Sanlien Technology Corp.

pALERT S303

P-wave Early Warning Seismometer

User Manual

V1.16
2022/04

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Menu

Version Record

Date	Description	Author
20201028	*Version 1.00*	Ching
20201119	First Edition Supplement *Version 1.01*	Ting
20201120	Supplementary Linux Function Explanation Revised Streaming Packet Description and Timing Diagram *Version 1.02*	Ching
20201125	Adjusted Connector Pin Description Table and DO Wiring Diagram *Version 1.03*	Ching
20201208	Corrected AUX Pin DO Output Current *Version 1.04*	Ting
20201222	Corrected Mode 16 Description *Version 1.05*	Ting
20201225	Corrected 5-2-3-11, Units of Speed, 5-1 supplemented Linux operating instructions, and 5-2-3-33 new function description. *Version 1.06*	Ting
20210217	Firmware 4.51 1. Added GPS Modbus Points 0x018F ~ 0x0197 2. Added [STORAGE_CONFIG] 3. Added FAKE_PPS *Version 1.07*	Ching

Version Record

Date	Description	Author
20210226	Firmware 4.54 Added CPU_RESET_END_LEVEL *Version 1.07*	Ching
20210324	Firmware 4.56 1. Added Positive Cycle File Storage 2. Added miniSEED Server Function 3. Added CEB Compensation Filter 4. Added the function of reading waveform file instead of sensor. *Version 1.08*	Ching
20210413	Added New Network Configuration Method Added Wi-Fi AP Function Explanation Corrected FAKE_PPS Parameter Explanation Added CPU_RESET_END_LEVEL Explanation *Version 1.09*	Ting
20210610	Firmware 4.59 MODE 1 packet added PACKET_NO Added [EVENT_FILE_OPTION]. Added [REMOTE_CONTROL]. Added PALERTV11 option Added SERIAL_NO description for memsCalData. Added real-time displacement Modbus point. Added button to restore factory setting. Added DO Action Logic Diagram *Version 1.10*	Ching
20211116	Renamed to pALERT S303 Added Quick Connector Male Pin Explanation Added JMA Intensity Scale Correspondence and 200 SPS Sampling Rate Explanation *Version 1.11*	Ching

Version Record

Date	Description	Author
20211221	Firmware 4.62 Added CEB Intensity Meter Transmission Mode Added NTP OFFSET_TH for NTP Time Calibration Quality Control Added Modbus Points for Time Calibration Status Information Added BRIGHTNESS_ON_ERR to Control Backlight Flash Brightness Added [REPLAY] to Simulate Event File Contents and Validate Algorithms Added RECORD_DRIVEN_BY_EVENT for NCREE to Switch Recording File Methods Added Factory Default Settings Parameters: COUNT_TO_VOLT, COUNT_TO_GAL, CPU_SLIP_TIMEOUT_TICK, CPU_DATA_ALIGNMENT, DESPIKE, SPIKE_DATA, and Others *Version 1.12*	Ting
20220105	Corrected Modbus Points PCB Temperature Unit	Ting
20220322	Added [RELAY_PD] *Version 1.13*	Ting
20220330	Added NTP offset to Mode 1 and Mode 16 *Version 1.14*	Ching
20220408	Added MMI PGA and PGV Configuration Explanation *Version 1.15*	Ching
20221109	Firmware 4.67 Introduced Whitelist Function to Address Cybersecurity Concerns. *Version 1.16*	Ting

1. Features

pALERT S303 is an advanced P-wave early warning seismometer, which not only has the first generation of Palert's P-wave early warning function, but also has the recording, intelligent warning (LINE, MQTT) function, and in terms of performance, the built-in 24 bits ADC and low-noise MEMS (Microelectromechanical Systems) accelerometer module greatly improves the signal-to-noise ratio, which can be used as the front-end sensing system of Rapid Structural Health Diagnosing System for rapid diagnosis of structural safety after earthquakes, besides the original secondary disaster prevention.

The pALERT S303 contains a tri-axial MEMS accelerometer in the hardware, three sets of TTL DO contacts for connecting and controlling external devices, 10/100MHz network communication capability, and a small embedded information display LCD, IP67 waterproof rating, and can be operated continuously for three hours with the internal battery in the event of a loss of external power.

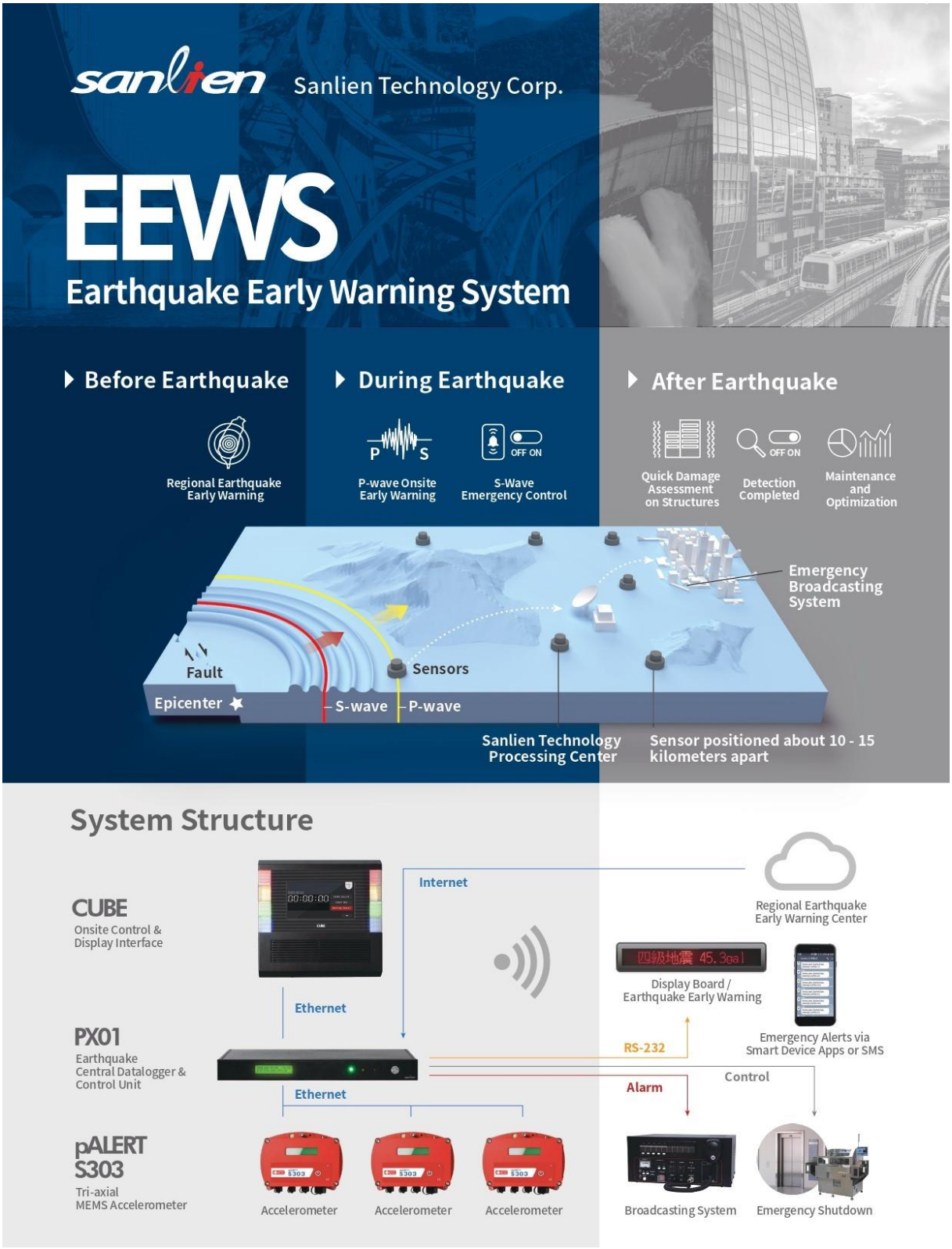
In terms of software functions, in addition to the original Palert's seismic discrimination technology (Pd, PGA, STA/LTA), the signal sampling rate has been increased from the original 100 sps to 1000 sps, and with the built-in low-pass filter, it can provide the user with the choice of 50, 100, 200, 500 or 1,000 data strokes per second. In terms of data recording, in addition to selecting the event trigger recording mode, you can also select continuous recording or timed recording; in terms of connectivity, in addition to providing TCP server functions, it also provides TCP client and Administration server functions; in terms of streaming data packets, in addition to the original Palert's Mode 1 and 2 packets, in addition to the increase in the Mode 4, 8 and 16 formats, users can choose according to the needs of the users. In terms of streaming data packets, in addition to the original Palert Mode 1 and 2 packets, Mode 4, 8 and 16 formats have been added, allowing users to choose between 16 bits and 24 bits resolution streaming packets.

In terms of seismicity, it supports MMI, KMA, JMA, GB/T, and the ten seismicity levels issued by the Central Weather Bureau (CWB); in terms of seismic alarm, it supports the group communication software LINE and the MQTT protocol; in addition, it also supports the Modbus TCP industrial protocol, which allows up to ten computers or mainframes to be connected simultaneously, which is convenient for the users to integrate into the monitoring and controlling system of the factory or the intelligent building.

For users who are not familiar with the control software, they can use the Palert Early Warning System for waveform reading or SanDAS for more detailed operation.

The company also provides Cube touch-type HMI, which is suitable for earthquake early warning in the field, and also provides rack-type integrated host PX01 to integrate the disaster prevention system in the factory, please contact the company's website for further requirements. http://www.sanlien.com

2. System Structure



3. Hardware

1. LCD Display
2. Function buttons
3. External Sensor Socket
4. AUX Output Socket
5. Power Socket
6. Network Socket
7. Leveling Screw

3-1 Waterproof Quick Connect

3-1-1 Plugging and Unplugging Method

The pALERT S303 uses a waterproof quick coupler with a Fool Proofing function. Users can press the coupler in until it clicks to indicate that the coupler is locked. To remove the connector, hold the connector at A in the figure below and use your thumb and forefinger to rotate B counterclockwise to remove the connector.

3-1-2 Power On and Off

When external power is supplied, the pALERT S303 will automatically turn on. When the external power is removed, the internal battery will continue to supply power to keep the instrument running, and the only way to turn off the instrument is as follows:

- Button is pressed for 12 seconds.
- Remote control via Modbus protocol.
- The internal battery voltage is exhausted.
- Ground pin 9 of the external sensor socket.

3-2 LCD Display

20 characters, 2 lines, provides the user with real-time status of the instrument.

3-2-1 Backlight

To save power consumption, the backlight is turned off during normal operation, but it will be turned on automatically in the following two situations:

1. When the user presses a button.

2. When the system detects an event or an abnormal connection.

When the above events disappear, the backlight will turn off automatically according to the user's setting seconds.

3-2-2 Display Content

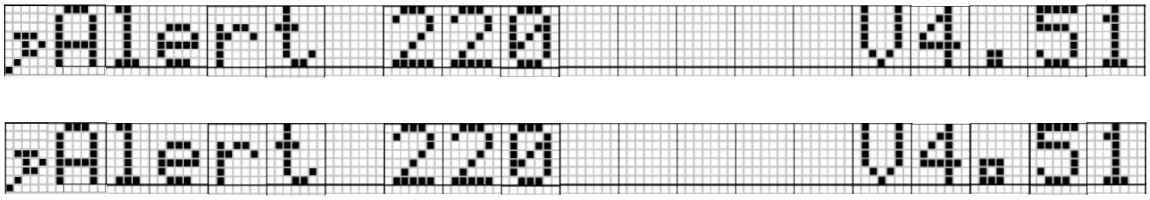
1. The first line normally displays "pALERT S303 Vx.xx" every 10 seconds, where Vx.xx denotes the software version, and if the ADC sampling data is normal, it will blink "." for every 100 samples.

