

RAEM1-6

QUICK START GUIDE



Version: 1.1.5

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1. System Connection

RAEM1-6 can be used as two different systems, one is as a **IoT remote unattended acoustic emission monitoring system**, and the other can be used as a **desktop type acoustic emission detector**.

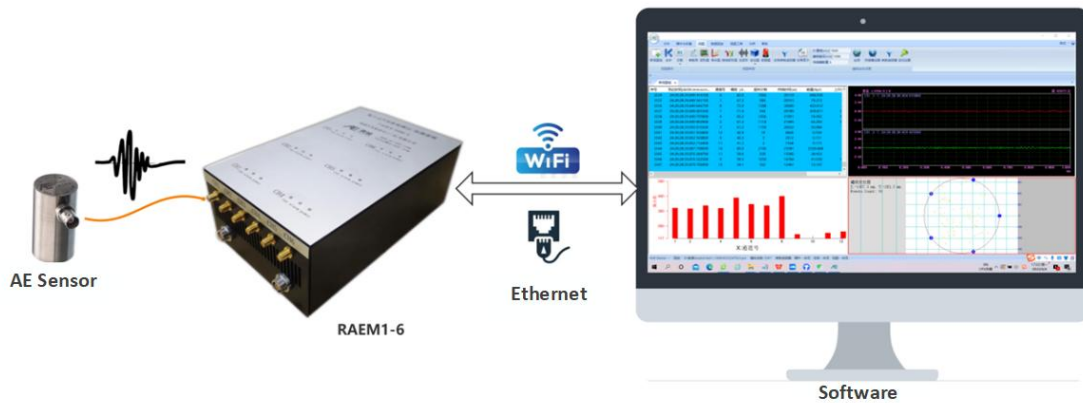


Fig. 1-1 RAEM1-6 Desktop Type Connection Diagram

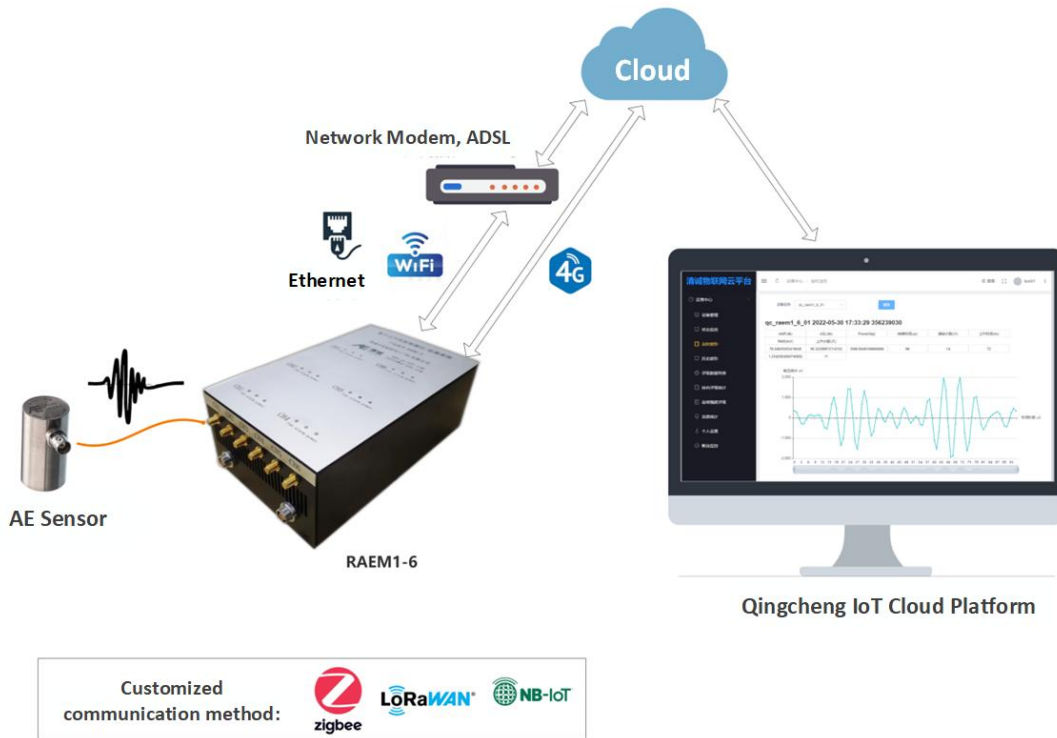


Fig. 1-2 RAEM1-6 IoT Remote Connection Diagram

1.1. Hardware Connection

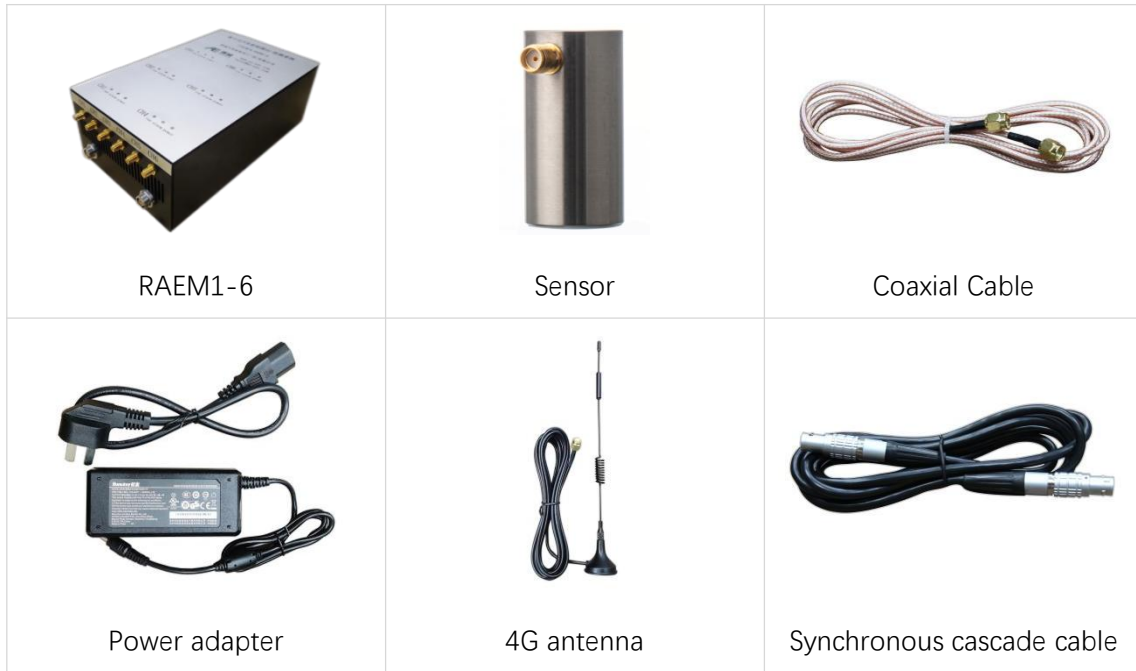


Fig. 1-3 RAEM1-6 System Hardware Set

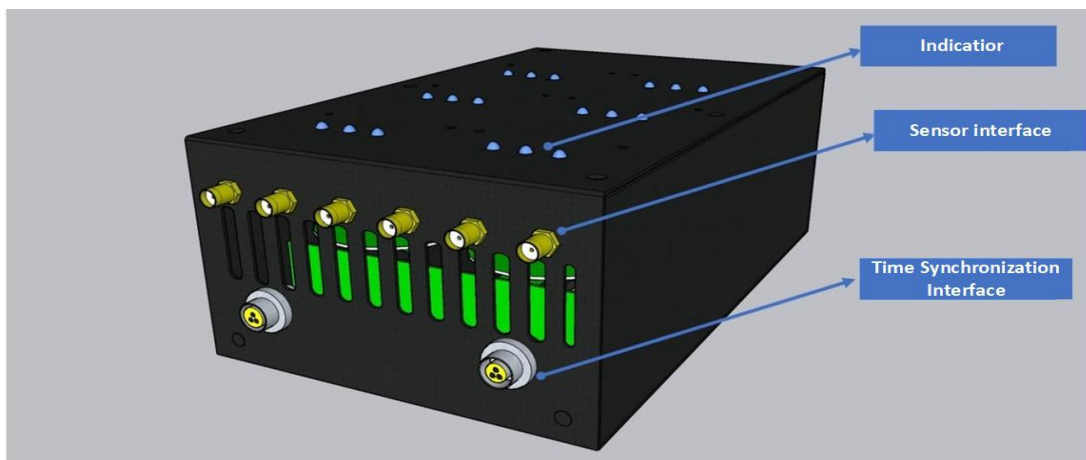


Fig. 1-4 RAEM1-6 Front Panel

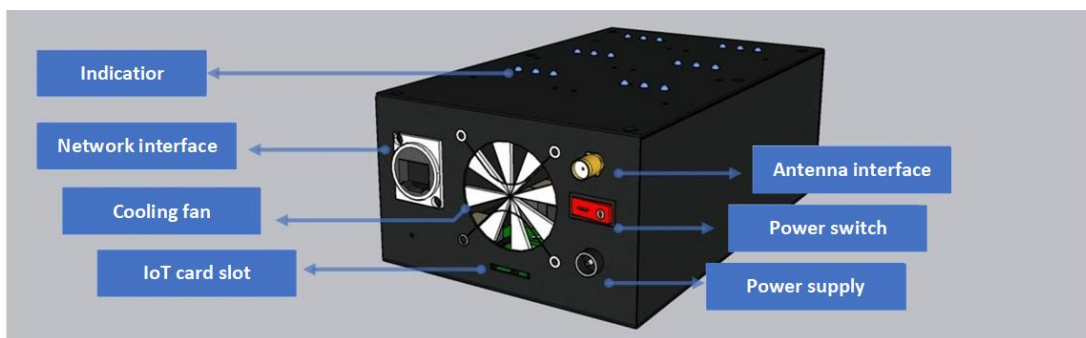


Fig. 1-5 RAEM1-6 Rear Panel

- 1) Read the RAEM1-6 label on the side of the case to figure out the matching power adaptor, preamp and sensor specs. For example the RAEM1-6 with the side label below is suitable to connect to the sensors at around 40kHz resonant frequency and the preamp voltage at 5V. There are six channels, from 1 to 6. The WiFi Hotspot name is RAEM1-5V-1 and the WiFi Hotspot IP address is 192.168.0.1.

Sensor: 5V/40kHz	Preamp voltage/center freq.
Host model: 1-6	
Wi-Fi: RAEM1-5V-1	
Wi-Fi/IP: 192.168.0.1	

Note: The input power supply to the RAEM1-6 should be 12V/5A so **check the power adaptor output**. The sensor type is normally the integral sensor with built-in preamplifier. The RAEM1-6 supplies power voltages to the preamplifier and it can be 5V, 12V or 28V. Therefore **check the preamp voltage before connecting to RAEM1-6** to avoid over voltage burning the preamp in the sensor. The analog filters in RAEM1-6 also require the sensor frequency range to match. So **check the sensor frequency range** before connection. Please pay attention to the case side label.

- 2) Connect the power adapter to the power port of RAEM1-6. The other end of the power adapter is connected to the electric supply.
- 3) Connect the sensor to the sensor connector of RAEM1-6 with coaxial cable. The sensor is recommended to be integral preamp model. If no integral preamp sensor is selected, connect the sensor to the external preamp, and then connect the preamp to the sensor port of RAEM1-6. Also, ensure that the power supply voltage of the preamp is consistent with the output voltage of RAEM1-6. Check the label on the side of the device to determine the sensor frequency range and preamp supply voltage.
- 4) Turn on the RAEM1-6 power switch and wait until the power light is steady on and the RUN light flashes.
- 5) Users can further connect and use the software or the cloud platform according to the test purpose and communication method.

2. RAEM1-6 Desktop Type Detector Connection

2.1. Ethernet Connection

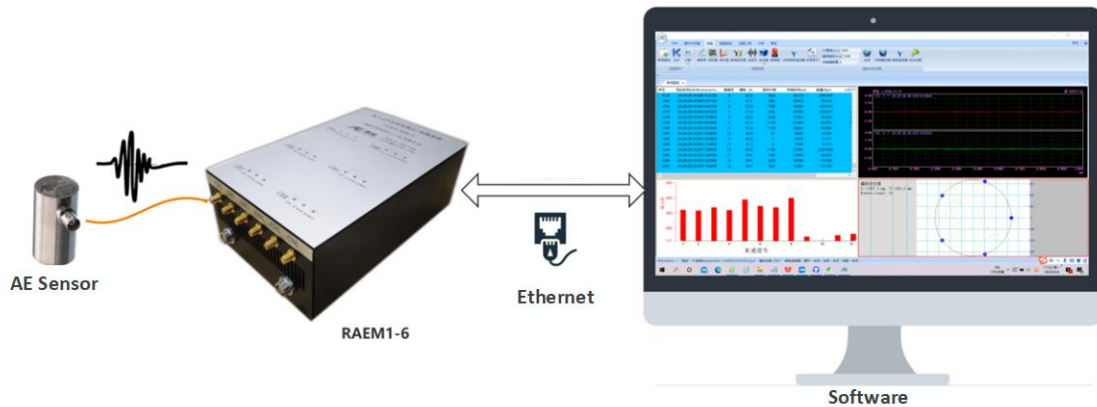


Fig. 2-1 Connecting a network cable to a RAEM1-6 desktop detector

RAEM1-6 can be directly connected to a PC for configuration and data collection using Ethernet. For a single RAEM1-6, connect the cable port at the back of the RAEM1-6 to the computer cable port using a network cable.

