX2 uses LXSDF T2A.

The figure shows the data communication between the device and the host device. The data specification between the device and the host is LXSDF T2A. The packet is continuously transmitted as a basic transmission unit, and the data of a certain meaning is shown for each byte in one packet consisting of several tens of bytes. 255, and 254 are sequentially transmitted to the start point of one packet, and then one packet of data bytes is repeatedly transmitted.





T2A Packets for Stream & Non-Stream Communications

(a) Data communication format LXSDF T2A between the device layer and the host layer.

(b) LXSDF T2A detailed structure.

Documentation of the layout of LXSDF T2A and neuroNicle FX2 data.

The LXSDF T2A format is a simple yet general-purpose serial communication format capable of transmitting real-time stream data and relatively low-speed general data in one packet format. The stream data is a typical example of a time-series data stream of an analog signal digitally converted. LXSDF T2A Communication Specification Document is provided in Document ID: LXE10 in the box below.

Document ID : LXE10
Document Title : LXSDF T2A Communication standard.
Download : https://github.com/LAXTHA/LXSDF/raw/master/LXE10_LXSDFT2A_CommunicationStandard_en.pdf

Since the LXSDF T2A format is a general-purpose data format, what data is recorded and sent for each specific product varies from product to product. The data placement situation on the LXSDF T2A for each product is called Device Specialization Standard. Refer to the separate document in the box below for the "LXSDF T2A Device Specialization" specification of neuroNicle FX2.

Document ID : LXE141
Document Title : neuroNicle FX2 Data Communication standard.
Download:
https://github.com/neuroNicle/neuroNicle-FX2/raw/master/LXE141_neuroNicle-FX2_CommunicationSpec_en.pdf

Overall flow of communication program development process.

The development tool of the host device achieves a state in which communication is possible by opening a COM port, extracts and acquires information from the received data according to the data format with reference to the communication standard document, and develops a postprocessing code do.

The overall structure of the program on the host side for communicating with the equipment with the LXSDF T2A standard is shown in the figure below.

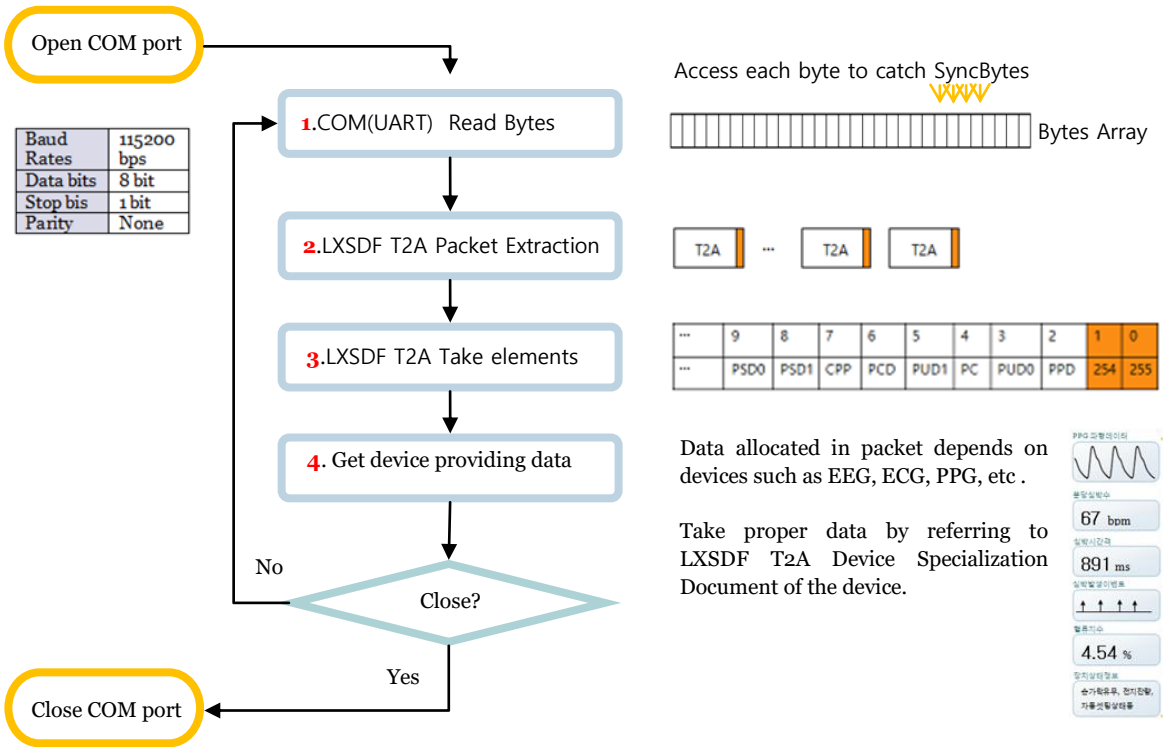
First, start with the com port open.

1.COM Read Bytes : Read the sequence of bytes received from the com port sequentially.

2.LXSDF T2A Packet Extraction : SyncByte, which is the starting point of the packet (Data is arranged in order of 255, 254) detection and packet unit separation.

3.LXSDF T2A Take elements : Separate packet elements. Each packet element acquired in this procedure may have different meaning for each product.

4.Get device providing data : Obtain the information provided by the device by referring to the product - specific data placement information document.



The entire program that communicates with neuroNicle Fx2.

Revision History

Release Date	Doc. ID	Description of Change
2018-04-03	LXE142 V1.0	First realease.