2. The second line is the message column, if there is any event or abnormality, the message will appear in this line.

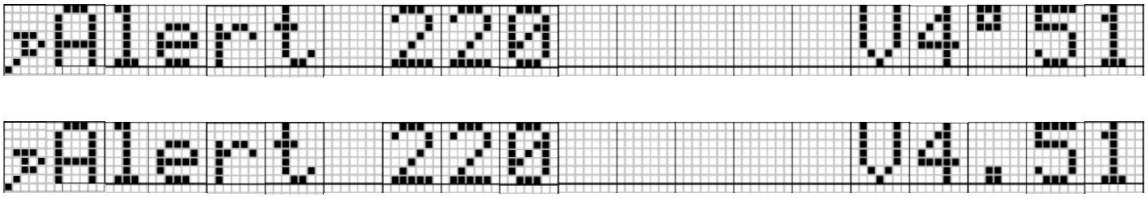
3. 40 bytes of LCD display will be synchronized with Modbus points, please refer to the following section for Modbus points.

3-2-3 Display Example

The following is the content displayed in the first line when the "SENSOR_TYPE" is set to Palert220. The part marked by the red box will be displayed alternately according to the data sampling rate of sps/100 set by the camera, e.g., the pattern of the red box will change once per second if the sampling rate is 200 sps. For example, if the sampling rate is 200 sps, the pattern of the red box will change once per second.



When the unit has the optional GPS function and the GPS signal is locked, then the first line displayed will be as follows:



3-3 Buttons

In addition to the Modbus protocol remote control, the machine can also be controlled by pushbuttons. If you don't want the pushbuttons to be touched or operated by uninvolved persons, you can refer to the section of the setup file at the end of this chapter for the password protection of the pushbuttons.

Note: To protect the button from misbehavior, please do not press the button within 10 seconds after the successful setup.

3-3-1 Pushbutton Seconds Description

When the button is pressed, the seconds are displayed on the LCD, and when it is released, it is the button seconds.

Button Seconds	Description
1	Display IP address
2	Restart NTP service
3	Cancel the alarm
4	Restart the network, NTP service and software
5	Display the program version date
6	Restart the software
7	Update software via FTP
8	Manually start logging
9	Test Mode
12	Shutdown
Compound button	Restore the factory setting, please refer to 3-3-11

3-3-2 Press 2 seconds to restart NTP service.

When the NTP server or network has been adjusted, and if you can not get the correct time from the NTP server, you can press 2 seconds to force the system to restart the NTP service, please refer to the following section for how to set up the NTP.

3-3-3 Press 3 seconds to cancel the alarm.

When the system detects an event, it will decide whether to record, activate DO, etc. according to the user's setting, you can press 3 seconds to cancel the event.

3-3-4 Press 4 seconds to restart network, NTP service and software.

The configuration file of pALERT S303 is only read when the program is started, so if there is any change, you have to restart the system to take effect, and this function will also restart the network and NTP service.

3-3-5 Press 5 seconds to display the program version date.

pALERT S303 not only provides software version, but also provides version date control.

3-3-6 Press 6 seconds to restart the software.

Same as pressing 4 seconds, but only restart the software.

3-3-7 Press 7 seconds to update the software via FTP.

The pALERT S303 will add new features from time to time. If the instrument's network settings allow access to the Internet, the software can be updated automatically through this feature. When you press 7 seconds and release it, the LCD display will show "FTP updating..." and try to get the latest software in the background operation, if the update is successful, the system will be restarted automatically.

3-3-8 Press 8 seconds to manually start the record.

If you want to activate the recording function manually, press 8 seconds and then release it, wait for the LCD to show "RecStandby, press 2", then press 2 seconds to activate the recording, the LCD will show "Manual Rec...", if you want to stop the recording press 3 seconds.

3-3-9 Press 9 seconds, Test Mode

When the DO of pALERT S303 is connected to an external device, this function can be used to test whether the external device can be driven normally. After pressing 9 seconds, "Test Mode: xx" will appear on the LCD, and then press 10 seconds to enter the self-testing mode, and the DO1 ~ DO3 will be turned on in two seconds. If you don't want to enter the self-test mode, you can press 9 seconds to leave the test mode, or don't press the button and wait for 60 seconds for the system to get out of the test mode.

3-3-10 Press 12 seconds to turn off the system.

Press 12 seconds to enter the shutdown procedure, and the system will be shut down after the shutdown procedure is completed, because the system has an internal battery as backup power, so the system can only be shut down after removing the external power supply.

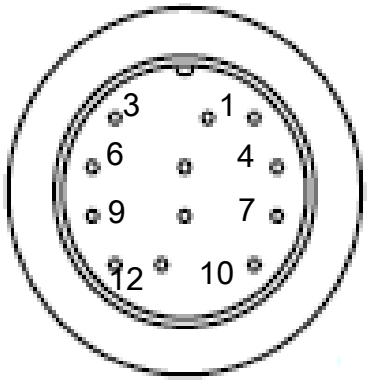
3-3-11 Restoring Factory Settings

If the user forgets the IP and password of the device, he/she can use the function of restoring the factory settings to restore them. Once successful, the IP will be restored to 192.168.255.1, and the password will be pi,p@ssw0rd.

Button Mode:

The unlock code is 15162612 with eight digits, that is to say, user must press the button in order of 1 second, pause, 5 seconds, pause, 1 second, pause, 6 seconds, pause, 2 seconds, pause, 6 seconds, pause, 1 second, pause, 2 seconds, pause, in order to unlock the device. (Pause for at least one second.)

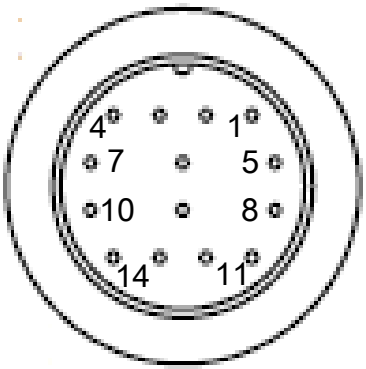
3-4 External Sensor Socket (Male)



Pin	Description	Pin	Description
1	Ground	7	NC
2	12 VDC output, 0.1 A maximum	8	NC
3	Sensor + input	9	Switch-off internal battery if grounded
4	Sensor – input	10	NC
5	NC	11	NC
6	NC	12	Protective earthing conductor

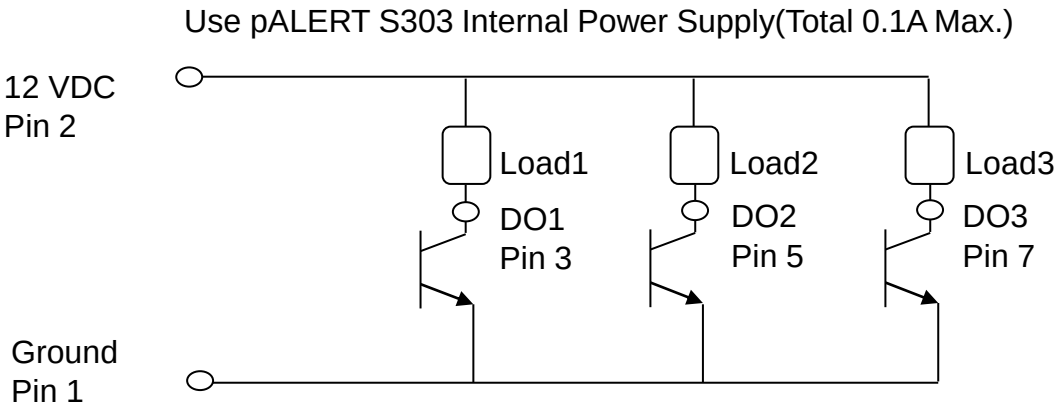
3-5 AUX Socket (Male)

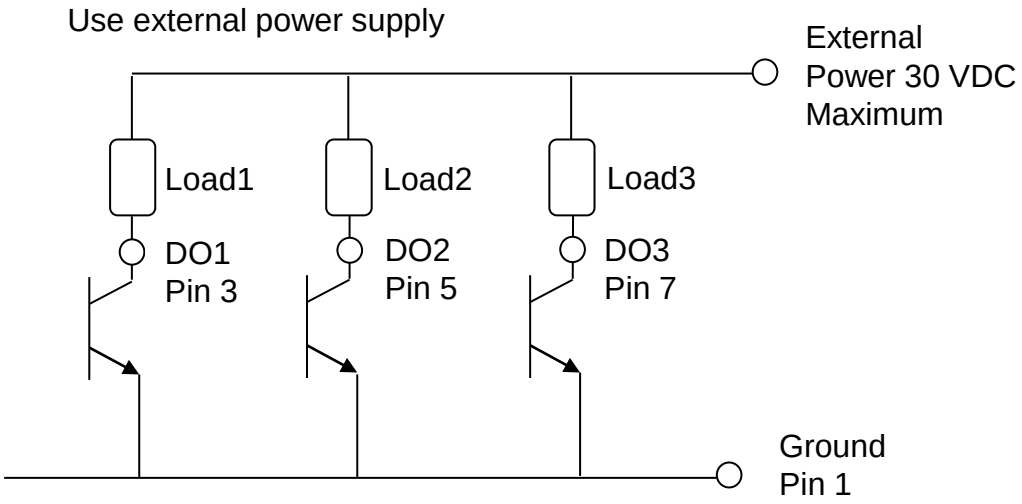
3-5-1 Pin description



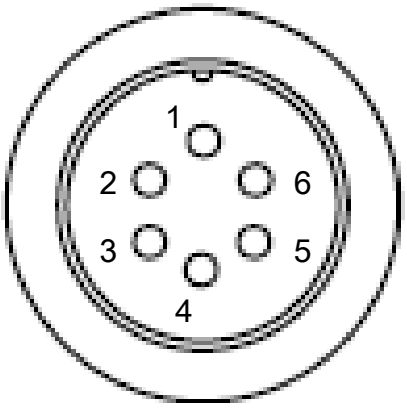
Pin	Description	Pin	Description
1	Ground	8	NC
2	12 VDC output, 0.1 A maximum	9	NC
3	DO1 output, 0.1 A maximum	10	NC
4	NC	11	NC
5	DO2 output, 0.1 A maximum	12	NC
6	NC	13	NC
7	DO3 output, 0.1 A maximum	14	Protective earthing conductor

3-5-2 Digital Output (DO) Wiring Instructions



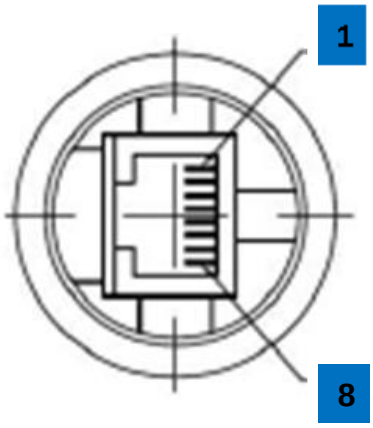


3-6 Power Socket (Male)



Pin	Description	Pin	Description
1	Ground	4	NC
2	10 ~ 30 VDC input, 1 A minimum	5	NC
3	NC	6	Protective earthing conductor

3-7 Network Socket



Pin	Description	Pin	Description
1	TX_D1+	5	BI_D3-
2	TX_D1-	6	RX_D2-
3	RX_D2+	7	BI_D4+
4	BI_D3+	8	BI_D4-

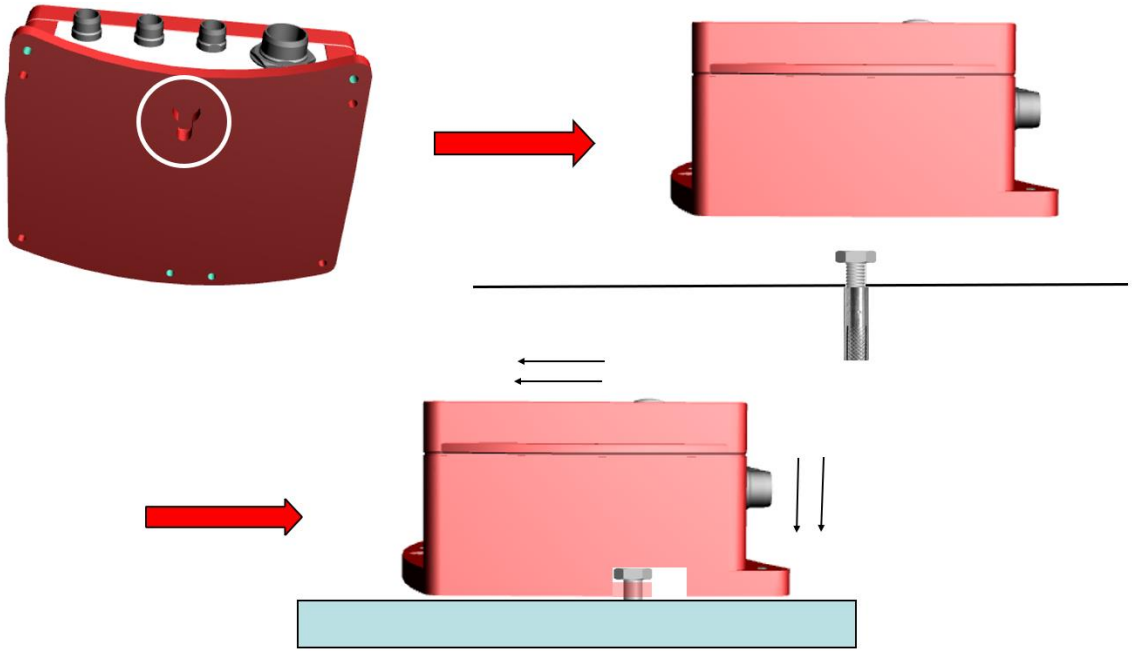
3-8 Leveling Screws

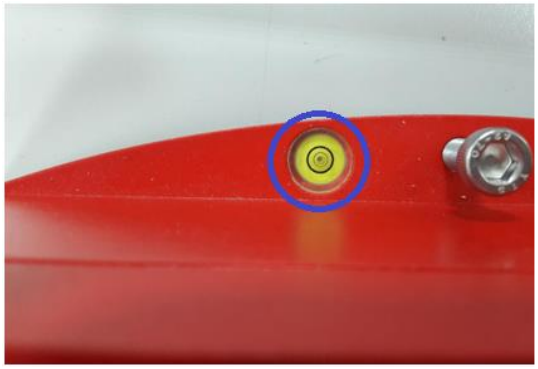
There are three leveling screws, which are used to adjust the level of the instrument, please refer to the installation section below.