If multiple RAEM1-6 networks need to be connected at the same time, RAEM1-6 networking is required. Connect these RAEM1-6 to a switch/router with network cables, and then connect the switch/router to the computer with a network cable. Multiple RAEM1-6 networking also requires clock synchronization by connecting multiple RAEM1-6 in series with cascades. Each RAEM1-6 has two clock synchronization ports. Connect one end of the cascading cable to any clock synchronization port of RAEM1-6, and connect the other end of the cascading cable to any clock synchronization port of another RAEM1-6 to cascade the two RAEM1-6. If so, cascade all required RAEM1-6 in series.

Before delivery, the master/slave mode of the channel is set for clock synchronization. Users do not need to perform operations. Generally, only one channel of each RAEM1-6 is set as the master, and the others are slave. **If multiple RAEM1-6 are cascaded, only one channel (which can be any channel) is kept as the master, and all the other channels are changed to the slave.**

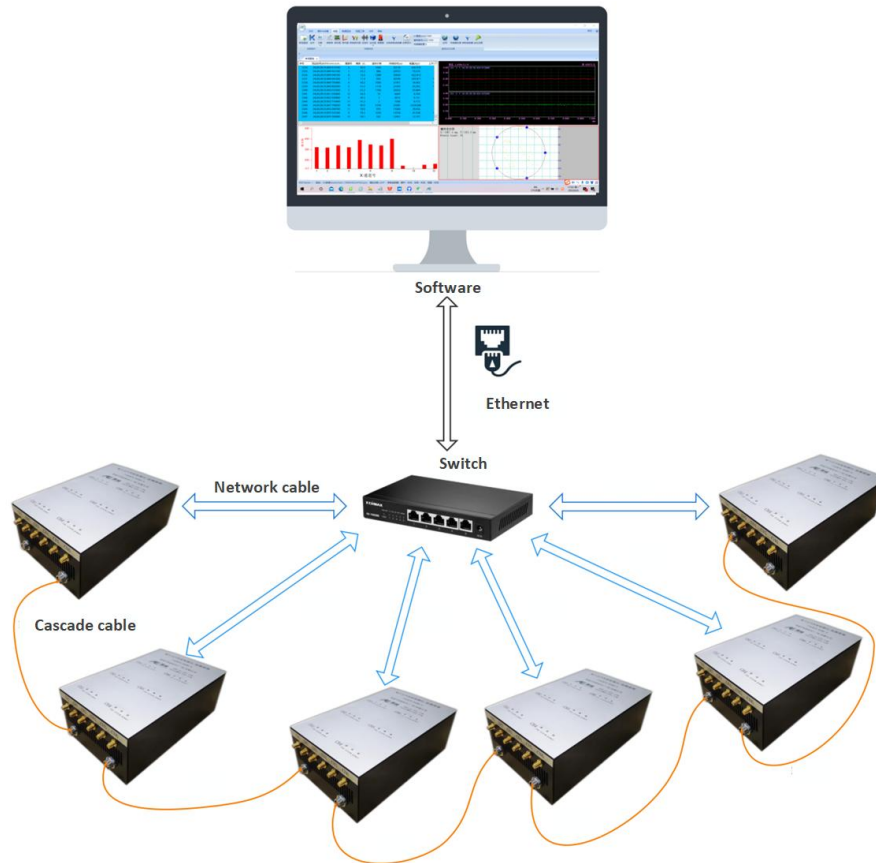


Fig. 2-2 Network connection of a RAEM1-6 desktop monitor

2.1.1. Computer Ethernet Properties Configuration

If this is the first time for the computer to connect to the device, you need to set the Ethernet configuration item for the computer.

Each channel of the RAEM1-6 has an Ethernet static IP Address, which should look like **192.168.0.xxx**. For example, the IP should be 192.168.0.101 goes up to 192.168.0.106. Each static Ethernet IP address is the unique address to find each channel. So it is not recommended to change the Ethernet static IP addresses of the RAEM1-6.

To communication the RAEM1-6 with the computer, it is necessary to configure the computer to be at the same communication segment with RAEM1-6. You can configure Ethernet attributes of the computer in the following ways:

- **Configuration 100M Ethernet full-duplex mode:** open the computer control panel >> network and Internet >> network connections, double-click the Ethernet, the following window pop up. Click "Configuration" >> "Advanced", find "Speed and Duplex" in "Properties", then select "100 Mbps full duplex".

Click OK.

➤ **IPv4 addresses to configure Ethernet 192.168.0. XX segment:** in the "Ethernet properties" window, double-click the "Internet protocol version 4 (TCP/IPv4)", and then in the pop-up window, click on the "use the following IP address:". Then enter the IP address "192.168.0. XX". **Note that "XX" can be any number but NEVER can be the same as any channel IP address of RAEM1-6 because it will cause communication conflicts. So for instance, you can enter "192.168.0.20".** The subnet mask is 255.255.255.0. The default gateway is 192.168.0.1. Click OK.

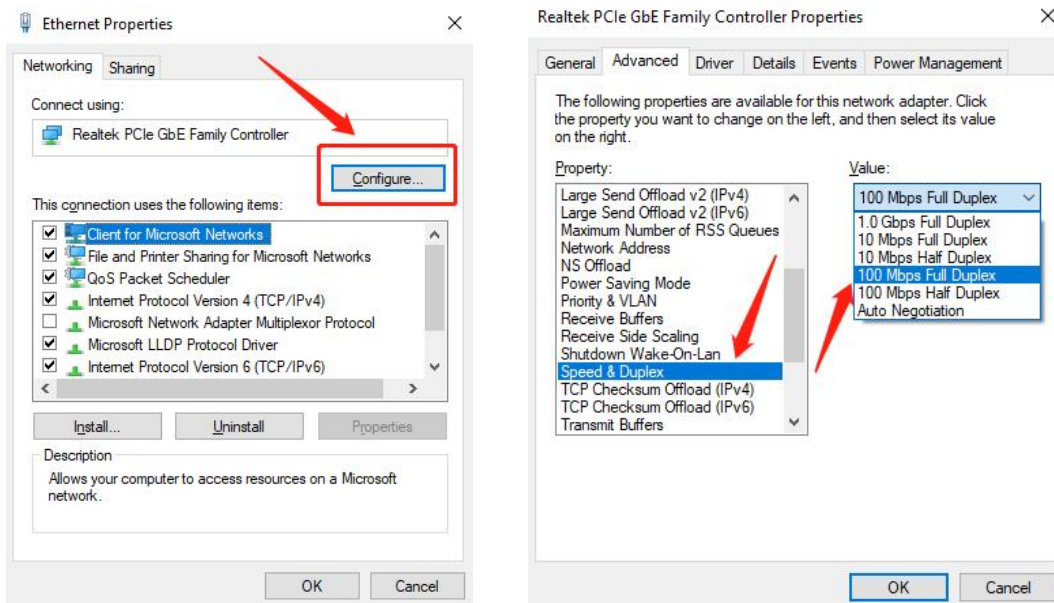


Fig. 2-3 Setting the Ethernet full-duplex mode

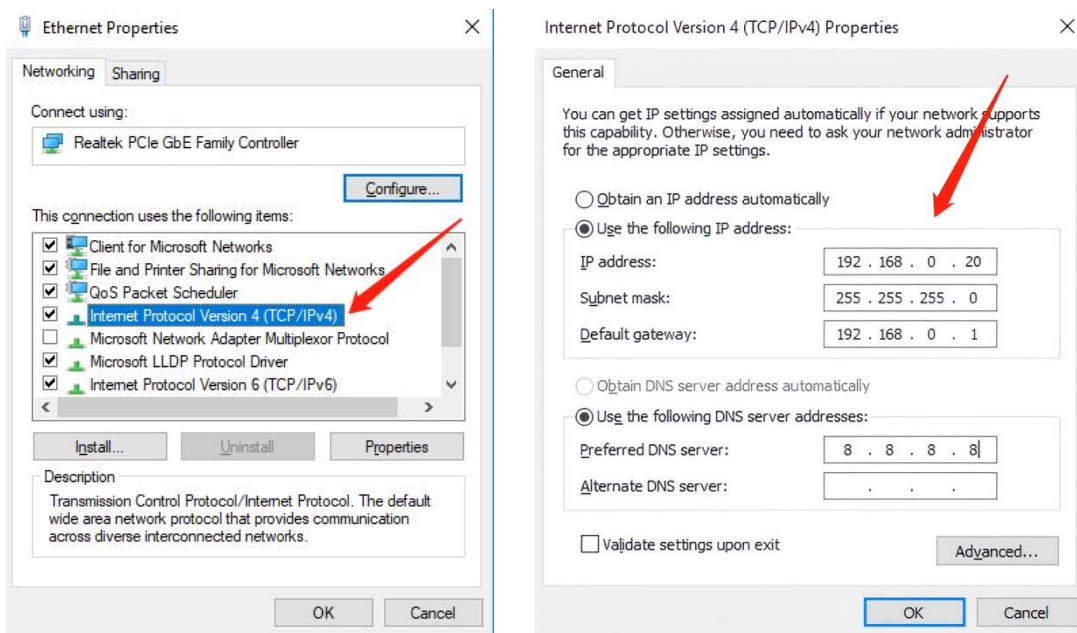


Fig. 2-4 Setting the Ethernet network segment

2.2. WiFi Connection

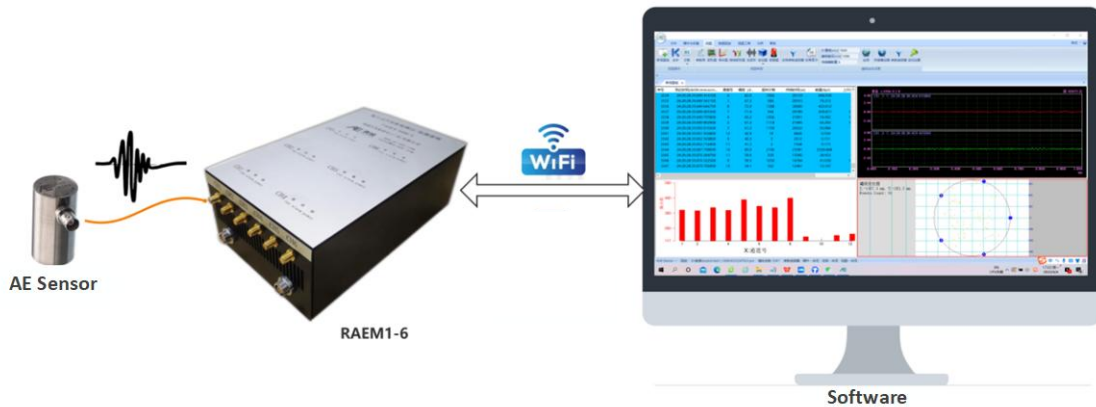


Fig. 2-5 Wi-Fi connection for a single RAEM1-6 desktop monitor

RAEM1-6 can be directly connected to a PC through its built-in Wi-Fi Hotspot signal. You are advised to use Hotspot connection only for settings. Open the Wi-Fi list of your computer, and find the Wi-Fi name with the same name as “the Wi-Fi” on the side label of RAEM1-6 to connect. The default password is 88888888.

After the connection is successful, all channels of RAEM1-6 should be displayed on the configuration software. If the connection fails, try moving the computer closer to RAEM1-6.



Fig. 2-6 Wi-Fi network of RAEM1-6 desktop detector

RAEM1-6 doesn't support wirelessly connecting to the WiFi router. So the “Router” mode is not available in RAEM1-6.

If you want to use WiFi to transmit data, use the Ethernet cable to connect RAEM1-6 to the WiFi router, then the data can be transmitted from the router to the computer or server via WiFi.

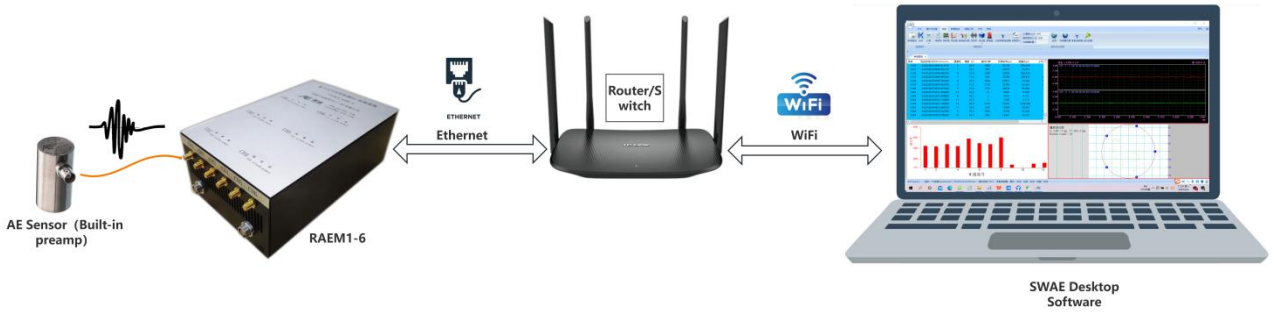


Fig. 2-7 RAEM1-6 router connection diagram

If you need to connect multiple RAEM1-6 using Wi-Fi, you need to use RAEM1-6 networking. Connect the RAEM1-6 to a Wi-Fi router with a network cable, and then connect the computer to the router over Wi-Fi.