4. Installation Method

4-1 Fixing method

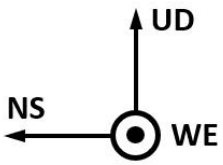
- Depending on the anchor diameter and length, drill holes in the ground (horizontal installation) or in the beams.
- Push the anchor into the hole.
- Insert the screw into the anchor hole and leave it at the appropriate height (about 0.8 cm).
- Insert the screws into the seismograph anchor holes.



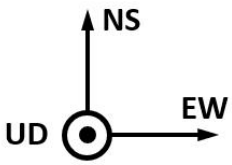


Adjust the three leveling screws (yellow arrows) to securely lock the seismograph to the floor (or wall) and adjust the leveling bubble to the center position (blue circle).

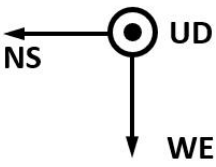
4-2 Installation Directions



WALL



NORTHWARD

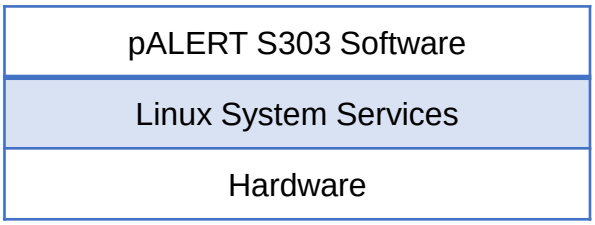


EASTWARD

There are three installation methods as shown in the figure, users must set the corresponding settings in the instrument's configuration file, otherwise the calculation of Pd may be incorrect, please refer to the following section about the configuration file.

5. Instrument Setting

The pALERT S303 system is built on the Linux operating system, so it is divided into two parts: Linux system services and pALERT S303 application layer functions.



5-1 Linux System Services

This section explains the Linux system services used by the pALERT S303. Users should refer to the Linux system related information.

5-1-1 SSH Services

Under the Linux system, users can use the putty program to log into the Linux system through the SSH protocol.

5-1-2 TCP/IP Service

TCP/IP Services	
Edit the configuration file	sudo nano /etc/networt/interfaces Set IP by this profile or get IP by DHCP. In addition to setting IP, you can set the default DNS in this file.
Start the service	sudo /etc/init.d/networking start
Stop the service	sudo /etc/init.d/networking stop
Restart	sudo /etc/init.d/networking restart

```
Example of DHCP interfaces
auto lo
auto eth0

iface lo inet loopback
iface eth0 inet dhcp
#iface eth0 inet static
#address 10.0.0.22
#netmask 255.255.255.0
#gateway 10.0.0.200
dns-nameservers 8.8.8.8 168.95.1.1
```

```
Example of fixed IP interfaces
auto lo
auto eth0

iface lo inet loopback
#iface eth0 inet dhcp
iface eth0 inet static
address 10.0.0.22
netmask 255.255.255.0
gateway 10.0.0.200
dns-nameservers 8.8.8.8 168.95.1.1
```

UPDATE: Due to the fine-tuning of the way Raspbian is set up for the network, it has been changed to the following since 2021:

TCP/IP Services	
Edit the configuration file	sudo nano /etc/dhcpcd.conf Set the IP via this profile or use DHCP to get the IP.
Start the service	sudo systemctl enable dhcpcd.service
Stop the service	sudo systemctl disable dhcpcd.service
Start the service	sudo systemctl start dhcpcd.service
Stop the service	sudo systemctl stop dhcpcd.service
Restart	sudo systemctl restart dhcpcd.service

Remarks:

When using this method, you need to modify /etc/networt/interfaces to keep only the source-directory /etc/network/interfaces.d. The rest of the settings can be deleted or commented out. If you do not use this method to configure the network and are sure to use a fixed IP address, we recommend disabling the dhcpcd service.

Example of dhcpcd.conf configuration 1: Using a fixed IP

```
interface eth0
static ip_address=10.0.0.22/24
static routers=10.0.0.200
static domain_name_servers=8.8.8.8
```

dhcpcd.conf Setup Example 2: Enabling DHCP

```
#interface eth0
#static ip_address=10.0.0.22/24
#static routers=10.0.0.200
#static domain_name_servers=8.8.8.8
```

You can set the default IP address when DHCP is enabled and the IP address cannot be obtained：

```
profile static_eth0
static ip_address=192.168.255.1/24
static routers=192.168.255.254
static domain_name_servers=192.168.255.254

# fallback to static profile on eth0
interface eth0
fallback static_eth0
```

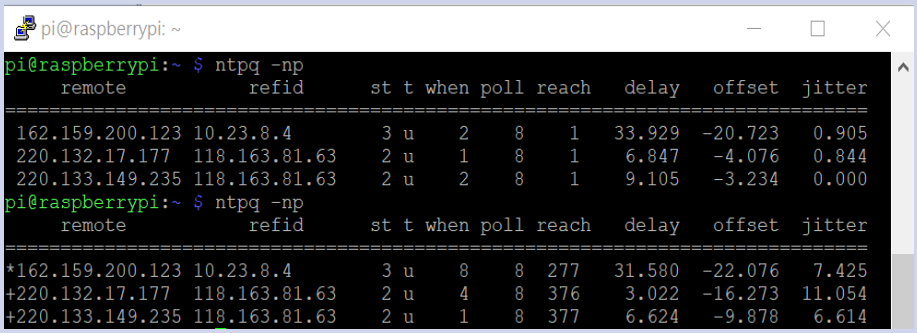
5-1-3 DHCP Service

DHCP Service	
Edit the configuration file	sudo nano /etc/dhcp/dhclient.conf This configuration file is used to set the DHCP related information. For example, update cycle, default IP if you can't get IP from DHCP server.
Restart	sudo dhclient –r

5-1-4 DNS Service

DNS Service	
Edit the configuration file	sudo nano /etc/resolv.conf This configuration file is used to set up the domain name service. DNS changes made in this way are not permanently stored in the system and will be forgotten when the system restarts the network function. If you want to save the DNS in /etc/networt/interfaces, please refer to the TCP/IP service section.
Restart	sudo /etc/init.d/dns-clean restart“.

5-1-5 NTP Service

NTP Service	
Edit the configuration file	sudo nano /etc/ntp.conf Use this configuration file to set the information of the Network Time Calibration Servo Host.
Start the service	sudo /etc/init.d/ntp stop
Stop the service	sudo /etc/init.d/ntp start
Restart	sudo /etc/init.d/ntp restart
Check NTP Status	ntpq –np A * at the top of the result means that it has been successfully calibrated. 

5-2 pALERT S303 Software Service

5-2-1 Instrument Setup Diagram

There are six files related to the configuration, which are stored in the /home/pi/Desktop/vAlert/bin directory, and their relationship is shown in Table 5-1, among which vAlert8.cfg, vAlert8Common.cfg, and hardware.cfg are of the same nature and have the same function configuration files. However, the closer to the pALERT S303 software layer, the more priority it has, that is, hardware.cfg > vAlert8Common.cfg > vAlert8.cfg.

Users can use this feature to place settings for individual instruments in vAlert8.cfg, and if pALERT S303 is used to form a monitoring network system, then settings that are common to the network can be placed in vAlert8Common.cfg. Hardware.cfg is reserved for settings that are needed for manufacturing purposes. Do not change this file.

<table>
<tr><td>vAlert8.cfg</td><td rowspan="3">memsCalData
geophoneData
initSetup.cfg</td></tr>
<tr><td>vAlert8Common.cfg</td></tr>
<tr><td>hardware.cfg</td></tr>
<tr><td colspan="2">pALERT S303 Software</td></tr>
</table>

Table 5-1

memsCalData stores the factory inspection data of the accelerometer, geophoneData stores the factory inspection data of the geophone (this file is not needed if the instrument is not used for geophone), and initSetup.cfg stores the initial settings of individual operations of the instrument, which is not needed for normal use.

5-2-2 Setup Syntax

There are two types of setting files, one is single setting and the other is multiple setting, no matter which setting, the setting item must start with "[" and end with "]", and the system will judge the end of the item by the empty line or the non-existence of sub-items. In addition, you can use "#" or "!" at the beginning of the word, then the line becomes a comment, please refer to the following vAlert8.cfg configuration file example. See the vAlert8.cfg configuration file example below:

- All settings must be case sensitive.
- For instrument compatibility, the following two lines are required and need to be placed at the beginning of the file:

[BLOCK_CONFIG_BY_ONE_ITEM]

YES

The following settings are correct

[BLOCK_CONFIG_BY_ONE_ITEM]

YES

[MQTT_CONFIG]

#

!

IP 127.0.0.1

PORT 1883

Remark 1

USER ia

PASSWORD 1111

LOCATION EEW

[FTP_CONFIG]

IP ftp.google.com

PORT 2121

USER google

Remark 2

PASSWORD 12345678

The following settings are incorrect

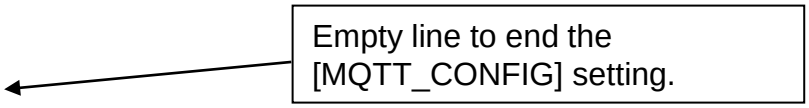
[BLOCK_CONFIG_BY_ONE_ITEM]

YES

[MQTT_CONFIG]

IP 127.0.0.1

PORT 1883

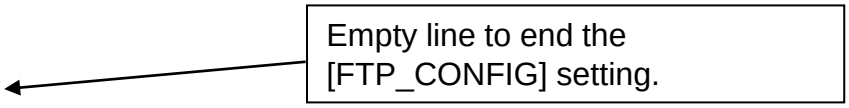


USER ia

PASSWORD 1111

LOCATION EEW

[FTP_CONFIG]



IP ftp.google.com

PORT 2121

USER google

Remark 2

PASSWORD 12345678

[VWHUB_CONFIG]

FTPIP 192.168.255.100

FTPPORT 22

USER palertS303

PASSWORD 1977

FTPDIR /home/data

With the above settings, the system will read in only the following configuration items.

[MQTT_CONFIG]

IP 127.0.0.1

PORT 1883

[VWHUB_CONFIG]

ftpip 192.168.255.100

FTPPORT 22

USER palertS303

PASSWORD 1977

FTPDIR /home/data

5-2-3 Function Configuration File Item Description (vAlert8.cfg, vAlert8Common.cfg and hardware.cfg)

5-2-3-1 [admin_server_ip]

This setting can provide the function of active external connection of this machine, when the IP address of this machine is private IP and it can not connect to it from the Internet, you can set the remote server IP in this setting, when the two sides establish the connection, this machine will become a Modbus TCP server, and it can accept Modbus commands, and this machine can connect to up to 5 units. Administration server.