Fig. 2-7 Wi-Fi networking for RAEM1-6 desktop monitor

The Wi-Fi router also needs to be configured. There are two methods to make the router configurations.

	RAEM1-6	WiFi Router	Computer
1	Static IP: 192.168.0.101 to 106	Use a fixed IP: e.g. 192.168.0.50	Use a fixed IP: e.g. 192.168.0.20
2	Change the static IP to dynamic IP and obtain IP from the router	Automatically assign IP address to devices	Obtain IP automatically from the router

Table 2-1 RAEM1-6 Networking IP Configuration Methods

Method 1 means the router must be configured to the network segment “0” same as the RAEM1-6 static Ethernet IP, which should be 192.168.0.xxx. But “xxx” cannot be the same the IP as RAEM1-6 channels. So it is recommended to be 192.168.0.50 to avoid conflicts. The computer Ethernet IPv4 address also should be a fixed IP, for example 192.168.0.20.

For method 2, the router can set to automatically assign IP addresses to devices. In that case, RAEM1-6 Ethernet IP should be changed to “Dynamic” IP instead of static. And the computer should also be changed to obtain IP automatically. One problem with Method 2 is if in some case, the RAEM1-6 needs to directly connect to computer through Ethernet cable afterwards, RAEM1-6 and the computer should both change the IP addresses to static IP again using the router before the direct connection.

After the connection is successful, all the channels connected to the router can be seen on the configuration software.

Multiple RAEM1-6 networks also require clock synchronization by connecting multiple RAEM1-6 in series with cascades. Each RAEM1-6 has two clock synchronization interfaces. Connect one end of the cascading cable to any clock synchronization interface of RAEM1-6, and connect the other end of the cascading cable to any clock synchronization interface of another RAEM1-6 to cascade the two RAEM1-6. If so, cascade all required RAEM1-6 in series.

Before delivery, the master/slave mode of the channel is set for clock time synchronization. Users do not need to perform operations. Generally, only one channel of each RAEM1-6 is set as the master, and the others are slave. If multiple RAEM1-6 are cascaded, only one channel (which can be any channel) is kept as the master, and all the other channels are changed to the slave.

2.3. RAEM1 Configuration Software Operation Guide

2.3.1. Basic Software Settings



To use “RAEM1 Configuration” software, **the firewall function on the computer must be turned off.**

The following is to turn off the firewall.

- ① Open “Windows Defender Firewall with Advanced Security”;
- ② Click “Windows Defender Firewall Properties”;
- ③ In the “Domain Profile” tab, change the “Firewall state” from “On” to “Off”.
- ④ Change the “Firewall state” to “Off” in the “Private Profile” and “Public Profile” tabs as well. Then

click “OK” to take effect.

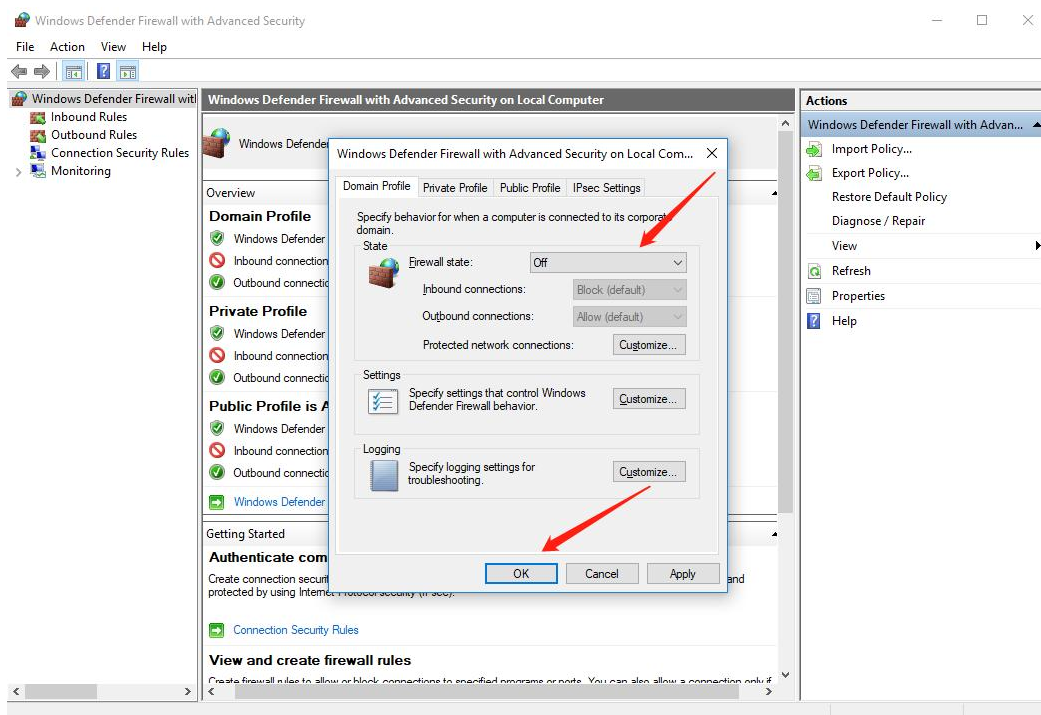


Fig. 2-9 Disabling the firewall

Decompress and open the compressed RAEM1 Configuration software package. Double click to run the “**RAEM1.exe**” under the “**RAEM1 Configuration x_x_x_x**” folder, for example. There are 32-bit and 64-bit software (labeled with “-x64”) available. Choose one that works on your environment.

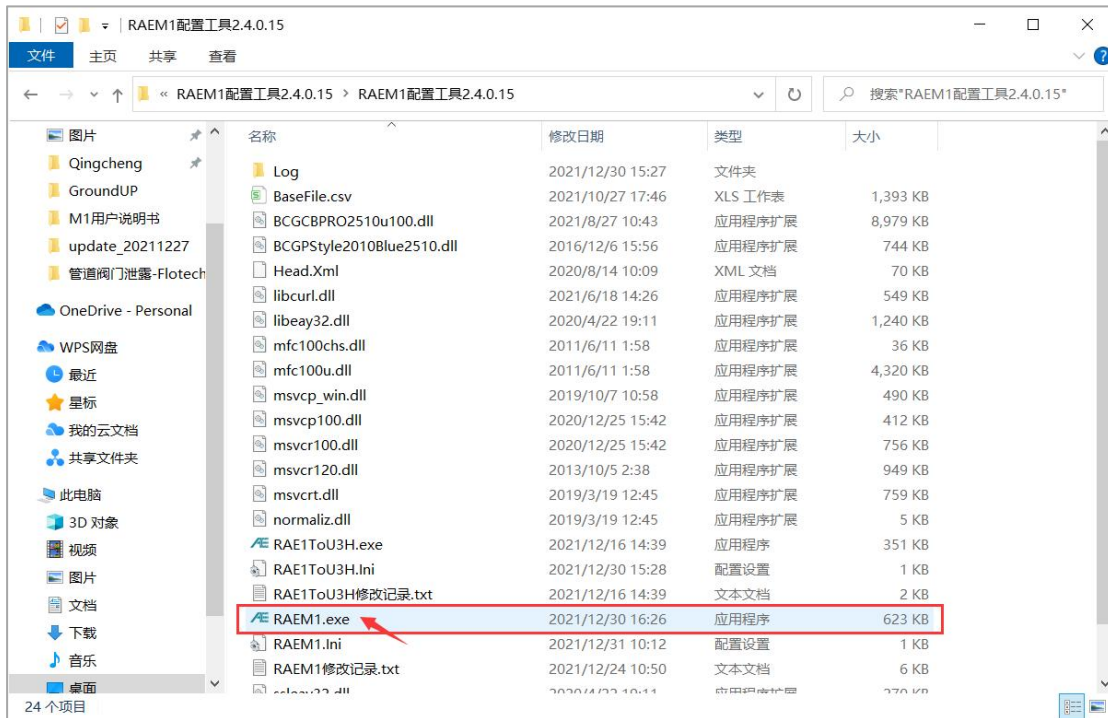


Fig. 2-10 RAEM1 Parameter configuration software executable file

The operation steps of “RAEM1 Configuration” software are:

- ① Also, when the first time running, it might pop up a firewall warning window. It must check both the private and the public network options and then click “Allow access”.



Fig. 2-11 Firewall Security Alert

- ② The RAEM1 Configuration software main interface is as shown below. It mainly consists of two big parts, the Device Configuration Information on the left window and the Device List including all the connectable devices on the right. The tabs of different pages are on top of the device configuration

information window. Click on the tabs to switch to different pages. On top of the device list on the right shows the current selected device IP. All the device information on the left window is from this current IP device. The **“Set Device”** button on the top right corner is to send the configuration information to the selected devices. Normally once the configurations are sent to the devices, it will take effects immediately, except for some settings with the **“Modify”** buttons next to them. On the bottom left corner there are two buttons, **“File Convert”** and **“Other”**. In the **“Device Information”** page, it shows the device firmware version and the sampling status on the bottom left corner of the device information window.

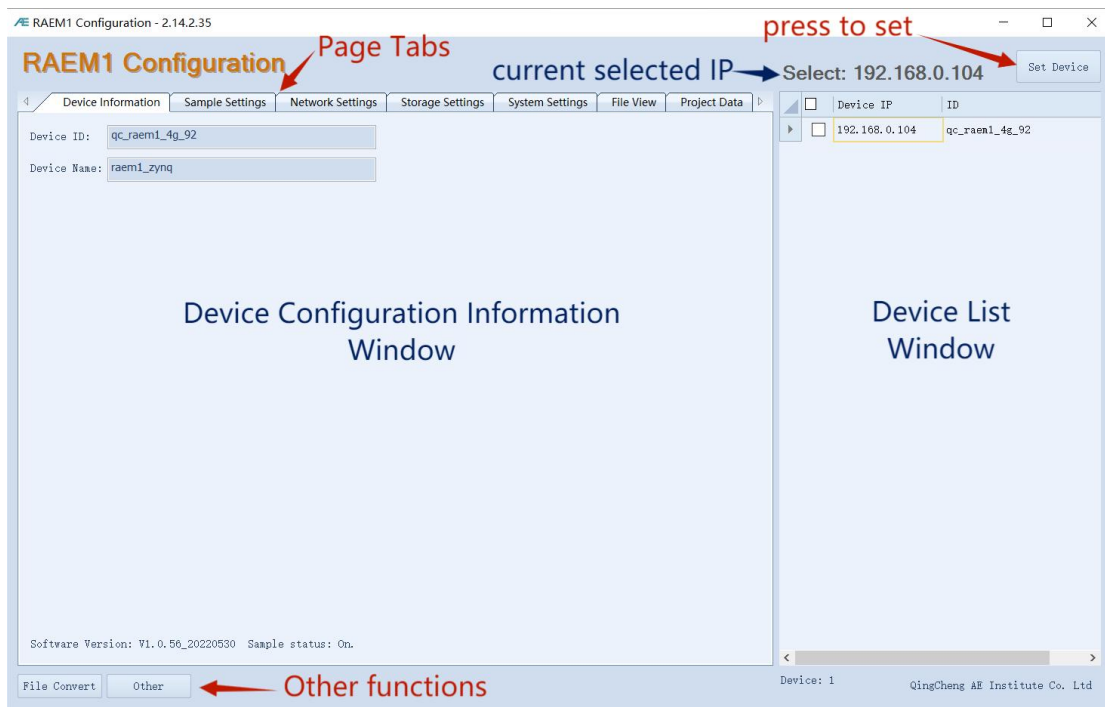


Fig. 2-12 RAEM1 Configuration Main Interface

③ The software should automatically list all the connectable RAEM1-6 channels in the device list on the right window (including Wi-Fi and Ethernet connections) under the current connected network. If the device IP and ID are shown in red on the device list, it means the channel is offline and it losses connection to the software currently. Follow the steps below to debug some common situations:

- If a desired RAEM1-6 channel is not on the list, please check whether the **“RUN”** light of the channel is flashing every second.
- If the connection is through Ethernet cable, make sure the Ethernet cable connection and the PC configurations are correct, see Section 2.1.
- If other connection methods are used, such as Wi-Fi, please check and debug the problems based on the connection methods mentioned in Section 2.2.