Syntax：
[ADMIN_SERVER_IP]
serverIP1:portNumber1
…
serverIP5:portNumber5

Example：
[ADMIN_SERVER_IP]
192.168.255.1:1502
test.modbusserver.com:502

Explanation :

- Connect to the first server with IP 192.168.255.1 and port 1502.
- Connect to the second server with domain name test.modbusserver.com and port 502.

5-2-3-2 *[API_CONFIG]*

When an event is triggered, a user-defined application can be called through this setting. The event is defined as a PGA, STA/LTA, or Pd triggered by a vibration that exceeds the voice alarm threshold, which is determined by whether it is day or night, and by the settings of [DAY_VOICEALARM_INTENSITY] and [NIGHT_VOICEALARM_INTENSITY]. VOICEALARM_INTENSITY].

Day or night is defined by [DAY_BEGIN_MINUTE] and [DAY_END_MINUTE].

Syntax：

[API_CONFIG]

EARTHQUAKE_API userApiOnEventRising

PD_API_PARAMETER YES/NO

EARTHQUAKE_FALLING_API userApiOnEventFalling

DORTS_FILE_UPLOAD YES/NO

ISO2631_FILE_UPLOAD YES/NO

Explanation :

- EARTHQUAKE_API, the system will call userApiOnEventRising when the event is on the verge of happening.
- PD_API_PARAMETER, with EARTHQUAKE_API, if set to YES, when Pd is triggered, userApiOnEventRising will be called when PGA or PGV is increased, with Pd value.
- EARTHQUAKE_FALLING_API, when the event is negative, the system will call userApiOnEventFalling program.
- DORTS_FILE_UPLOAD, when DORTS is selected, if it is set to YES, then the DORTS event record can be uploaded to FTP server, please refer to the [VWHUB_CONFIG] section in this chapter for the FTP server setting.
- ISO2631_FILE_UPLOAD, when ISO 2631 vibration standard is selected, if set to YES, then you can upload ISO2631 event log to FTP server, please refer to [VWHUB_CONFIG] section in this chapter for FTP server setting.

Example：
[API_CONFIG]
EARTHQUAKE_API /home/pi/Desktop/vAlert/bin/eqAlert.sh
PD_API_PARAMETER YES
EARTHQUAKE_FALLING_API /home/pi/Desktop/vAlert/bin/uploadFile.sh
DORTS_FILE_UPLOAD NO
ISO2631_FILE_UPLOAD NO

5-2-3-3 *[AUTO_RECORD]*

This setting provides the function of recording automatically when the power is turned on, or the function of starting and closing the recording at regular intervals, please be sure to disable the trigger detection function to use this function.

Syntax：
[AUTO_RECORD]
AUTO_START YES/NO
START_SECONDS startSecondsAfterStart
STOP_SECONDS stopSecondAfterStart
INTERVAL_MINUTE stroeEveryNminutes

Example 1：
[AUTO_RECORD]
AUTO_START YES

Explanation 1:

- Recording is started automatically after the program starts.
- When using this function only, it is recommended to set [PRE_EVENT_SECOND] to 5 seconds and [POST_EVENT_SECOND] to 0 seconds. A new file is generated when the system changes the day.

Example 2:
[AUTO_RECORD]
START_SECONDS 30
STOP_SECONDS 90

Explanation 2:

- Logging starts 30 seconds after the program starts and ends 90 seconds after the program starts.
- Users can modify the start and record time in Unix Timestamp format at any time via Modbus points.

Example 3:
[AUTO_RECORD]
INTERVAL_MINUTE 5

- To use this function, please update the firmware to version 4.56 or above.
- Enable the continuous recording function and save the file every 5 minutes. The 5 minutes is calculated by dividing the system minutes by 5, i.e. 0, 5, 10...55 minutes.
- If the system time at the start of the program is 13:02:30, you have to wait until 13:05:00 to start recording.
- It is recommended to set both [PRE_EVENT_SECOND] and [POST_EVENT_SECOND] to 0 seconds.

5-2-3-4 [BACKUP_CONFIG]

Syntax: [BACKUP_CONFIG] is a single line.

Explanation : After this function is enabled, the program will backup vAlert8.cfg to vAlert8Cfg.bak every time when it runs.

5-2-3-5 *[BACKUP_PROGRAM]*

Syntax: [BACKUP_PROGRAM] is a single line.

Description：After this function is enabled, the program will backup the main program paInt.exe to paIntBak.exe every time the program is executed.

5-2-3-6 *[BA_DOOR_ADDRESS], [BA_DOOR_INTENSITY], [BA_HOST_IP]*

The pALERT S303 can send Modbus TCP commands to open the Modbus DO device on the network when the seismic event is greater than the threshold, this function must be combined with the [BA_HOST_IP], [BA_DOOR_INTENSITY] and [BA_DOOR_ADDRESS] settings.

Example：
[BA_HOST_IP]
192.168.255.100

[BA_DOOR_INTENSITY]
4

[BA_DOOR_ADDRESS]
150

Explanation :

This setting can automatically turn on the DO address 150 of Modbus TCP device with IP 192.168.255.100 when the seismic event exceeds level 4.

5-2-3-7 *[BROADCAST_PORT]*

To provide more efficient emergency message transmission, this setting can send broadcast packets to the configured UDP port during an earthquake event. The machine will also send out time packets to this UDP port every minute.

This function can be used with LF-01 (Desktop Earthquake Alert and CO2 Display).

Example：
[BROADCAST_PORT]
502

Explanation:

- Sends broadcast packets to the UDP 502 port of this domain. To disable this function, set it to 0.
- Time Packet Format

Byte No.	Description
0 ~ 1	packet number
2, 3, 4	0
5	0x13
6	1
7	0x10
8 ~ 9	0x0360
10 ~ 11	0x0006
12	0x0c
13 ~ 14	Year
15 ~ 16	Month
17 ~ 18	Day
19 ~ 20	Hour
21 ~ 22	Minute
23 ~ 24	second

- Seismic Packet Format

Byte No.	Description
0 ~ 1	packet number
2, 3, 4	0
5	6
6	1
7	6
8 ~ 9	0x035f
10 ~ 11	intensity

5-2-3-8 *[BROADCAST_CANCEL_TIMER]*

With the [BROADCAST_PORT] setting, UDP cancel packets will be sent after the event is over and the seconds countdown of this setting is finished, the default value is 5 seconds.

Example：
[BROADCAST_CANCEL_TIMER]
10

Explanation:

- UDP cancel packet sent after the end of the event for 10 seconds.
- End packet format

Byte No.	Description
0 ~ 1	packet number
2, 3, 4	0
5	0x0b
6	1
7	0x10
8 ~ 9	0x035d
10 ~ 11	0x0002
12	0x04
13 ~ 14	0x0000
15 ~ 16	0x0000

5-2-3-9 *[CONFIG_TO_FILE]*

When this function is enabled, the configRead.txt file will be generated in the /home/pi/Desktop/vAlert/bin directory according to the three configuration files vAlert8.cfg, vAlert8Common.cfg, and hardware.cfg read in, and users can check this file to see if the functions are correctly read in by the system.

Syntax: [CONFIG_TO_FILE] is a single line.

Explanation：Please put this line at the beginning of the configuration file.

5-2-3-10 *[CWB2019INTENSITY]*

The Central Weather Bureau (CWB) will revise the seismicity scale in 2019 and implement a new scale starting from 2020, which is mainly differentiated by PGA for seismicity up to magnitude 4, and PGV for seismicity above magnitude 5 (inclusive). This design sets the instrument to the CWB 2020 seismicity class.

Syntax: [CWB2019INTENSITY] YES

- CWB Standards for Calculation of Seismicity Scale by 2020

Earthquake intensity	Perceived by Humans	PGA (gal)
0	Not felt	Below 0.8
1	Slight	0.8 ~ 2.5
2	Mild	2.5 ~ 8.0
3	Light	8.0 ~ 25
4	Moderate	25 ~ 80
5	Strong	80 ~ 250
6	Very strong	250 ~ 400
7	Severe	Above 400

- CWB 2020 Seismic Intensity Scale:

Earthquake intensity	Perceived by Humans	PGA (gal)	PGV (cm/s)
0	Not felt	Below 0.8	
1	Slight	0.8 ~ 2.5	
2	Mild	2.5 ~ 8.0	
3	Light	8.0 ~ 25	
4	Moderate	25 ~ 80	
Weak 5			15 ~ 30
Strong 5			30 ~ 50
Weak 6			50 ~ 80
Strong 6			80 ~ 140
7			Above 140

To correspond to the CWB 2020 Seismic Intensity Scale, the following values are represented by the pALERT S303 device:

CWB 2020 Earthquake intensity	**pALERT S303** Earthquake intensity value
0	0
1	1
2	2
3	3
4	4
Weak 5	5.1
Strong 5	5.9
Weak 6	6.1
Strong 6	6.9
7	7

5-2-3-11 *[DAY_BEGIN_MINUTE], [DAY_END_MINUTE]*

In practical application, if you want to have different levels of event triggered control and message notification according to day or night, user can define the day and night time in these two settings, the unit is minutes, 00:00am is 0 minutes, 23:59 is 1439 minutes.

Syntax and Example： [DAY_BEGIN_MINUTE] 480 [DAY_END_MINUTE] 1020

Explanation:

[DAY_BEGIN_MINUTE] is set to 480, dividing 480 by 60 equals to 8, which means the daytime starts at 8:00.

[DAY_END_MINUTE] is set to 1020, divide 1020 by 60 to equal 17, it means the daytime ends at 17:00.

This sets the daytime range from 8:00 to 17:00.

The default daytime range is 7:00 to 18:00.

5-2-3-12 *[DAY_VOICEALARM_INTENSITY]*

The threshold of the seismicity of the message to be sent after an earthquake event is triggered during the daytime, please refer to [DAY_BEGIN_MINUTE] and [DAY_END_MINUTE] for the definition of the daytime and nighttime time.

Example：
[DAY_VOICEALARM_INTENSITY]
1

Explanation:

The system performs sending a message when the seismicity of a daytime seismic event is greater than the equivalent of a 1-magnitude earthquake.

5-2-3-13 *[DORTS_VIBRATION]*

This unit can be optionally used to calculate the vibration standard (DORTS) of the Taipei Metro Transit Bureau.

Syntax：
[DORTS_VIBRATION]
BUILDING_TYPE buildingType
WARNING_DB warningDb
MAXIMUM_LATCH YES/NO

Description

BUILDING_TYPE in the range 1 ~ 6

BUILDING_TYPE	Building Type
1	Precision Instrument Facility
2	Large Auditorium
3	Television Station
4	Residential Complex
5	Commercial Building
6	Industrial Facility

Vibration Standard

Octave Central Frequency	Precision Instrument Facility	Large Auditorium	Television Station	Residential Complex	Commercial Building	Industrial Facility
2	32	49	58	62	67	74
4	35.5	53	60	64	69	76
8	38	57	63	66	71	78
16	42	62	68	68	77	84
31.5	45	67	75	75	84	90
63	53.5	73	82	82	90	97

Unit: dB，Ref.: 10^{-6}G

- WARNING_DB, since the DORTS standard only provides a single threshold, this setting can provide a warning when the vibration is approaching the threshold, and the default value is -6 dB; when combined with the [SINGLE_RELAY_MODE] of the DO, it can generate three kinds of DO output conditions.

DO Output	Vibration condition
DO1	Normal
DO2	Warning
DO3	Exceeds the DORTS vibration standard.

If you do not want to use the warning function, you can set this value to be greater than or equal to zero.

MAXIMUM_LATCH, this setting provides the lock function for the vibration event, when the setting is YES and the vibration event occurs (the vibration exceeds the warning value), the DO output will be held forever (even if reboot), unless the user cancel the alarm (press the button for 3 seconds or via Modbus remote control).

Example：
[DORTS_VIBRATION]
BUILDING_TYPE 3
WARNING_DB -3
MAXIMUM_LATCH YES

5-2-3-14 *[DISK_MIN_SPACE]*

This machine can automatically delete the log files under the /home/pi/Desktop/vAlert/rec directory to ensure that the system has enough workspace, the unit is 4 kB, when the storage space is lower than this setting, the system will erase the 20 oldest files at a time; the default value of the system is 262144, that is, about 262,144 * 4 = 1048 MB.

Syntax：
[DISK_MIN_SPACE]
384000

Note: The minimum storage space for is set to 384000 * 4 = 1,536,000 kB.

5-2-3-15 *[EVENT_FILE_MAX_LENGHT_IN_SECOND]*

This setting provides the function of the maximum capacity of the recording file, when the recording exceeds this number of seconds, the file will be closed automatically and another new file will be generated, the default value is 60 seconds.

Syntax：
[EVENT_FILE_MAX_LENGTH_IN_SECOND]
100

5-2-3-16 *[EVENT_FILE_FORMAT]*

The pALERT S303 provides two record formats, the bit-compressed CSV format and the miniSEED format.

Syntax： [EVENT_FILE_FORMAT] miniSEED/mseed

Example 1: [EVENT_FILE_FORMAT] miniSEED

Explanation 1: Select the miniSEED record format.

Example 2: [EVENT_FILE_FORMAT] Mseed

Explanation 2: Select the Mseed record format.

Example 3: [EVENT_FILE_FORMAT] CSV

Explanation 3: Select the CSV record format.

5-2-3-16 *[EVENT_FILE_FORMAT]*

This function defines the detailed settings of the event log file.

Syntax：

[EVENT_FILE_OPTION]

PACKETNO_CHECK YES/NO

DATA_FIXED_POINT YES/NO

Example：

[EVENT_FILE_OPTION]

PACKETNO_CHECK YES

DATA_FIXED_POINT NO

Explanation:

- Enable Palert Mode 1 packet number checking function, if the machine detects the packet number is not consecutive, it will display "PackectErr[%d]" on the LCD, and if there is an event file record, it will appear in the header of the file.
- This function is very important for RSHD calculation, if the packet is incomplete, it means the file is incomplete, and the calculation result will be incorrect, so if you use HAZUS RSHD, you should set this function to YES.
- Set the record file to use floating point format, the default data format of the record file is 4F10.3, that is, the fixed point format with three decimal places, if you want the data to display a smaller value, you can set it to NO, and then the data format will be in floating point format.

5-2-3-18 *[FTP_CONFIG]*

This machine provides the function of software update through the network, this setting is to define the information of remote software update FTP server, when the button is seven seconds, it will try to update the new software according to these settings.

Example：
[FTP_CONFIG]
IP palert.sanlien.com.tw
PORT 2121
USER ia
PASSWORD 1111

5-2-3-19 *[FTE-D04_IP]*

Example：
[FTE-D04_IP]
192.168.255.123

Explanation: Set the IP of FTE-D04 to 192.168.255.123.

5-2-3-20 *[FTE-D04_HEART_BEAT_INTERVAL]*

Configures the FTE-D04's heartbeat functionality to confirm operational status. This setting defines the interval for sending heartbeats, measured in seconds. The FTE-D04 periodically checks for the presence of heartbeat signals sent by the host. If not received, it triggers a warning signal from the FTE-D04.

Example:

[FTE-D04_HEART_BEAT_INTERVAL]

4

Explanation: Configures the device to send a heartbeat signal to the FTE-D04 every four seconds.

5-2-3-21 *[GEOPHONE]*

The fourth axis of the pALERT S303 can be augmented with a geophone to measure velocity. The device also provides low-frequency compensation for the geophone down to 1 Hz, offering cost savings to users who would otherwise need to purchase a low-frequency geophone.

Example： [GEOPHONE] COMPENSATION YES

Explanation: If frequency compensation is enabled, it will be compensated according to the setting parameters of /home/pi/Desktop/vAlert/bin/geophoneData.

➢ Contents of geophoneData

Item	Description
DAMPING_RATIO	Damping Ratio
DAMPING_RESISTOR	Damping Resistor (Fill in 10000000 if none)
FREQUENCY	Natural Frequency in Hz
GAIN	Output Sensitivity in V/m/s
MASS	Mass Block Weight in kg
RESISTANCE	Coil Resistance in ohms

Example：
GAIN 28.3
DAMPING_RATIO 0.7
RESISTANCE 360
DAMPING_RESISTOR 10000000
MASS 0.083
FREQUENCY 4.5

5-2-3-22 *[GPS]*

The pALERT S303 can be equipped with optional GPS module. This setup is a hardware related item, which has been properly setup before shipment from the factory, so if there is any modification needed, it should be assisted by the FAE of Sanlien Technology.

Example：
[GPS]
USB_PORT 1
BAUD 9600
PPS_PIN 40

5-2-3-23 *[GPIO_CONFIG]*

This design defines the hardware connection information. This design is a hardware related item, which has been properly set up before leaving the factory, so if there is a need for modification, it should be assisted by the FAE of Sanlien Technology.

[GPIO_CONFIG]

POWER_OFF_SIGNAL_PIN 23

RELAY1_PIN 4

RELAY2_PIN 5

RELAY3_PIN 6

RELAY4_PIN 3

CPU_RESET_PIN 29

CPU_RESET_END_LEVEL 1

Example 1：
[GPIO_CONFIG]
RELAY4_PIN 21
AUDIO_RELAY_PIN 3

Explanation 1: The unused AUDIO_RELAY_PIN of pALERT S303 is used as RELAY4_PIN. pALERT S303 is defaulted to 3 groups of DOs.

Example 2：
[GPIO_CONFIG]
CPU_RESET_PIN 29
CPU_RESET_END_LEVEL 1

Explanation 2:

- RPi will control the voltage of GPIO.29 to reset CPU, please check the actual pin position of the hardware.
- CPU_RESET_END_LEVEL is set incorrectly, which may cause the CPU to be reset during shutdown, please do not modify this parameter by yourself.

5-2-3-24 *[HEIGHT]*

The instrument's installed altitude in meters is stored in Modbus points for users to query.

Example：
[HEIGHT]
35

5-2-3-25 *[ISO_2631]*

This machine can be optionally purchased with the ISO2631 vibration standard calculation function.

Explanation:

- LOCATION_TYPE

5-2-3-25 *[ISO_2631]*

This machine can be optionally purchased with the ISO2631 vibration standard calculation function.

Explanation:

➢ LOCATION_TYPE

Location Type	Building Type
0	Hospital, Precision laboratories
1	House
2	Office, school and temple
3	Factory

Building Type	Warning		Capacity	
	Horizontal	Vertical	Horizontal	Vertical
Hospital, Precision lab. (Day, Night)	0.005	0.0036	0.01	0.0072
House (Day)	0.01	0.0071	0.02	0.014
House (Night)	0.007	0.005	0.014	0.01
Office, School and Temple (Day, Night)	0.02	0.014	0.04	0.028
Factory (Day, Night)	0.04	0.029	0.08	0.058

Day: 7:00 ~ 22:00 Night: 22:00 ~ 7:00 Unit: m/sec^2

➢ MAXIMUM_LATCH, this setting provides a lockout function for vibration events. When the setting is YES and a vibration event occurs (the vibration exceeds the warning value), the DO output will be held forever (even after reboot), unless the user cancel the alarm (press the button for three seconds or via Modbus remote control).

5-2-3-26 *[JMA]*

The Japan Meteorological Agency (JMA) intensity scale is used. Note that the sampling rate must be set to 200 SPS when using the JMA intensity scale.

The JMA intensity scale is described below:

JMA Intensity scale	pALERT S303 Magnitude
0	0
1	1
2	2
3	3
4	4
5 Weak	5.1
5 Strong	5.9
6 Weak	6.1
6 Strong	6.9
7	7

Syntax：

[JMA]

RING_SECOND ringSeconds

Explanation:

- The recommended value of ringSeconds is 10 seconds for calculating the frequency domain of the seismicity step.
- Because the JMA magnitude step uses frequency domain weighting to calculate the magnitude of earthquakes, a certain amount of time domain data must be available for the calculation.

5-2-3-27 *[KMA_INTENSITY]*

Adoption of Korean intensity Scale.

Syntax： [KMA_INTENSITY] YES/NO

5-2-3-28 *[LINE]*

With LINE message notification, the system sends a message when an event occurs according to the settings of this item.

Syntax： [LINE] IP lineServerIp STATION_NAME stationName EARTHQUAKE_LANGUAGE CHINESE/ENGLISH EEWS_DAY_INTENSITY dayThreshold EEWS_NIGHT_INTENSITY nightThreshold

Example： [LINE] IP linegw.iot.sanlien.com FOLDER_NAME lineServiceFolder STATION_NAME pALERT S303 EARTHQUAKE_LANGUAGE CHINESE EEWS_DAY_INTENSITY 1 EEWS_NIGHT_INTENSITY 4

Explanation:

- The IP of the LINE server is linegw.iot.sanlien.com.
- STATION_NAME is the name of the machine, this information will appear in the LINE message.
- Chinese messages, the threshold for posting messages is level 1 during the day and level 4 at night.

5-2-3-29 *[LCD]*

Syntax：
[LCD]
COLUMN columnNumber
ROW rowNumber
DISPLAY_CONFIG YES/NO
DISPLAY_ON_ERR YES/NO
BRIGHTNESS_ON_ERR 0 ~100

Example：
[LCD]
COLUMN 20
ROW 2
DISPLAY_CONFIG NO
DISPLAY_ON_ERR YES
BRIGHTNESS_ON_ERR 80

Explanation:

- The LCD of this unit is fixed to 20 * 2, please keep this setting.
- DISPLAY_CONFIG can choose whether to display the setting content or not, this example is not display (default value is NO).
- DISPLAY_ON_ERR can select whether to turn on the backlight of LCD when there is an error message, this example is to turn on the backlight (default value is YES).
- BRIGHTNESS_ON_ERR can set the brightness of the backlight when the LCD is blinking, 0 is off and 100 is on.

5-2-3-30 *[LCD_TITLE]*

This setting allows the user to customize the instrument name on the first line of the LCD display. The default setting is pAlert S303 and the maximum length is 14 characters.

Example：
[LCD_TITLE]
pAlert S303

5-2-3-31 *[LF-01_IP]*

pALERT S303 can send event information directly to our desktop seismic display LF-01, the information is transmitted through UDP broadcast packet, this setting is provided to capture the CO2, temperature and humidity information of the LF-01 and store it in the Modbus point table, if you set [BA_HOST_IP], the DO of [BA_DOOR_ADDRESS] will be activated when the CO2 concentration exceeds 2000 ppm, and it will be deactivated when the CO2 concentration is lower than 1000 ppm.

Example：
[LF-01_IP]
192.168.255.11

5-2-3-32 *[LISTEN_PORT]*

The default port of Modbus TCP/UDP server is 502, users can also modify different ports through this setting.

Example：
[LISTEN_PORT]
503

Explanation:

- Uses port 503 as the Modbus TCP server port.

5-2-3-33 *[LOCAL_LATITUDE]*、*[LOCAL_LONGITUDE]*

The instrument is installed with latitude and longitude, which are stored in Modbus points for users to query.

5-2-3-34 *[LOCAL_STREAM_DEBUG]*

This machine provides the function of outputting data packets to the network TCP port, the data format is text format, and this TCP port can also be the machine itself (127.0.0.1). If you want to view the continuous waveform on the web page, you must use the default value. This function provides up to five ports with the following default values:

```
[LOCAL_STREAM_DEBUG]
IP0 127.0.0.1:5000
IP1 127.0.0.1:5200
IP2 127.0.0.1:5400
IP3 127.0.0.1:5100
IP4 127.0.0.1:5300
```

```
Example 1：
[LOCAL_STREAM_DEBUG]
IP0 192.168.255.100:1968
IP1 127.0.0.1:19680
IP4 10.0.0.111:26000
```

Explanation 1: Set five TCP ports as real-time data output, as follows

- 192.168.255.100 port: 1968
- 127.0.0.1 port: 19680
- 127.0.0.1 port: 5400
- 127.0.0.1 port: 5100
- 10.0.0.111 port: 26000

Example 2：
[LOCAL_STREAM_DEBUG]
STREAMING_CH3 YES

Explanation 2: Generally, the web page only shows the output of 3 axis, if you want to view the waveform of the 4th axis, you need to enable this function. The default setting is NO.

5-2-3-35 *[MINISEED_SERVER]*

After version 4.56, this machine starts to support miniSEED Server function, this function must be plug-in ringserver program, which will be downloaded automatically after system update. This function must be used with STATION_NET, STATION_NAME, STATION_CH_NAME, STATION_CH_GEO_NAME, STATION_LOCATION under [PALERT_LOCAL_MODE].