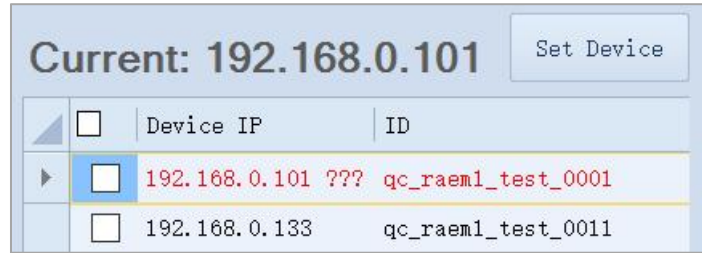


Fig. 2-13 "RAEM1 Configuration" Tool Device Offline

④ If you want to change the configuration settings, please first check the checkbox of the channels you want to update before modifying the settings in the left window. Click **"Set Device"** after modifications. Then the configuration settings will be updated to the checked channels and take effects immediately. When multiple channels are selected, all the configuration settings in the left window (except for the **Device Information** page, **System Settings** page and part of the **Network Settings** page) are updated to the selected channels for batch operations.

⑤ The buttons in the **"System Setting"** page (see the red rectangle below) only take effects on the current selected channel (see the "Current" IP on the top right corner), no matter it is checked in the checkbox or not. If you want the batch operation of those button functions to multiple channels, you can right click on the device list to select the batch function in the context menu after selecting multiple channels to be updated.

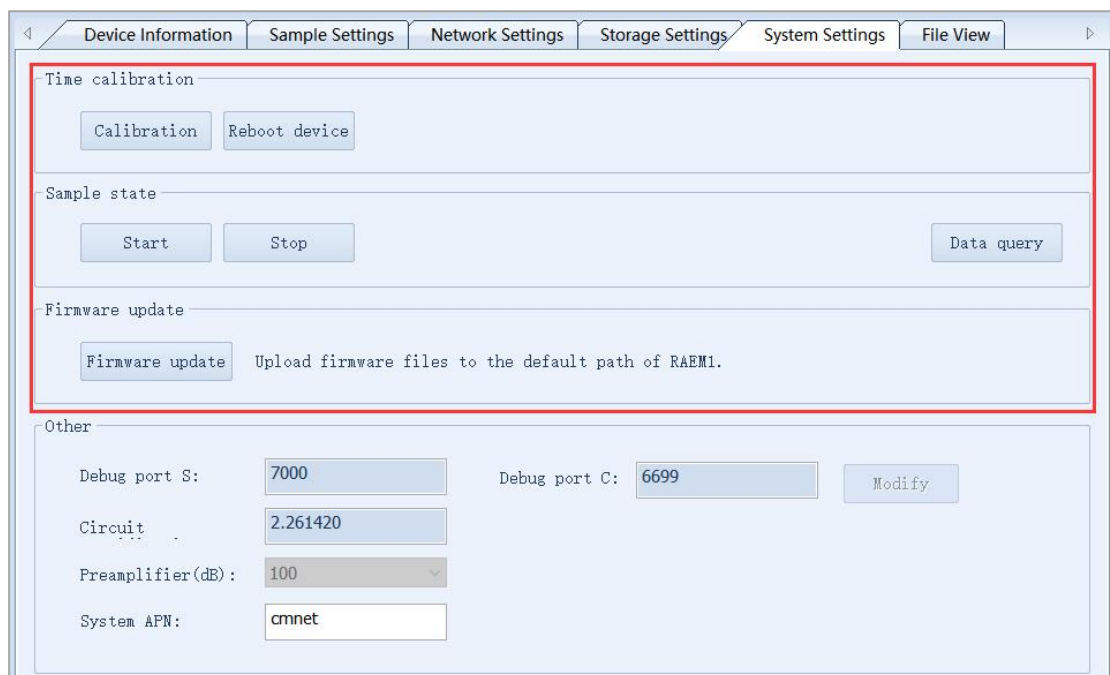


Fig. 2-14 RAEM1 Configuration Software System setting buttons

⑥ In the device list, right click to show the context menu. The context menu is only effective on the selected channels in the list.

- ✧ **Start sampling:** send command to the device to require the device to start collecting;
- ✧ **Stop sampling:** send command to the device to stop it from collecting data;
- ✧ **Calibrate device time:** apply the current PC time to the device;
- ✧ **Reread device info:** read the device settings information again, whether it is checked or not;
- ✧ **Reboot device:** make the device restart;
- ✧ **Firmware file upload:** used to update the device firmware. It can choose one or multiple files at the same time (maximum 20 files at a time).
- ✧ **AST check:** this function is exclusive for certain type of RAEM1 (with a transmitter sensor). It requires two sensors for Auto Sensor Test (AST) check. The device sends out the excitation signal to the transmitter sensor to generate the acoustic waves and the receiver sensor collects the acoustic signals. Based on the receiving signals, it can test out how the sensor sensitivity and coupling status.
- ✧ **Enter sleep mode:** by enabling the sleep mode, it stops acquisition, transmission and communication to save power. But be careful with this function because it may require some efforts to wake up the device.

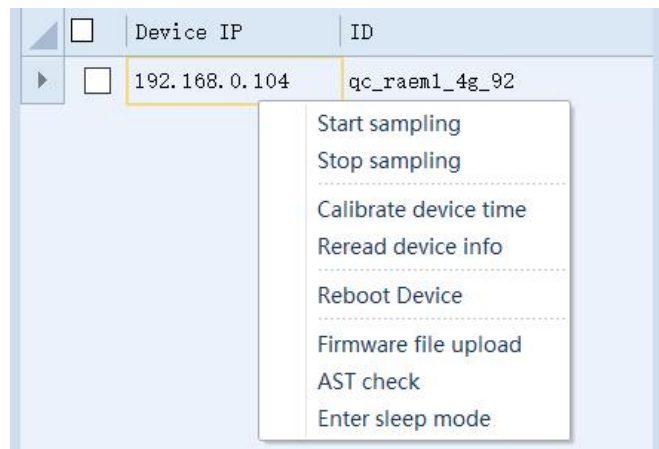


Fig. 2-15 RAEM1 Configuration Software context menu

⑦ In the “**Network Settings**” page, the “**Modify**” button is only able to modify the current selected channel configurations, for example **Ethernet IP address**, and **Master/Slave**. After changing the values in those frames, click “**Modify**” buttons to pop out the window as the figure below. Click the “**Setup**” button to send the channel. No need to click “**Set Device**” button after.

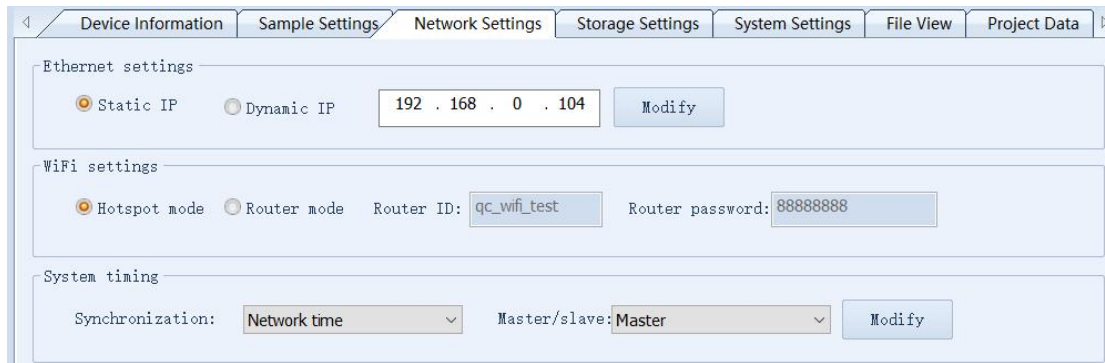


Fig. 2-16 RAEM1 Configuration Software “Modify” button

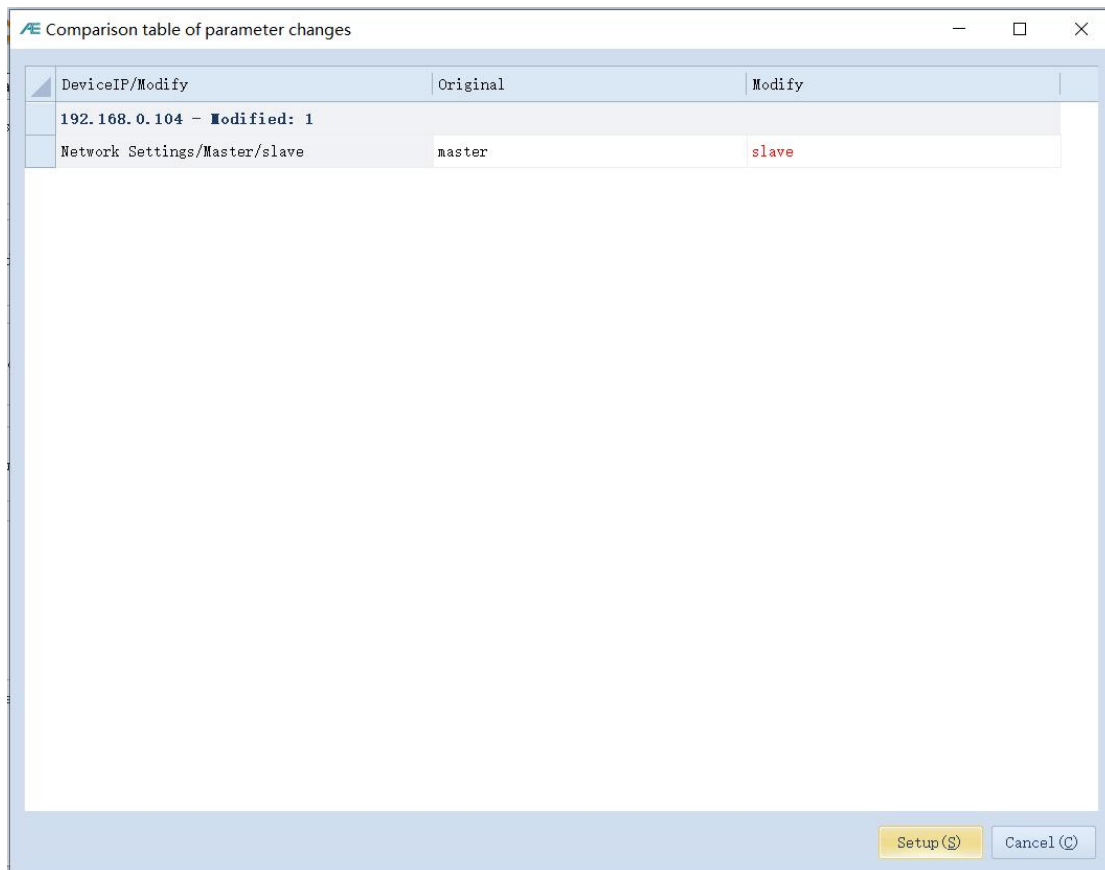


Fig. 2-17 RAEM1 Configuration Software “Modify” Confirmation window

- ⑧ There are two buttons on the bottom left corner of the interface:
- ✧ **File Convert:** opens the “RAE1ToU3H.exe” program which converts the downloaded “RAEM1” data packages to “U3H” format (.pra & .aed) or CSV format.
 - ✧ **Other:** there are a few options, one is to save the configurations as a file in the PC; the other option is to read the configuration file from the PC. It also can change the display languages, between Chinese and English. After selecting the language, it needs to click the “Reboot” button at the bottom to take effect. The software will restart and update the display language.

The following is the introduction of RAEM1 Configuration software functions.

2.3.2. Configuration Software Data Query

Under **System Settings**, click **Data Query** to access the real-time data page. You can view the reported value of the current data, which is updated once 1 second by default.

The **File View** function of the RAEM1 configuration software can obtain the data stored locally by RAEM1-6. It also supports downloading and format conversion. For details, see Chapter 3.3.6 of the **M1-6 User's Manual Operation Guide**. The following is a brief introduction to the software file function.

Click the "**File View**" to switch to the device's file view.