Syntax：
[MINISEED_SERVER]
IP ringserverIp
PORT ringserverPort

Example：
[MINISEED_SERVER]
IP 127.0.0.1
PORT 18000

Explanation:

- The IP address for the ring server is set to localhost, i.e., 127.0.0.1.
- The port for the ring server is configured as 18000.

5-2-3-36 *[MODBUS_TCP_DO]*

This configuration allows the real-time transmission of the local Digital Output (DO) status to remote Modbus TCP devices, with control capability for up to 5 devices.

Syntax：
[MODBUS_TCP_DO]
IP ip1:port1:addr1
IP ip2:port2:addr2

Example：
[MODBUS_TCP_DO]
IP 192.168.255.100:502:100
IP 192.168.255.101:1502:200
IP 192.168.255.102:502:300

Explanation:

- This configuration sends the real-time DO status of the local device to the following Modbus TCP devices:
- 192.168.255.100, port 502, DO address 100.
- 192.168.255.101, port 1502, DO address 200.
- 192.168.255.102, port 502, DO address 300.

5-2-3-37 *[MQTT_CONFIG]*

When an event is triggered and exceeds the threshold, the device provides message propagation via MQTT.

Syntax： [MQTT_CONFIG] IP mqttServerIp PORT mqttServerPort USER id PASSWORD password LOCATION instrumentLocation EEWS_DAY_INTENSITY dayThreshold EEWS_NIGHT_INTENSITY nightThreshold

Example： [MQTT_CONFIG] IP 127.0.0.1 PORT 1883 USER ia PASSWORD 1111 LOCATION BUILDING1 EEWS_DAY_INTENSITY 1 EEWS_NIGHT_INTENSITY 4

Explanation:

- Use the local device as the MQTT broker, with the port set to 1883.
- The LOCATION is set to BUILDING1, and the published topic is sanLien/BUILDING1/EEWS/ONSITE. The message threshold for sending is for earthquakes of intensity 1 during the day and intensity 4 during the night.

5-2-3-38 *[MMI_INTENSITY]*

Adopts the MMI Seismic Intensity Scale.

Syntax： [MMI_INTENSITY] PGA/PGV/YES/NO 1/2/YEN/NO

Explanation:

For firmware version 4.65 and later:

- For PGA, use MMI PGA for intensity calculation.
- For YES, use MMI PGA for intensity calculation.
- For PGV, use MMI PGV for intensity calculation.

For firmware version 4.64 and earlier:

- For 1, use MMI PGA for intensity calculation.
- For YES, use MMI PGA for intensity calculation.
- For 2, use MMI PGV for intensity calculation.

MMI PGA Intensity Scale

Intensity	PGA (gal)
1	1.7 or less
2	1.7 ~ 7
3	8 ~ 13
4	14 ~ 38
5	39 ~ 91
6	92 ~ 179
7	180 ~ 339
8	340 ~ 649
9	650 ~ 1239
10	1240 or above

MMI PGV Intensity Scale

Intensity	PGA (gal)	PGV (mm/s)
1	1.67 or less	1 or less
2	1.68 ~ 7.99	
3	8.00 ~ 13.72	1 ~ 11
4	13.73 ~ 38.22	12 ~ 34
5	38.23 ~ 90.16	35 ~ 81
6	90.17 ~ 176.4	82 ~ 160
7		161 ~ 310
8		311 ~ 600
9		601 ~ 1160
10		1161 or above

5-2-3-39 *[MAIN_PORT_INTERFACE]*

The device utilizes the default Linux network device as the network connection device. Users can modify this setting to use a different network device. Please note that this setting should be handled by an FAE engineer, as incorrect configuration may render the system inoperable.

Example： [MAIN_PORT_INTERFACE] eth0

Explanation:

Uses eth0 as the network communication device.

5-2-3-40 *[NTP_RESET], [NTP]*

This setting provides control over the Linux NTP service and hardware control related to time.

Syntax： [NTP_RESET] RESET_TH numberTh RTC_TO_SYSTEM_TIME YES/NO ERR_IF_TIME_NOT_SYNC YES/NO RTC_TYPE RX8900/DS1307 FAKE_PPS YES/NO OFFSET_TH MilliSeconds

Example：
[NTP_RESET]
RESET_TH 3
RTC_TO_SYSTEM_TIME YES
ERR_IF_TIME_NOT_SYNC YES
RTC_TYPE RX8900
FAKE_PPS NO
OFFSET_TH 10

Explanation:

- The pALERT S303 checks the synchronization with the NTP server approximately every 10 seconds. If the synchronization is not achieved after ten attempts, the system considers it as a reset counter increment. The RESET_TH is set to 3, meaning that if approximately 300 seconds pass without synchronization, the Linux NTP service will be restarted.
- RTC_TO_SYSTEM_TIME is set to YES, indicating that when the system is not synchronized with the NTP server, the system time will be set to the RTC time when the reset counter increments.
- In some situations where synchronization with the NTP server is not possible, setting YES treats it as an error and displays it on the LCD. If set to NO, it does not treat it as an error.
- RTC_TYPE is set to use the RX8900 RTC. Note that this setting must be assisted by an FAE, as an incorrect configuration will render the system's RTC inoperable.

- FAKE_PPS is set to NO by default. Setting it to YES means that the system time is used as the NTP server source, and the system time source includes a clock with 1 PPS. Some network devices for time synchronization require a NTP server source clock with 1 PPS, and this setting is needed in such cases. The /etc/ntp.conf file must have the necessary configurations.

```
server 127.127.28.0 prefer maxpoll 3
fudge  127.127.28.0 refid GPS
server 127.127.28.2 maxpoll 3
fudge  127.127.28.2 refid PPS
```

- OFFSET_TH is used to control the quality of NTP time synchronization. If the time difference with the NTP server exceeds the configured threshold, the NTP service will be restarted.

5-2-3-41 *[NCREE_HOST]*

The device supports the communication protocol of the NCREE EEW network strong-motion seismometer.

Detailed Settings for [NCREE_HOST]		
Setting	Configuration	Description
IP	IP:port	NCREE_HOST information
STATION_NUMBER	Integer	Station code number provided by NCREE
NCREE_TRIG	YES NO	Enable or disable NCREE triggering function. If enabled, other earthquake-related triggering logic will be automatically disabled.
RECORD_DRIVEN_BY_EVENT	YES NO	Choose to record event files or continuous records. Continuous recording is in miniSeed format, and event files are in CSV format.
LTA_CONSTANT	Float	Constant for the NCREE algorithm's Long-Term Average (LTA)
STA_POINT	Integer	Number of data points used to calculate the Short-Term Average (STA)
TRIG_THRSH_UP_PT	Integer	Data points for the first-stage trigger threshold
TRIG_THRSH_DOWN_PT	Integer	Data points for the first-stage trigger end threshold
TRIG_THRSH_UP	Float	Trigger threshold for the first stage
TRIG_THRSH_DOWN	Float	End trigger threshold for the first stage
WIN_TRIG_PT	Integer	Data points for the second-stage trigger threshold
WIN_TRIG_THRSH_DOWN_PT	Integer	Data points for the second-stage trigger end threshold

Example 1：

[NCREE_HOST]

IP 192.168.255.100:26000

STATION_NUMBER 65535

Explanation 1:

- Sends real-time earthquake event information to the NCREE host with IP 192.168.255.100 and port 26000.
- The station code is 65535, and it must be in the range of 0 to 65535.
- Since the NCREE triggering function is not enabled, the system's built-in earthquake triggering logic provides triggering information to the NCREE host.

Example 2：

[NCREE_HOST]

IP 192.168.255.100:26000

STATION_NUMBER 65535

NCREE_TRIG YES

RECORD_DRIVEN_BY_EVENT YES

LTA_CONSTANT 0.3

STA_POINT 80

TRIG_THRSH_UP_PT 10

TRIG_THRSH_DOWN_PT 20

TRIG_THRSH_UP 3.5

TRIG_THRSH_DOWN 3.2

WIN_TRIG_PT 20

WIN_TRIG_THRSH_DOWN_PT 50

Explanation 2:

- Sends real-time earthquake event information to the NCREE host with IP 192.168.255.100 and port 26000.
- The station code is 65535, and it must be in the range of 0 to 65535.
- Enables NCREE triggering logic, automatically disabling other built-in earthquake triggering logic.
- Enables the record event file mode.
- LTA is fixed at 0.3.
- Uses a continuous dataset of 80 points to calculate STA.
- If STA/LTA reaches the trigger threshold of 3.5 (TRIG_THRSH_UP) and continues for 10 consecutive data points (TRIG_THRSH_UP_PT), it is considered the first-stage trigger. If it continues for 20 consecutive data points (WIN_TRIG_PT), it is considered the second-stage trigger.
- If the device is in the first-stage trigger state and STA/LTA reaches the end trigger threshold of 3.2 (TRIG_THRSH_DOWN) and continues for 20 consecutive data points (TRIG_THRSH_DOWN_PT), it is considered the end of the first-stage trigger.
- If the device is in the second-stage trigger state and STA/LTA reaches the end trigger threshold of 3.2 (TRIG_THRSH_DOWN) and continues for 50 consecutive data points (WIN_TRIG_THRSH_DOWN_PT), it is considered the end of the second-stage trigger.

5-2-3-42 *[NET_DEVICE]*

This machine provides COAP protocol to broadcast the message to the network when an event occurs.

Syntax：
[NET_DEVICE]
YES/NO

COAP Protocol of the Device			
GET	PUT	OPTION	PAYLOAD
	V	\global\heartbeat	time=Unix timestamp Send once every 9 seconds of the minute
	V	\global\eews\onsite	int=5&exercise=0
	V	\global\relay	set=ff
	V	\global\eews\cancel	time=Unix timestamp

5-2-3-43 *[NIGHT_VOICEALARM_INTENSITY]*

During the nighttime period, after triggering an earthquake event, the intensity threshold for sending messages is set. For definitions of daytime and nighttime, please refer to [DAY_BEGIN_MINUTE] and [DAY_END_MINUTE].

Example：
[NIGHT_VOICEALARM_INTENSITY]
5.1

Explanation:

- When the intensity of a nighttime earthquake event is greater than or equal to "Weak Seismic Intensity 5" (assuming the intensity scale is based on CWB 2020 seismic intensity), the system executes message sending.

5-2-3-44 *[OSMOS_OASYS]*

The device supports connecting to the OSMOS OASYS monitoring host.

Syntax：
[OSMOS_OASYS]
IP hostIp:port

Example：
[OSMOS_OASYS]
IP 192.168.255.100:10001

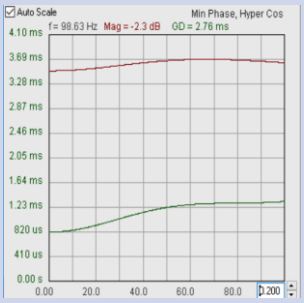
Explanation:

- Connect to the OSMOS OASYS monitoring host with IP 192.168.255.100 and port 10001.
- To connect to the OASYS host, the /home/pi/Desktop/vAlert/bin directory must contain the osm_palert.crt and osm_palert.key authentication files.

5-2-3-45 *[PALERT_LOCAL_MODE]*

Regarding local settings for sensors, sampling, filtering, and triggering, as the rules are similar to those mentioned above, they will be described in a table for simplicity.

Syntax：
[PALERT_LOCAL_MODE]
Setting Name Setting Content

[PALERT_LOCAL_MODE] Setting Detail Description		
Setting Name	Setting Content	Explanation
AUTO_OFFSET	TRTC YES NO	Select the auto reset mode, YES is always on auto reset, TRTC means auto reset normally, but no reset when an event is detected, NO is no auto reset.
CEB_MODE	YES NO	When the setting is YES, it means this machine uses the protocol of China Earthquake Administration.
CEB_SEND_TIMEOUT_USEC	> 5,000	When the network communication between the local computer and CEB server is busy and there is a data transmission collision, the waiting transmission time of the local computer is measured in microseconds (10-3 seconds).
CEB_COMP_FILTER	YES NO	Version 4.56Open Compensation Filter Bandpass, Hyper, 1000 sps, Fc: 0.14, BW: 0.5 Num Taps:25, Window:off, Hyper Cosine:0.5, Min. phase 
COUNT_TO_GAL	Float	The default setting is 2924.0291. Note that this setting must be operated by FAE personnel, and incorrect settings will result in system inoperability.
COUNT_TO_VOLT	Float	The default setting is 3355443. Note that this setting must be operated by FAE personnel, and incorrect settings will cause the system to fail.
CPU_BPS_460800	YES NO	The default setting for the internal CPU transmission speed is NO. Note that this setting must be operated by FAE personnel, and incorrect settings will cause the system to fail to operate.
CPU_DATA_ALIGNMENT	YES/NO	Note that this setting must be operated by FAE personnel. Incorrect setting will cause the system to fail to operate.