Index	Time	RMS (uv)	ASL (dB)	AMP (dB)	power	MAX RMS (uv)	MAX ASL (dB)	MAX AMP (dB)
13	14:50:09 443	0.077342	36.089869	52.537779	3.828089	0.000000	0.000000	0.000000
12	14:49:59 441	0.150980	33.759757	68.669242	14.587921	0.159451	42.686995	67
11	14:49:58 441	0.062462	27.043915	60.521719	2.496838	0.430496	50.103265	69
10	14:49:57 444	0.181176	43.806899	59.397669	21.006641	0.236112	36.902226	75
9	14:49:56 444	0.236112	36.902226	75.287797	35.677073	0.108102	33.534137	68
8	14:49:55 442	0.090851	33.064515	66.814161	5.282168	0.754463	47.375297	84
7	14:49:54 442	0.754463	47.375297	84.821045	364.275307	0.325578	48.299732	65
6	14:49:53 442	0.325578	48.299732	65.917914	67.836593	0.294519	42.110469	72
5	14:49:52 451	0.080052	29.173022	66.642158	4.101082	0.401910	49.359823	70
4	14:49:51 453	0.028458	24.861026	55.315269	0.518271	0.480399	51.004832	73
3	14:49:50 444	0.480399	51.004832	69.034816	147.692423	0.125224	40.828119	53
2	14:49:49 437	0.094094	38.588644	53.377069	5.665950	0.000000	0.000000	0.000000
1	14:49:46 450	0.201345	40.000265	65.559967	25.943904	0.201345	40.000265	65

Fig. 2-18 Real-time data query

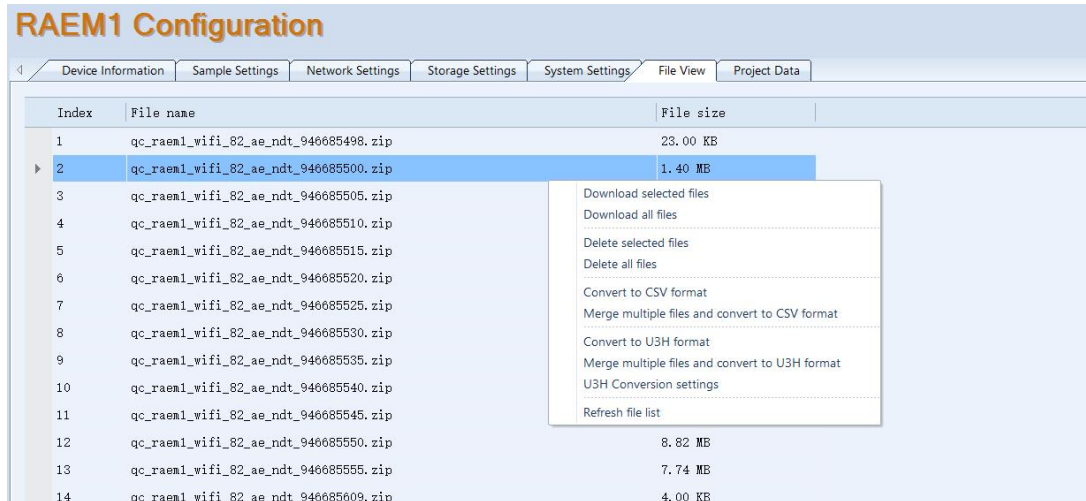


Fig. 2-18 RAEM1 Parameter sets the File View bar of the software

You can download, delete, convert to CSV format, convert to U3H format, and refresh the list.

Right-click the menu, you can:

- ✧ **Download selected files.** Only the selected files in the list will be downloaded.
- ✧ **Download all files.** Download all the files in the list.
- ✧ **Delete selected files.** Deletes selected files from the device.
- ✧ **Delete all files.** Delete all files from the device.
- ✧ **Convert to CSV format.** Convert the selected files in the list to CSV format. One file in the list is converted to one CSV file. But if the number of data is greater than 830,000, it will be stored as multiple files.
- ✧ **Merge multiple files and convert to CSV format.** The selected files are converted and stored in a single file. The premise is to accommodate, if the number of data is greater than 830,000, it will also be stored as multiple files.
- ✧ **Convert to U3H format.** Convert the selected file in the list to U3H format, and convert a file in the list to one U3H file. If multiple files are selected at the same time, multiple U3H format files will also be generated.
- ✧ **Merge multiple files and convert to U3H format.** Convert the selected file to a U3H format file. If you want to convert all files, press Ctrl + A, first make the list of files select all, and then select Convert.
- ✧ **U3H conversion Settings.**

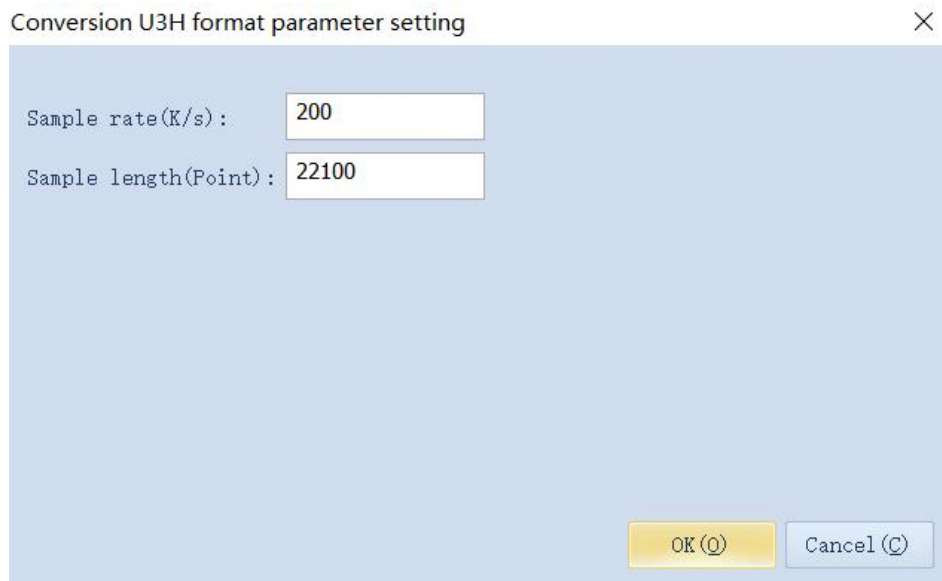


Fig. 2-20 RAEM1 Parameter setting Software converts U3H Settings

- ✧ **Refresh file list:** If the file list is still being updated, the above features will be disabled.

Press "Ctrl + A" to select all files. When using the mouse to drag and select multiple files, please make sure the mouse is in the file name column, not the empty column of the list.

2.4. Online Data Collection by SWAE Software

SWAE software can be used to connect RAEM1 and RAEM-6 for online collection, including real-time display of parameters and waveform. Install the SWAE software package and install the software. Connect RAEM1-6 to the computer and configure the computer, hardware, and software settings. When RAEM1-6 is running the collection, the real-time collection can be started.

- support online transmission mode: Ethernet connection (single or networking), Wi-Fi network connection.



Remarks: attention when using SWAE online acquisition, it is necessary to close the firewall:

- ✧ ① **Open Windows Defender Firewall with Advanced Security.**
- ✧ ② **Open "Windows Defender Firewall Properties";**
- ✧ ③ **In the domain profile, change Firewall status to Off.**
- ✧ ④ **Repeat Step 3 under Private Profile and Public Profile.**
- ✧ ⑤ **Click "OK".**

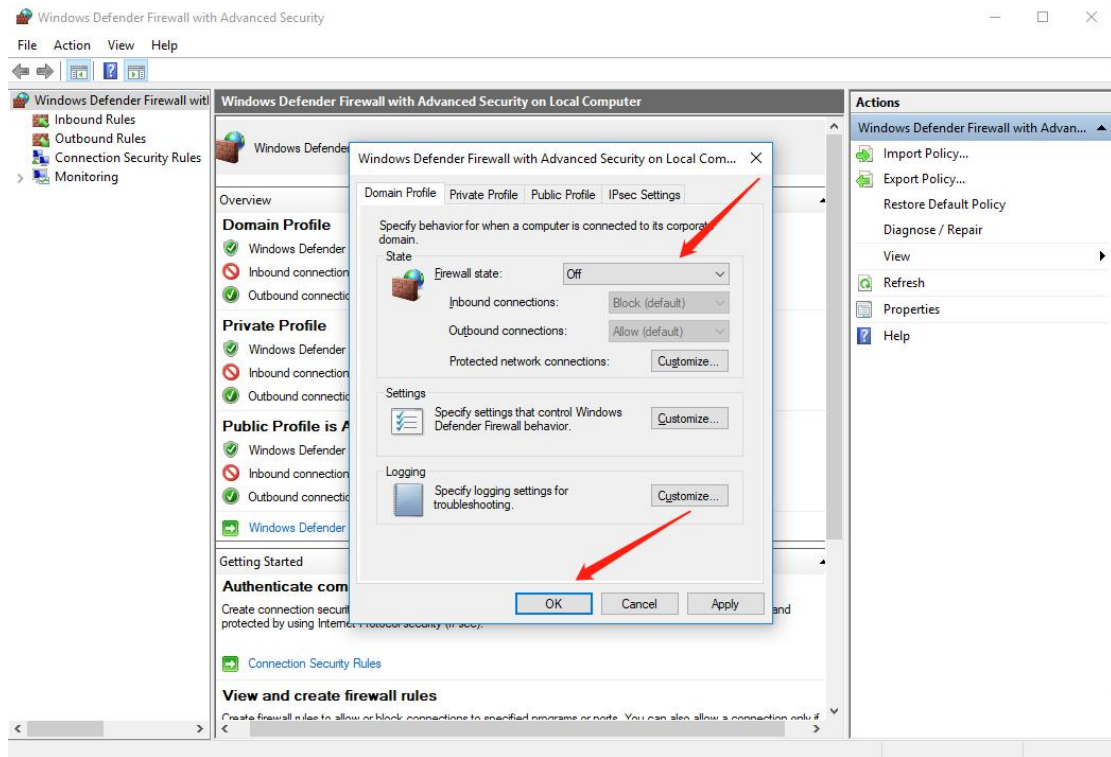


Fig. 2-21 Disabling the firewall

Follow these steps to connect RAEM1-6 to the software for use:

- (1) Connect the RAEM1-6 devices according to the Ethernet connection method described in Chapter 3.1 or Wi-Fi connection method described in Chapter 3.2. You can choose single direct connection or multi-device networking. However, please note that for the Wi-Fi direct connection of a single RAEM1-6, due to the transmission rate and stability, it is recommended that this mode only be used with the parameter configuration software.
- (2) To send the data to SWAE software, the RAEM1-6 and the computer should be under the same network segment, i.e. 192.168.0.xxx (but different IPs). If they are already connected via a network cable or Wi-Fi router, Windows users can tap the network button at the bottom right of the screen and view the network properties of the connection. Check whether the IP address of the connected computer is on the target network segment 192.168.0.xxx, and write down xxx.
- (3) RAEM1-6 also needs to be set up in "RAEM1 configuration" software to be able to send data to the specified computer. In the device list, select the channels that you want to send data to the SWAE software. On the "Storage Settings" page, disable the "Save Waveform", "Save Parameters", and "Upload original data" functions. Enable "Send U3H software" and enable "send waveform" and

"send parameter" data. The IP Address type select "Enter IP", and then enter the computer's IPv4 address which can be marked down in Step (2). Fill in the port number truthfully. Then click the "Settings" button in the upper right corner of the configuration software to send the above changed Settings to the selected channel of RAEM1-6. Close the configuration software. So that RAEM1-6 will send the data to the specified computer.

Caution: Ensure that the IP address of RAEM1-6 and the target IP address of the computer are on the same network segment, but cannot the same IP.

Note: Turn off local waveform and parameter saving because local SD card saving may slow down sending data to SWAE and cause data loss. As long as the waveform and parameters sent to the "U3H Server" are enabled, all the original data will be sent to the SWAE, and then saved in the "U3H" format.

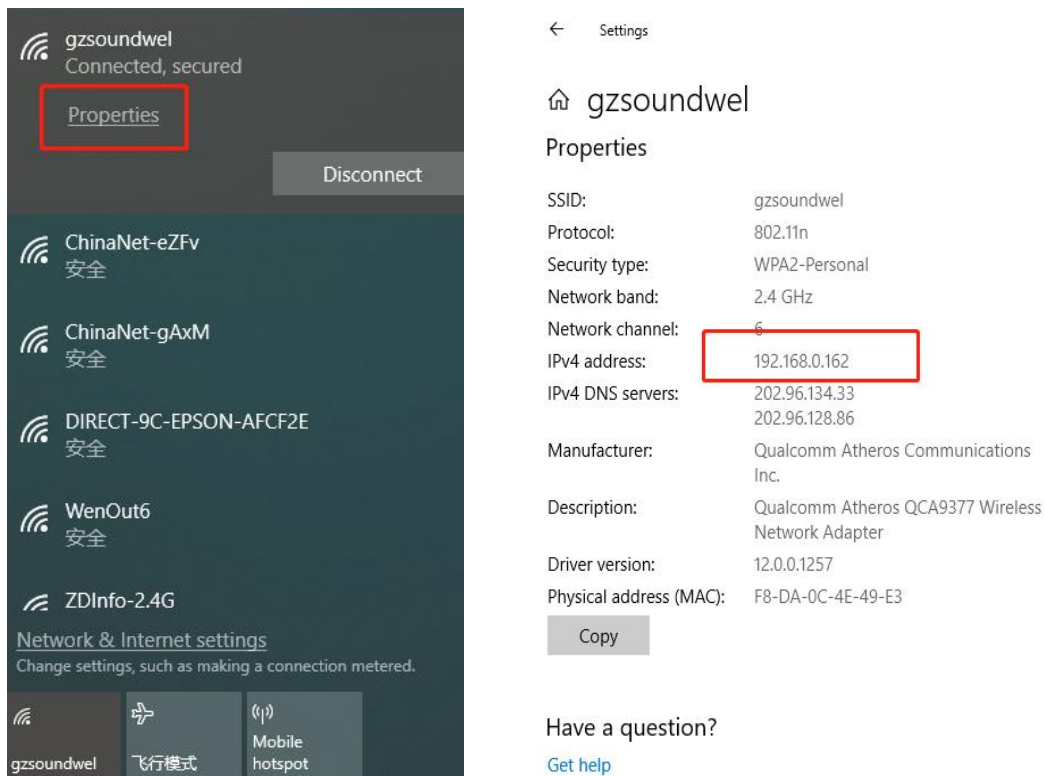


Fig. 2-22 Viewing the WiFi router connected computer network address

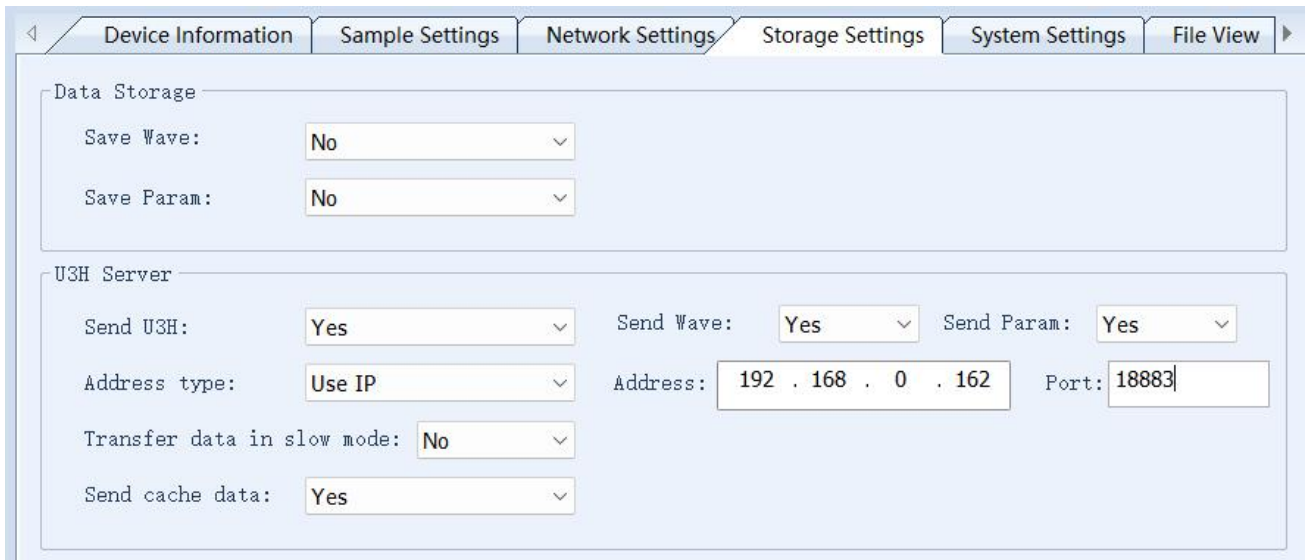


Fig. 2-23 Setting the target IP address of the PC in RAEM1 Configuration software

- (4) The SWAE software needs to be installed. After the software is installed, start the software, click "Hardware and Sample", and click "Sample Settings".



Fig. 2-24 Software sample Settings

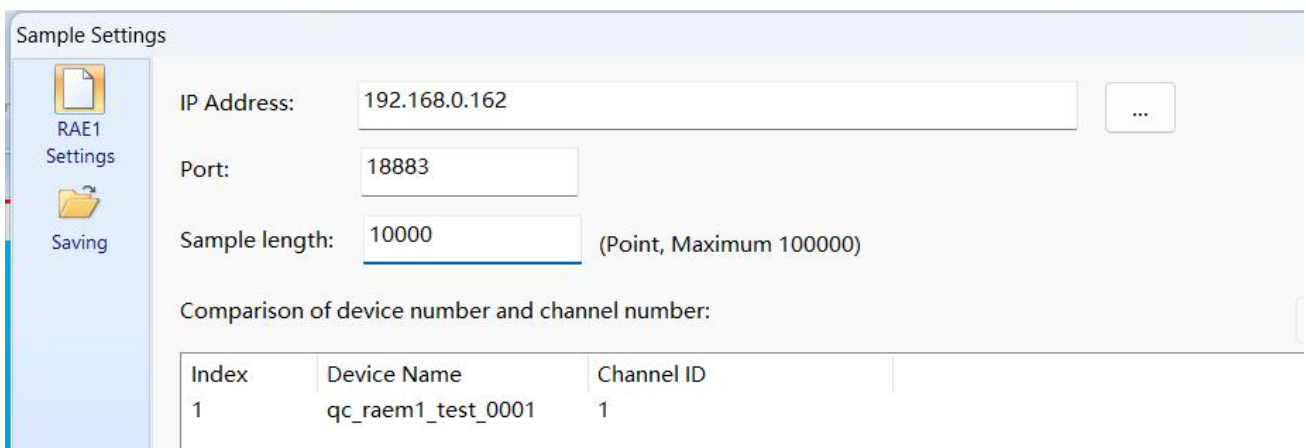


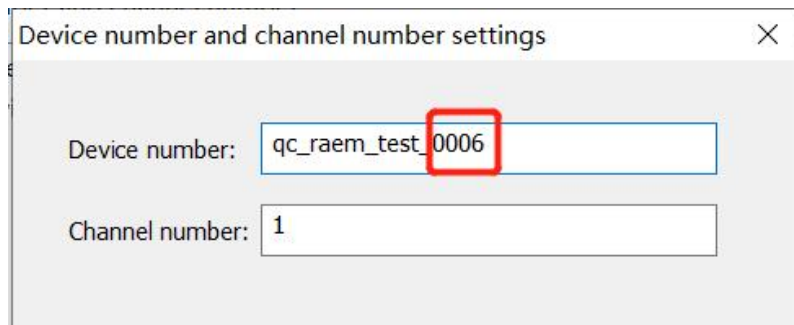
Fig. 2-25 Change Address in the Settings

- ① IP Address: specifies the IP address of the target PC. This parameter is the same as IP address in Step (4) above. You can also click "... "on the right. Get the current computer IP address.
- ② Port number: The port number is the same as that set in "RAEM1 Configuration" software.
- ③ *Sampling speed: consistent with the sampling speed set by RAEM1-6 channels.

④ Sampling length: only related to the waveform window display in SWAE. It is recommended to set the value equal to RAEM1-6 sampling rate multiplied by EET (or the “sample length in unit of microseconds in the configuration software”).

⑤ Click the "Add" button to add channels. The pop-up window will allow to set the device number and channel number. If you don't define the channels here, the software will assign the channel numbers based on the arrival orders of different channels. For example, if Channel 0003 data arrives first, Channel 0003 will be assigned as channel #1 in the software.

- Device number: Enter the last four digits of the channel ID as follows:
- Channel number: Manually define the channel number, which is defined as 1 in ascending order.



(5) Click "Save" and click "Sample" button:

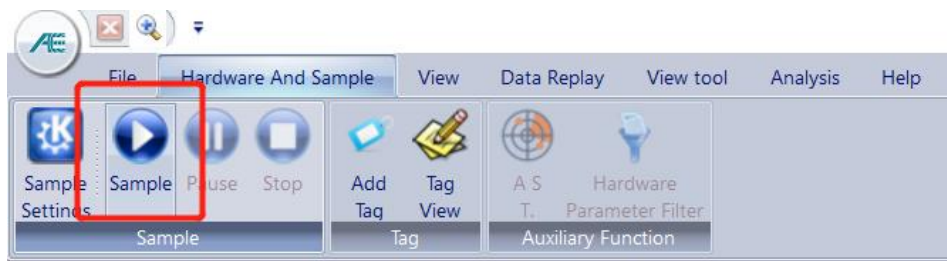


Fig. 2-26 Click and Collect

(6) Define the data saving path: save the data sent by RAEM1-6 into "U3H" software format (.PRA and .AED format).

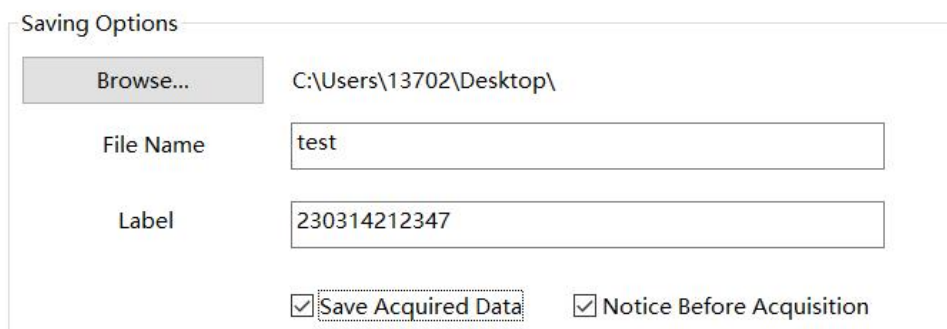


Fig. 2-27 Save path for the collection file

(7) Starting sampling will have a network matching process for a few seconds, and parameters and waveform can be observed to be sent online. Generally, the waveform will appear first, and then wait 3 seconds for the parameters to appear.

No	Arrival time(dd:hh:mm:s...	AE cha...	Amplit...	Counts	Duration(us)	Energy(KpJ)	Rise counts
1	8:13:55:47:454 502736	1	100.0	514	9993	148749.398	24
2	8:13:55:47:497 744779	1	61.4	35	739	8.878	1
3	8:13:55:47:548 200830	1	56.8	1	24	25.572	1
4	8:13:55:47:549 480741	2	60.3	129	2810	15.106	20
5	8:13:55:54:267 856169	1	57.1	1	25	37.893	1
6	8:13:55:54:354 205246	2	100.0	514	10000	49015.131	28
7	8:13:55:54:354 207256	1	100.0	516	10000	57642.832	31
8	8:13:56:07:286 056438	2	100.0	495	10000	13843.719	3
9	8:13:56:07:286 058668	1	100.0	488	10000	16009.981	3
10	8:13:56:07:574 185696	1	88.5	497	9815	528.356	36
11	8:13:56:07:574 227926	2	78.8	502	9908	344.065	63
12	8:13:56:07:681 915543	1	67.9	96	2185	23.984	1
13	8:13:56:07:682 078694	2	64.0	94	2091	14.655	15
14	8:13:56:07:732 594594	1	68.6	64	1357	22.053	0
15	8:13:56:07:732 614744	2	61.7	97	1947	15.089	24
16	8:13:56:14:719 848091	2	100.0	466	9997	14983.857	3
17	8:13:56:14:719 886941	1	88.0	500	9977	971.655	2
18	8:13:56:14:762 010134	2	61.0	8	178	22.428	3

Fig. 2-28 Parameter table data

(8) When the mouse scrolls over the waveform view, the channel number will be changed:

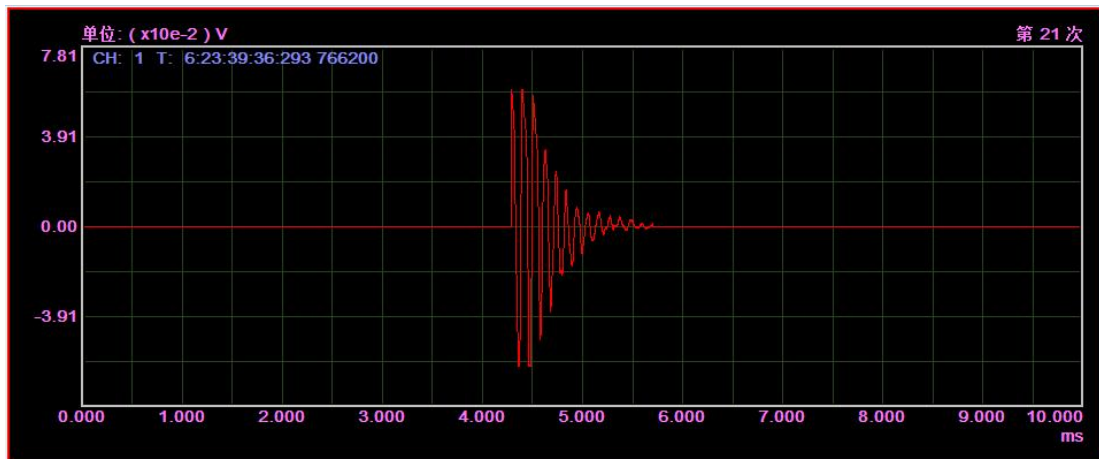


Fig. 2-29 Waveform view

For details, see Chapter 3.4 of the User manual. By default, the data is in the form of (.pra) and (.aed). All parameters and waveform transmitted from the click of the "Sample" button are saved.