[PALERT_LOCAL_MODE] Setting Detail Description		
Setting Name	Setting Content	Explanation
CPU_RTC_PPS_ENABLE	YES NO	This setting informs whether or not to set the time of Linux system and whether or not to check the PPS signal of the internal CPU, the default setting is NO. Note that this setting must be operated by FAE personnel, and incorrect setting will cause the system to fail to operate.
CPU_SLIP_TIMEOUT_TICK		Note that this setting must be operated by FAE personnel. Incorrect setting will cause the system to fail to operate.
CPU_STATUS_DISPLAY_INTERVAL	>= 5	The LCD will display the CPU temperature, external voltage, battery voltage and RTC battery voltage according to the seconds of this setting, and the default value is 60, unit seconds.
DATA_PORT	ttyAMA0 ttyUSB0 ~ ttyUSB127	Set the data port of internal ADC, the default value is ttyAMA0. Note that this setting must be operated by FAE personnel, incorrect setting will result in system failure.
DESPIKE	Float	Note that this setting must be operated by FAE personnel. Incorrect setting will cause the system to fail to operate.
DOWN_SAMPLING_BY_AVRG	YES NO	The default value is YES, which means that the sampling rate will be averaged after high speed sampling and low-pass filtering.
EVENT_MAX_SECONDS	>= 60	Maximum event duration, when this time is exceeded, the system will attempt to reset to zero and clear all seismic event flags, the default value is 180, in seconds.
EVENT_MIN_SECONDS	> 0	Minimum duration of seismic event, the minimum duration that the seismic flag will remain after the event is triggered, the default value is 10 seconds, in seconds.
EXT_POWER_LOW_TH	< 50	When the voltage of the external power supply is lower than this value, the LCD will display an error message, the default value is 10 in V.
FILTER_CEB_MODE	YES NO	Enable special filtering specification for CEB.
FIR_MODE	YES NO	FIR or IIR filtering is used, and the default value is NO.

[PALERT_LOCAL_MODE] Setting Detail Description		
Setting Name	Setting Content	Explanation
GEO_CH_4	YES NO	Set the fifth axis of the recorder to record displacement or speed meter, the default setting is NO. The default 5-axis record is a, b, c, pd, displacement.
GEOPHONE_OK_TH	>= 10	When the fourth axis is used for speed timing, set the lowest signal count value for self-test, the default value is 1000, unit count.
GEOPHONE_STREAMING	YES NO	When the 4th axis is used for speed timing, set the displacement data of streaming mode 1 to be used as speed meter, the unit is 0.001 mm/sec, and the default value is NO.
HPF	0.1、0.3、0.5、1、2、3 (Hz)	Set the frequency of using the High Pass Filter in Hz, or 0 if it is not used. This machine uses a Butterworth 2nd order filter.
HPF_GAIN	YES NO	The default setting is NO for the high-frequency compensation filter specified by the China Seismological Administration (CSA).
INSTALLATION_ANGLE	0 ~ 360	The installation angle of the instrument, if the instrument can not face north due to the limitations of the site, you can set this value, the calculation method is clockwise angle, the default value is 0, the unit is degree.
INT_BATTERY_LOW_TH	< 10	When the internal battery voltage is lower than this value, the LCD will display an error message, and the default value is 3.5 in V.
LCD_BACK_LIGHT_SECOND	> 0	The default setting is 15 and the unit is second.

<table>
<tr><th colspan="3">[PALERT_LOCAL_MODE] Setting Detail Description</th></tr>
<tr><th>Setting Name</th><th>Setting Content</th><th>Explanation</th></tr>
<tr><td>LPF</td><td>10 、 20 、 40
50 、 80 、 100
(Hz)</td><td>Set the frequency of using low-pass filter in Hz, or 0 if it is not used.You can choose to use either IIR or FIR filter, and the following is a description of its characteristics.
<table>
<tr><th colspan="3">IIR Butterworth</th></tr>
<tr><th>Frequency</th><th>Order</th><th>HI_ORDER order</th></tr>
<tr><td>10</td><td>4</td><td>8</td></tr>
<tr><td>20</td><td>4</td><td>14</td></tr>
<tr><td>40</td><td>4</td><td>14</td></tr>
<tr><td>50</td><td>4</td><td>12</td></tr>
<tr><td>80</td><td>4</td><td>12</td></tr>
<tr><td>100</td><td>4</td><td>12</td></tr>
</table>
<table>
<tr><th colspan="2">FIR Raised Cos</th></tr>
<tr><th>Frequency</th><th>Order</th></tr>
<tr><td>10</td><td>32</td></tr>
<tr><td>20</td><td>32</td></tr>
<tr><td>40</td><td>32</td></tr>
<tr><td>50</td><td>32</td></tr>
<tr><td>80</td><td>32</td></tr>
<tr><td>100</td><td>32</td></tr>
</table></td></tr>
<tr><td>LPF_HI_ORDER</td><td>YES
NO</td><td>If you use LPF, you can select a higher filter order, as shown in the above table of HI_ORDER, the default is YES.</td></tr>
<tr><td>MINIMUM_OFFSET_GAL</td><td>>= 0.1</td><td>Set the minimum value of whether the zero self-calibration is successful or not, if higher than this value, the system will continue to perform zero calibration until it is successful, the unit is gal, and the default value is 5.</td></tr>
<tr><td>MEMS_4G</td><td>YES
NO</td><td>If you want to use the 4G version of the sensor, the default value is NO, please note that this setting must be matched with the hardware.</td></tr>
<tr><td>MODE</td><td>CHINA
INTERNATIONAL</td><td>Whether to use the China Earthquake Administration version, the default is INTERNATIONAL.</td></tr>
</table>

[PALERT_LOCAL_MODE] Setting Detail Description		
Setting Name	Setting Content	Explanation
MOUNT_MODE	WALL NORTHWARD EASTWARD	Please refer to the Installation Direction section for the installation orientation of the instrument, which is defaulted to NORTHWARD. The axial direction in the log file is shown as follows: a: UD direction b: NS direction c: EW direction d: Auxiliary axis, according to user's installation decision.
MSEEDFILE_VALID_DAY	>= 1 and <= 120	When using the China Seismological Bureau mode, the system will save a file in miniSEED format in the /home/pi/Desktop/vAlert/rec directory every day, the file name starts with mseedFileYYYYYMMDD, this setting determines the number of days of existence of these files, the default is 90, the unit is days.
PD_TRIG_ENABLE	YES NO	Turn on the Pd trigger to monitor the seismic event mode (P-wave displacement), the default value is NO.
PD_WATCH_THRESHOLD	>= 0.01	Set the alarm threshold of P-wave displacement in centimeters, the default value is 0.2 in centimeters, and DO1 will be activated when triggered.
PD_WARNING_THRESHOLD	>= 0.01	Set the warning threshold of P-wave displacement in centimeters, the default value is 0.3 in centimeters, and DO2 will be activated when triggered.
PGA_TRIG_ENABLE	YES NO	Turn on the PGA Trigger Monitor Seismic Event Mode, the default value is NO.
PGA_WATCH_THRESHOLD	>= 0	Set the alarm threshold of PGA trigger in gal. The default value is 9999 and DO1 will be activated when the trigger is activated.
PGA_WARNING_THRESHOLD	>= 0	Set the warning threshold of PGA trigger in gal. The default value is 9999, and the DO will be activated when the trigger is triggered.
PGA_ACTION_THRESHOLD	>= 0	Set the warning threshold of PGA trigger in gal, the default value is 9999, and DO3 will be activated when triggered.
PGV_EVENT_FILE	YES NO	Set whether to enable the addition of the PGV field to the log file, the default value is NO.
POWEROFF_SECONDS_TO_CPU	>= 10	Set the number of seconds for the system to shut down safely, the default value is 15 and the unit is seconds.

[PALERT_LOCAL_MODE] Setting Detail Description		
Setting Name	Setting Content	Explanation
RECORD_RAW	YES NO	Set the waveform data of the log file to not pass through the filter, and the default value is NO.
RING_CHANNELS	1 ~ 4	This machine provides users to grab sensor data directly through Linux share memory, its Key id is 2000, the default value of this setting is 3, for the data format, please refer to the ring chapter about share memory later.
RING_SECONDS	5 ~ 200	Set the length of the sensor data stored in share memory in seconds, the default value is 0, which means this function is not enabled.
RING_FILTERED	YES NO	Set whether the data in share memory is filtered or not, the default value is NO.
RTC_BATTERY_LOW_TH	< 10	When the RTC battery voltage is lower than this value, the LCD will display an error message, and the default value is 2.5 in V.
RTC_SOURCE	RPI CPU	Set whether RTC is controlled by CPU or RPI, the default value is RPI, please note that this setting must be set by FAE according to the hardware, wrong setting will cause system error.
RTD_FROM_FILE	Waveform_File_Name	This function is added in version 4.56.Set to replace sensor by input file, this function is for research purpose and should not be used in general, the data format of the file is CSV, three floating point data per line, the unit is gal, for example: -2.950,-1.097,-1.015 -1.875,-1.071,-1.133 -0.841,-0.919,-1.309 -0.476,-0.961,-0.824 0.333,-0.938,-1.129 The sampling rate coefficients are set to SPS1000 and SPS400.
RTD_CHECKSUM	YES NO	This machine can send the RTD data of sensor through TCP port, this item sets whether the data packet has error checking Byte, the default value is NO, please refer to the description of RTD packet format in the following chapter.

[PALERT_LOCAL_MODE] Setting Detail Description		
Setting Name	Setting Content	Explanation
RTD_IP	IP:PORT	Set the IP and Port number of the remote TCP port, if you don't want to use this function, please comment or delete this setting.
RTD_BITS	16 24	Select 16 or 24 bit RTD packet, the default value is 16, 24 bit is not yet supported.
SAMPLING_RATE	50、100、200、400、500、1000	Select the system's data sampling rate (per second), which is 100 by default. SPS1000 does not support 400. SPS400 does not support 500 and 1000. If the system does not have SPS1000 or SPS400 setting, it means the maximum sampling rate is 200.
SENSOR_TYPE	PALERT220 PALERTV10 PALERTV11	Select the type of sensor, the default value does not have this setting, please note that this is a hardware-related setting that must be confirmed and operated by the FAE, and incorrect settings will cause the system to fail to operate.
SERIAL_NO	0 ~ 65535	Set the serial number for the device, which must be a numeric value. This setting is crucial as it will be placed in Modbus registers. We recommend keeping the range within 0 to 65535. Additionally, please note that the serial number is preconfigured during the manufacturing process for validation purposes. If users decide to make changes, it is advised to retain the original serial number for future reference and recalibration.
SERVER_IP	IP1:PORT1 IP2:PORT2 IP3:PORT3	Configure the server and port information of the local active external connection, up to 3 groups.
SERVER_PASSWORD	PASSWORD1 PASSWORD2 PASSWORD3	If this machine is set to the China Earthquake Administration mode, this setting provides the connection password of the corresponding server.
SERVER_STREAM_MODE_TAIWAW	1、2、4、8、16	Set the format of the output packet after connecting to the server, please refer to the following section for the description of the format of the output packet.
SPIKE_DATA	FIRST_DATA INTER_DATA	The options for excluding Spike are to use the first data, or to fill in using the mean.
SPS400 SPS1000	YES NO	To set the data transfer speed of CPU, please note that this setting is related to the hardware, and must be set by FAE, incorrect setting will cause the system to be unable to operate.