3. RAEM1-6 IoT Monitoring System Operation Guide

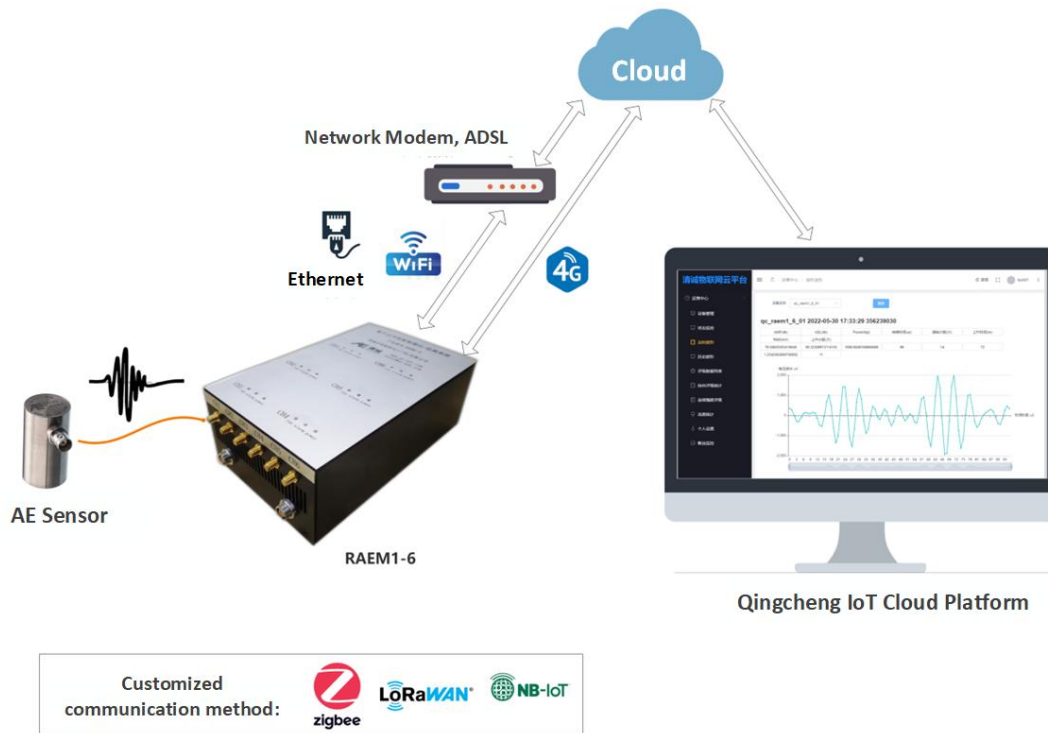


Fig. 3-1 Connecting the RAEM1-6 monitoring system

In addition to the function of detector, RAEM1-6 can also be used as monitoring equipment, namely, RAEM1-6 sound wave (acoustic emission) monitoring system. Data can be uploaded to various cloud platforms through existing Ethernet and Wi-Fi communication or upgrading 4G or other communication methods to realize long-term unattended monitoring of monitoring/detection objects in the Internet of Things. Provide flexible alarm threshold Settings, can actively push the alarm information to the client mobile phone.

Now connect the hardware as required. After completion, start RAEM1-6, and you can start the operation after logging in to the QingCheng IoT could platform.

The Internet of Things cloud can be the Qingcheng Internet of Things cloud platform independently developed by Qingcheng, or it can be Ali Cloud, or Amazon AWS, or users can put forward other client cloud requirements. This manual mainly describes how to use Qingcheng IoT cloud platform and Ali Cloud platform.

3.1. 4G network connection

RAEM1-6 can use 4G Internet of Things network card to connect to cloud server directly through mobile Internet for parameter configuration, data transmission, display analysis and other purposes.

A single RAEM1-6 can directly connect to the cloud through its built-in 4G module. You need to connect a 4G antenna and plug in an Internet of Things card. After the hardware connection is complete, start RAEM1-6 to log in to the cloud server and start operations.

The IoT card slot is on the back of the RAEM1-6. Generally, the factory does not provide IoT card. Customers need to buy their own IoT cards can be wireless mobile cards of any carrier, 2G, 3G, 4G, 5G networks, standard (Mini-SIM) SIM card size. The Internet of Things network card can be inserted to use. Note that the metal chip is inserted face down. Because the slot is relatively inward, a thin pen or other similar object is needed to insert or remove it. To insert, push the IoT card in until the card is locked in the slot. To remove, push the card inward with the pen, and the card will be ejected.



Fig. 3-2 RAEM1-6 Connecting to the cloud over 4G

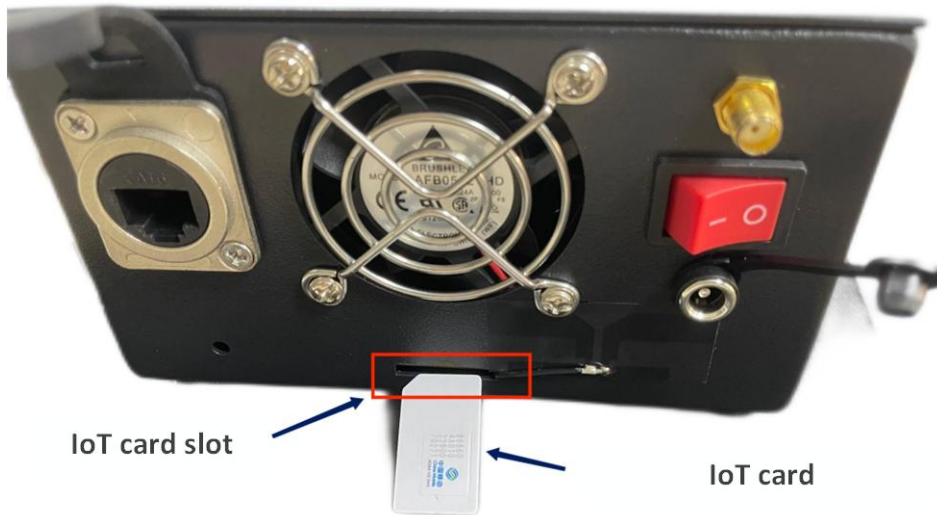


Fig. 3-3 RAEM1-6 Network adapter and card slot for the Internet of Things

If multiple RAEM1-6 are used and connected to the cloud via 4G networks, clock synchronization is also required. It is only necessary to connect all RAEM1-6 in series with a cascade cable. Each RAEM1-6 has two clock synchronization interfaces. Connect one end of the cascading cable to any clock synchronization interface of RAEM1-6, and connect the other end of the cascading cable to any clock synchronization interface of another RAEM1-6 to cascade the two RAEM1-6. If so, cascade all required RAEM1-6 in series.

Before delivery, the master/slave mode of the channel is set for clock synchronization. Users do not need to perform operations. Generally, only one channel of each RAEM1-6 is set as the master, and the others are slave. If multiple RAEM1-6 are cascaded, only one channel (which can be any channel) is kept as the master, and all the other channels are changed to the slave. If you really need to operate by yourself, you need to use network cables to connect RAEM1-6 to the computer and operate with "RAEM1 Configuration software".

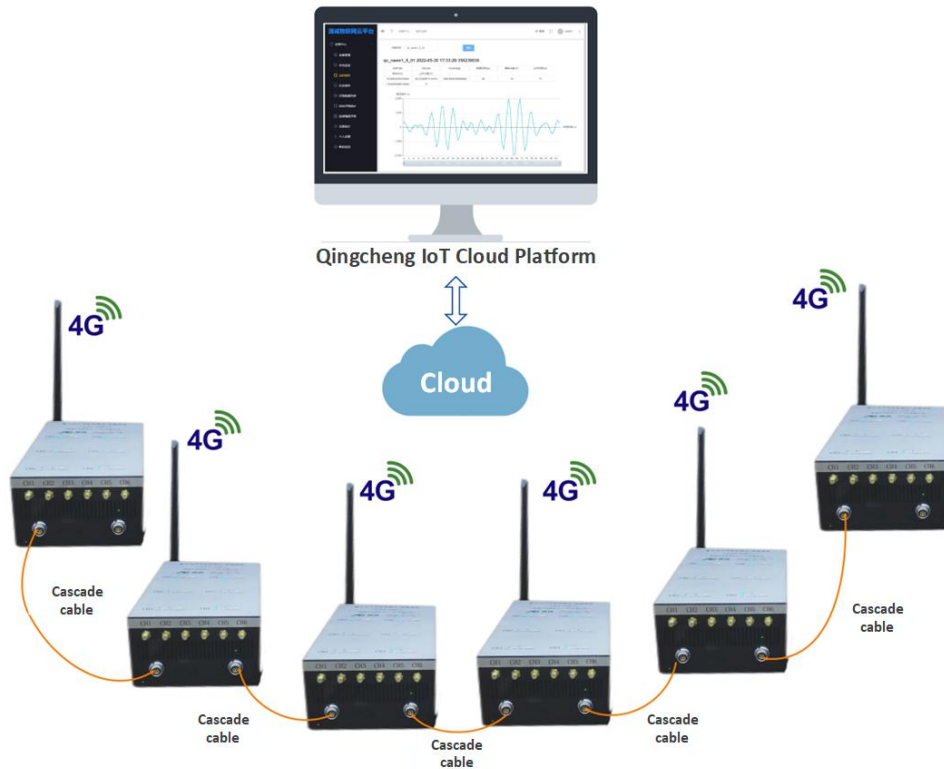


Fig. 3-4 RAEM1-6 on the 4G network

3.2. Wi-Fi Network connection

RAEM1-6 can also use a wireless network gateway to connect to the cloud server for parameter configuration, data transmission, display and analysis, such as Wi-Fi router. The following example uses a Wi-Fi router as an example.

A single RAEM1-6 as a monitoring system can be connected to the Internet through a router. Connect RAEM1-6 to the Wi-Fi router with network cable first. Then the router connects to the Internet. Log in the IoT cloud platform. In this case, the Wi-Fi router also needs to be configured. **The router must be configured as network segment 0, that is, 192.168.0.xxx, and the router must be set to automatically assign IP addresses to devices.** After the connection is successful, you can directly access the Internet to view devices and start operations on the cloud platform of the Internet of Things. If your computer is on the same Wi-Fi router as RAEM1-6, you can also use the RAEM1 Configuration Software (see Section 3.3) for local configuration and simple debugging.

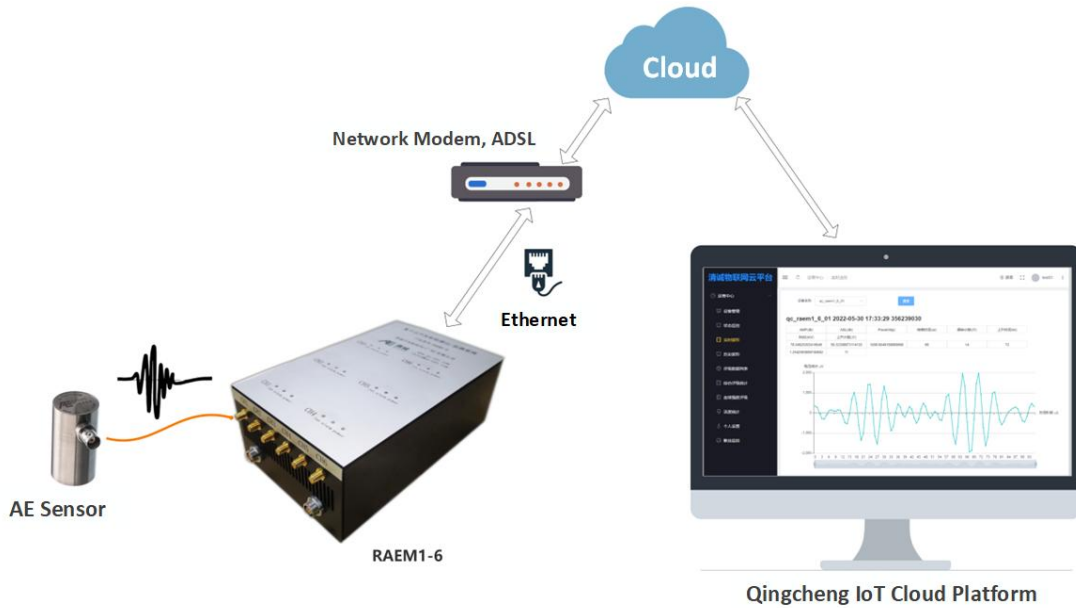


Fig. 3-5 Connecting to the cloud center through the gateway

RAEM1-6 can also use a wireless network gateway to connect to the cloud server for parameter configuration, data transmission, display and analysis, such as Wi-Fi router. The following example uses a Wi-Fi router as an example.

A single RAEM1-6 as a monitoring system can be connected to the Internet through a router. Connect RAEM1-6 to the Wi-Fi router with an Ethernet cable first. Then the router connects to the Internet. Log in the IoT cloud platform to view data.

The Wi-Fi router also needs to be configured. There are two methods to make the router configurations.

	RAEM1-6	WiFi Router
1	Static IP: 192.168.0.101 to 106	Use a fixed IP: e.g. 192.168.0.50
2	Change the static IP to dynamic IP and obtain IP from the router	Automatically assign IP address to devices

Table 3-1 RAEM1-6 Networking IP Configuration Methods

Method 1 means the router must be configured to the network segment “0” same as the RAEM1-6 static Ethernet IP, which should be 192.168.0.xxx. But “xxx” cannot be the same the IP as RAEM1-6 channels. So it is recommended to be 192.168.0.50 to avoid conflicts.

For method 2, the router can set to automatically assign IP addresses to devices. In that case, RAEM1-6 Ethernet IP should be changed to “Dynamic” IP instead of static. One problem with Method 2 is if in some case, the RAEM1-6 needs to directly connect to computer through Ethernet cable afterwards, RAEM1-6 and

the computer should both change the IP addresses to static IP again using the router before the direct connection.

After the connection is successful, you can directly access the Internet to view devices and start operations on the cloud platform of the Internet of Things. If your computer is connected to the same Wi-Fi router as RAEM1-6, you can also use the RAEM1 Configuration Software (see Section 3.3) for local configuration and simple debugging.

Multiple RAEM1-6 networks also require clock synchronization by connecting multiple RAEM1-6 in series with cascade cable. Each RAEM1-6 has two clock synchronization interfaces. Connect one end of the cascading cable to any clock synchronization interface of RAEM1-6, and connect the other end of the cascading cable to any clock synchronization interface of another RAEM1-6 to cascade the two RAEM1-6. If so, cascade all required RAEM1-6 in series.

Before delivery, the master/slave mode of the channel is set for clock synchronization. Users do not need to perform operations. Generally, only one channel of each RAEM1-6 is set as the host, and the others are slave. If multiple RAEM1-6 are cascaded, only one channel (which can be any channel) is kept as the host, and all the other channels are changed to the slave.

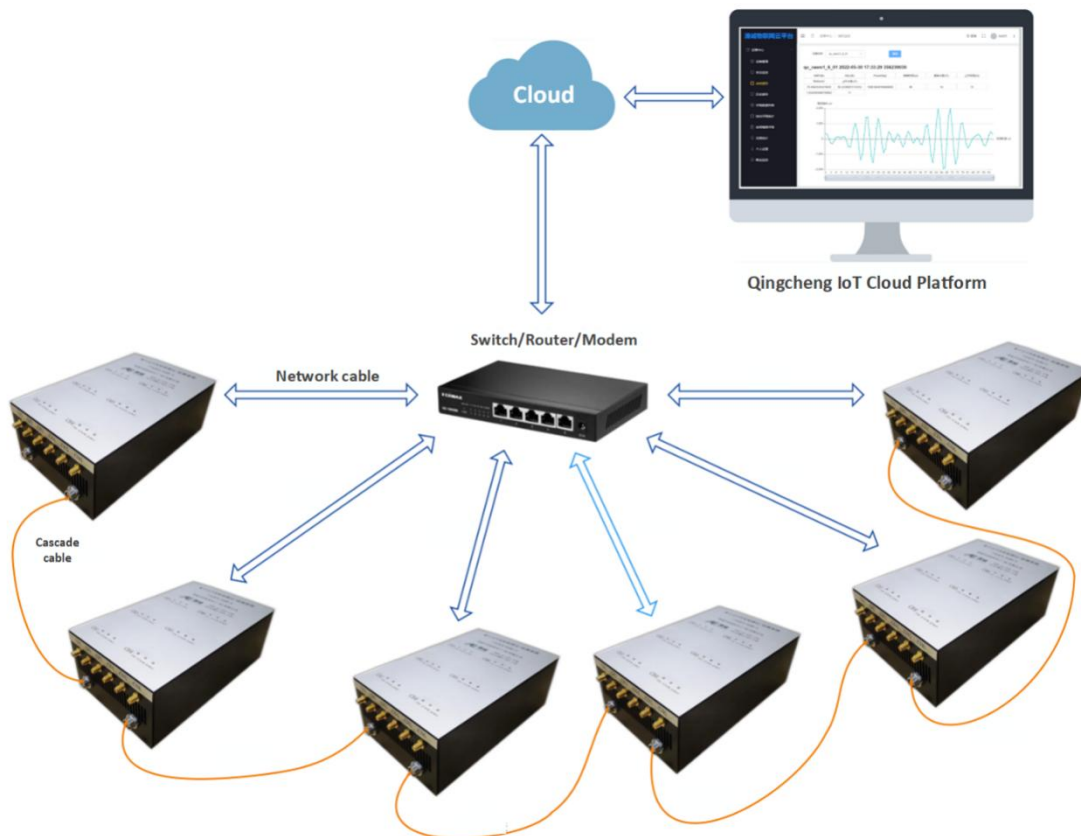


Fig. 3-6 Networking of RAEM1-6 through the gateway

3.3. Qingcheng IoT Cloud Platform

Qingcheng Internet of Things Cloud Platform is a cloud platform developed by Qingcheng AE Institute for our own Internet of Things acoustic emission products. Customers can log in to the platform to remotely check and modify the device configurations in real time, as well as real-time display of AE waveform, parameters, and the rating levels, alarms and reports, etc.

Log in to the Qingcheng IoT cloud platform (<http://8.136.201.16:83/>) and enter the user's name and password. At present, the cloud platform does not support users to register their own accounts. All account registration needs to be operated through Qingcheng Company. Please contact us for user registration and login information.

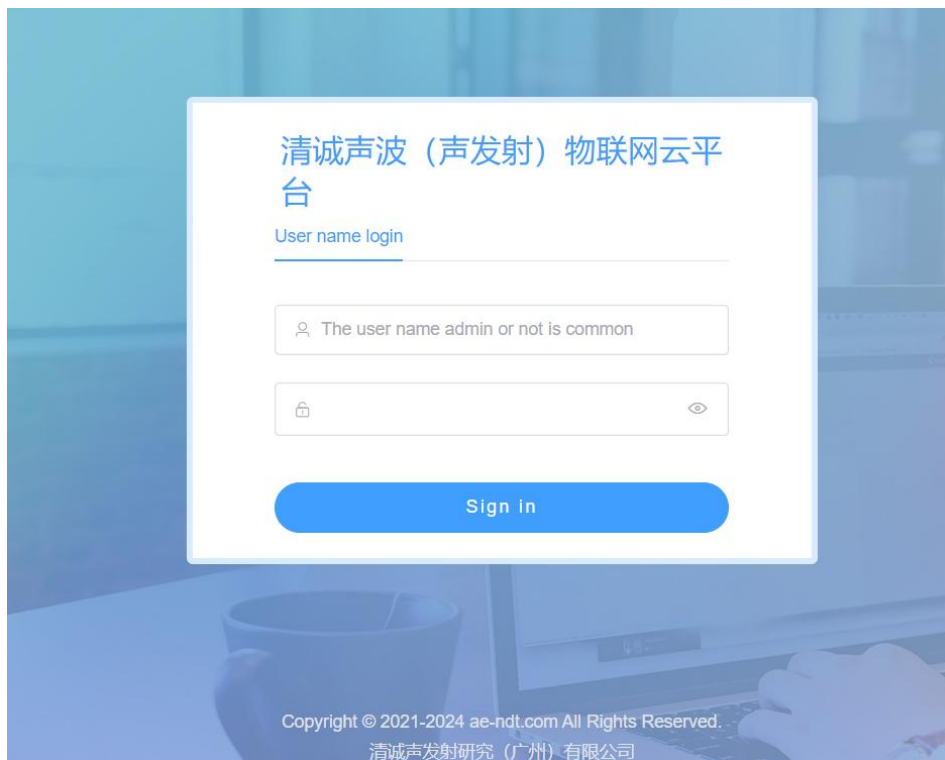


Fig. 3-7 Qingcheng Internet of Things cloud platform login

After the login, at the upper right menu bar of the platform page, there are languages (Chinese/English) conversion and user interface and password settings available.

Please refer to Chapter 4.3 of the **M1-6 User's Manual Operation Guide** for detailed introduction of Qingcheng Internet of Things cloud platform.

4. Data Format Conversion

The format of RAEM1-6 data needs to be converted before in-depth data analysis can be carried out on Qingcheng U3H software or other third-party data analysis software. Currently, there is no software for direct analysis and display of RAEM1-6 data.

The data generated by RAEM1-6 can be converted using our format conversion software "**RAE1toU3H**" (you can also open the software through the "File Conversion" button in the lower left corner of RAEM1 configuration tool software). The "**File View**" page of the RAEM1 configuration tool allows you to download data and convert formats at the same time, as detailed in Chapter **3.3** of the **M1-6 User's Manual Operation Guide**.

The converted files (. pra and. aed) can be opened and analyzed in U3H software. For details about how to use 3H software, please contact our company to obtain the U3H software manual. It can also be converted to CSV format for third-party software analysis. Conversion software supports multi-channel conversion.

- 1) After the conversion is complete, the corresponding U3H files (. pra and. aed), which can be imported into our SWAE host computer for analysis:

名称	修改日期	类型	大小
qc_raem1_df_0002_ae_ndt_946685362.zip	2021/7/6 14:41	压缩(zipped)文件...	8,711 KB
qc_raem1_df_0002_ae_ndt_946685367.zip	2021/7/6 14:41	压缩(zipped)文件...	8,624 KB
qc_raem1_df_0002_ae_ndt_946685372.zip	2021/7/6 14:41	压缩(zipped)文件...	8,626 KB
RAE1_210519113557072.aed	2021/7/8 17:33	AED 文件	29,476 KB
RAE1_210519113557072.pra	2021/7/8 17:33	PRA 文件	503 KB

Fig. 4-1 3H data is generated after conversion

- 2) If you want to convert to CSV format, click "▼" next to "Convert U3H" and click "**Convert CSV file.**" After the conversion is complete, you can view the corresponding CSV file in the corresponding directory. The generated CSV file has the prefix RAE1. The first column of the CSV file is the time and the second column is the waveform (the voltage value at each collection point). When the generated CSV file exceeds about 800,000 lines, another new CSV file is automatically generated.

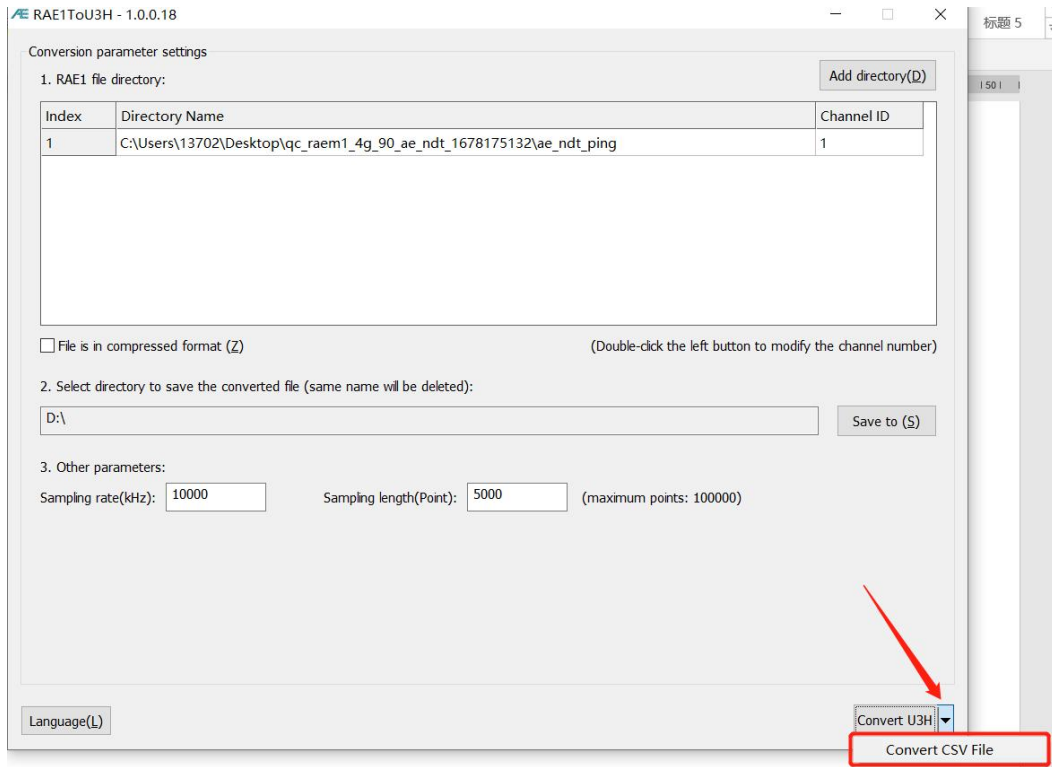


Fig. 4-2 Converting RAE1ToU3H to CSV button

名称	修改日期	类型	大小
qc_raem1_test_06_ae_ndt_16318580...	2021/9/17 14:01	WinRAR ZIP 压缩...	995 KB
qc_raem1_test_06_ae_ndt_16318581...	2021/9/17 14:01	WinRAR ZIP 压缩...	2,057 KB
qc_raem1_test_06_ae_ndt_16318581...	2021/9/17 14:01	WinRAR ZIP 压缩...	2,053 KB
qc_raem1_test_06_ae_ndt_16318582...	2021/9/17 14:01	WinRAR ZIP 压缩...	2,053 KB
qc_raem1_test_06_ae_ndt_16318582...	2021/9/17 14:01	WinRAR ZIP 压缩...	2,052 KB
RAE1_210917135354494.csv	2021/10/13 17:39	XLS 工作表	49,993 KB

Fig. 4-3 CSV file generated after conversion

A2		fx 2021/09/17/ 13:53:54 494				
	A	B	C	D	E	F
1	Date Time	单位(V)				
2	2021/09/17	0.002921				
3		0.008655				
4		0.014426				
5		0.018658				
6		0.020844				
7		0.020468				
8		0.018228				
9		0.015076				
10		0.012219				
11		0.009366				
12		0.006787				
13		0.004294				
14		0.001776				
15		-0.000632				
16		-0.002405				
17		-0.003949				
18		-0.005338				
19		-0.006592				
20		-0.007516				
21		-0.008282				
22		-0.009012				
23		-0.009573				
24		-0.010196				
25		-0.010443				

Fig. 4-4 CSV file format