[PALERT_LOCAL_MODE] Setting Detail Description		
Setting Name	Setting Content	Explanation
SPS_CH0 SPS_CH1 SPS_CH2 SPS_CH3	50、100、200、400、500、1000	China Seismological Administration (CSA) has a special setting to set different sampling rates for different channels, but it is not recommended to use this setting. SPS1000 does not support 400. SPS400 does not support 500 and 1000. If there is no SPS1000 or SPS400 setting in the system, it means the maximum sampling rate is 200.
STATION_NET	Maximum 2 half-characters	miniSEED utilizes SCNL to identify stations. S stands for Station. C stands for Channel, if user set HL, the three-axis output will be HLZ, HLN, HLE. N stands for Network, which is the monitoring network code. L is for Location, the vertical position of the station. STATION_NAME is S; STATION_CH_NAME is C for three-axis; STATION_CH_GEO_NAME is C for the fourth axis; STATION_NET is N; and STATION_LOCATION is L.
STATION_NAME	Maximum 5 half-characters	
STATION_CH_NAME	Maximum 2 half-characters	
STATION_CH_GEO_NAME	Maximum 2 half-characters	
STATION_LOCATION	Maximum 2 half-characters	
STA_LTA_TRIG_ENABLE	YES NO	Setting up to use STA/LTA Trigger Detection Mode
STA_WIDTH	> 0	Set the duration of STA in seconds, the recommended value is 2.
LTA_WIDTH	> 0	Set the length of the LTA in seconds, the recommended value is 40.
STA_LTA_THRESHOLD	> 0.05	Set the trigger threshold (positive edge) of STA/LTA, the recommended value is 3.
STA_LTA_STOP_THRESHOLD	> 0	Set the end threshold threshold (negative edge) for STA/LTA triggered events, the recommended value is 1.
STA_LTA_EVENT_TIME	> 3	Set the duration of the event in seconds after the STA/LTA is triggered, the recommended value is 30.
STA_LTA_RELAY1	> 0	Set the threshold for the local DO1 to be activated after the STA/LTA event is triggered, in gal.
STA_LTA_RELAY2	> 0	Set the threshold of DO2 activation in gal when STA/LTA event is triggered.
STA_LTA_RELAY3	> 0	Set the threshold of DO3 in gal when STA/LTA event is triggered. The three DOs are controlled independently.

[PALERT_LOCAL_MODE] Setting Detail Description		
Setting Name	Setting Content	Explanation
STREAMING_IN_MSEC	0 ~ 1000	Set the length of the streaming packet when the camera is in the China Earthquake Bureau mode, this setting also affects the streaming packet Mode 4, 8, the unit is mini second, the recommended value is 1000.
STREAM_TRIG_PACKET	YES NO	If YES is selected and Pd trigger mode is set, if Mode 1 or 2 streaming packet output is selected, a Mode 2 packet will be sent at the time of trigger, and another Mode 2 packet will be sent after 3 seconds, which can be used as remote P-wave warning function, default value is NO. Note: Mode 2 packet is the header part of mode 1.
VECTOR_INTENSITY	YES NO	When using the old CWB seismic class standard (before 2020), you can choose either horizontal or triaxial to calculate the seismicity class of earthquakes, and the default value is NO.
VECTOR_RMS	YES NO	Set to use RMS, the data will be stored in Modbus point bit PALERT_VECTOR with default value NO.
VECTOR_RMS_SECOND	1 ~ 30	This setting determines the length of the RMS calculation in seconds, and the default value is 1.
WATCH_TIME	5 ~ 255	Set the length of alert time after a Pd and PGA event.
WARNING_TIME	5 ~ 255	Set the length of the warning time after a Pd and PGA event is triggered.
ZEROING_PERIOD_IN_MINUTE	> 1	Set whether to enable the timer reset calculation in minutes, if you don't use this function, just delete this line, if you don't enable the AUTO_OFFSET function, it is recommended to turn on this function, the recommended value is 60.
ZEROING_DATA_LENGTH	> 400	Set the number of data strokes required for auto reset.

5-2-3-46 *[PRE_EVENT_SECOND]*

Set the number of seconds "before" a seismic event is recorded in a seismic record, the maximum value is 200 and the default value is 20.

Syntax and example： [PRE_EVENT_SECOND] 10

Explanation:

- Set the number of seconds recorded before a seismic event for seismic records to 10 seconds.

5-2-3-47 *[POST_EVENT_SECOND]*

Set the number of seconds for recording seismic events "after" the earthquake record. The maximum value is 600, with a default of 20.

Syntax and example： [POST_EVENT_SECOND] 10

Explanation:

- Set the post-event recording duration for seismic events to 10 seconds.

5-2-3-48 *[POWER_OFF_SWITCH_EXIST]*

Set whether the system has a button switch. Please note that this function is hardware-related and must be configured by an FAE. Incorrect settings may disrupt normal system operation, with a default value of YES.

Syntax： [POWER_OFF_SWITCH_EXIST] YES/NO

5-2-3-49 *[RECORD_INTENSITY]*

Set the threshold intensity value for initiating earthquake event recording, which can be combined with the settings of [PRE_EVENT_SECOND] and [POST_EVENT_SECOND].

Syntax and example： [RECORD_INTENSITY] 5.1

Explanation:

- Set the initiation threshold for earthquake recording to 5 (CWB 2020 seismic scale).

5-2-3-50 *[RECORD_PGA]*

Set the PGA threshold value for initiating earthquake event recording, which can be combined with the settings of [PRE_EVENT_SECOND] and [POST_EVENT_SECOND]. This setting has the same effect as [RECORD_INTENSITY], and both operate on an OR logic, triggering recording if either condition is met.

Syntax and example： [RECORD_PGA] 8.5

Explanation:

- Set the recording initiation condition for earthquakes to PGA >= 8.5 gal.

5-2-3-51 *[RELAY_INTENSITY]*

Set the intensity threshold for DO actions during seismic events. This setting combines with the results of PD_TRIG_ENABLE, PGA_TRIG_ENABLE, and STA_LTA_TRIG_ENABLE from the [PALERT_LOCAL_MODE] setting. Refer to Section 15 for the logic diagram of DO actions.

```
Syntax：
[RELAY_INTENSITY]
RELAY1  relay1Intensity
RELAY2  relay2Intensity
RELAY3  relay3Intensity
```

```
Example：
[RELAY_INTENSITY]
RELAY1 1
RELAY2 3
RELAY3 5.1
```

Explanation:

- Set the triggering intensity for DO1 to DO3 for 1st-degree, 3rd-degree, and 5 (weak) seismic events (5.1).

5-2-3-52 *[RELAY_PD]*

Set the Pd threshold for DO actions during seismic events, measured in cm. This setting combines with the results of PD_TRIG_ENABLE, PGA_TRIG_ENABLE, and STA_LTA_TRIG_ENABLE from the [PALERT_LOCAL_MODE] setting. Refer to Section 15 for the logic diagram of DO actions.

```
[RELAY_PD]
RELAY1  relay1cm
RELAY2  relay2cm
RELAY3  relay3cm
```

Example：

[RELAY_PD]

RELAY1 0.2

RELAY2 0.3

RELAY3 0.35

Explanation:

➢ Set the triggering Pd values for DO1 to DO3 to 0.2, 0.3, and 0.35 cm.

5-2-3-53 *[RELAY_PGV]*

Set the velocity threshold for DO actions during seismic events, measured in mm/second. This setting combines with the results of PD_TRIG_ENABLE, PGA_TRIG_ENABLE, and STA_LTA_TRIG_ENABLE from the [PALERT_LOCAL_MODE] setting. Refer to Section 15 for the logic diagram of DO actions.

Syntax： [RELAY_PGV] RELAY1 relay1mm RELAY2 relay2mm RELAY3 relay3mm

Example： [RELAY_PGV] RELAY1 1.5 RELAY2 15 RELAY3 30

Explanation:

➢ Set the triggering velocity values for DO1 to DO3 to 1.5, 15, and 30 mm/sec.

5-2-3-54 *[RELAY_RESET_BY_MANUAL]*

After the seismic event ends, DO will automatically reset. Users can set it to manual reset mode (press the button for three seconds or remotely control it via the Modbus protocol), with a default value of NO.

Syntax and example： [RELAY_RESET_BY_MANUAL] YES

Explanation:

➢ Set DO to manual reset mode after a seismic event.

5-2-3-55 *[RELAY1_GAL]*

Set the PGA action threshold for DO1 during seismic events. This setting combines with the results of PD_TRIG_ENABLE, PGA_TRIG_ENABLE, and STA_LTA_TRIG_ENABLE from the [PALERT_LOCAL_MODE] setting. Refer to Section 15 for the logic diagram of DO actions.

Syntax and example： [RELAY1_GAL] 8.5

Explanation:

- Set the PGA action threshold for DO1 during seismic events to 8.5 gal.

5-2-3-56 *[RELAY_RESET_BY_MANUAL]*

Set the PGA threshold for the action of DO2 during seismic events. This setting combines with the results of [PALERT_LOCAL_MODE] settings PD_TRIG_ENABLE, PGA_TRIG_ENABLE, STA_LTA_TRIG_ENABLE using OR logic, as illustrated in Section 15's logic diagram.

Syntax and example： [RELAY2_GAL] 80

Explanation:

- Set the PGA action threshold for DO2 during seismic events to 80 gal.

5-2-3-57 *[RELAY_CONTROL_BY_ERR]*

Set the PGA threshold for the action of DO3 during seismic events. This setting combines with the results of [PALERT_LOCAL_MODE] settings PD_TRIG_ENABLE, PGA_TRIG_ENABLE, STA_LTA_TRIG_ENABLE using OR logic, as illustrated in Section 15's logic diagram.

Syntax and example： [RELAY3_GAL] 250

Explanation:

- Set the PGA action threshold for DO3 during seismic events to 250 gal.

5-2-3-58 *[RELAY_CONTROL_BY_ERR]*

When the system detects any errors, such as low external voltage or abnormal NTP conditions, DO1 will turn off, and DO2 will activate. If everything is normal, DO1 will activate, and DO2 will turn off. The default value is NO.

Syntax and example： [RELAY_CONTROL_BY_ERR] YES

Explanation:

- Use DO1 and DO2 as indicators of system abnormalities.

5-2-3-59 *[RELAY_BLINK_MODE]*

Set whether the DO is ON or blinks at a one-second frequency during operation. The default value is NO.

Syntax and example： [RELAY_BLINK_MODE] YES

Explanation:

- Set the DO to blink during operation.

5-2-3-60 *[REMOTE_CONTROL]*

Set whether the local device allows controlling the DO output status via Modbus (REMOTE_RELAY, 0x031E). Note that even if allowed, the DO output is a result of the OR operation with the Modbus points.

Syntax and example： [REMOTE_CONTROL] RELAY NO

Explanation:

- Set the local device to not allow controlling DO via Modbus. The default setting is YES.

5-2-3-61 *[REPLAY]*

Set the local device to read specific waveform files and generate results based on the waveform file data, simulating settings such as Relay control and filtering effects. The filenames for specific waveform files are aData.txt, bData.txt, cData.txt, and they need to match the correct sampling rate settings.

Syntax and example： [REPLAY] RELAY NO

5-2-3-62 *[RESTORE_IP_WHILE_IP_ERROR]*

When set to dynamically obtain an IP, if the system obtains an erroneous IP, it can automatically copy /home/Desktop/vAlert/bin/interfacesBackup to /etc/network/interfaces and restart the network service.

Syntax: [RESTORE_IP_WHILE_IP_ERROR] on a single line.

Explanation:

- Enable the functionality to backup file recovery network settings and restart the network.
- If not using this feature, please delete this line.

5-2-3-63 *[SERVICE]*

Set the local device to actively contact the service server every 60 seconds to check for service updates. The connection process is as follows:

Priority is given to the user-defined server connection. If unsuccessful or no service request is found, it uses palertService.sanlien.com. Delete this setting if the feature is not used.

a. Send GET /index.php?inst= px01SerialNo HTTP/1.1

b. Check the response message for service_code:no:

If no is 1:

sprintf(buf, "./serviceApi "%s" "%s" –c %d –v %d –d %d %s", serviceIp, "/palertService", serviceCode, mbusAi[PX_VERSION], revDate, px01SerialNo);

If no is 0:

sprintf(buf, "./serviceApi "%s" "%s" –c %d –v %d –d %d %s", serviceIp, serviceDir, serviceCode, mbusAi[PX_VERSION], revDate, px01SerialNo);

c. System call: system(buf)

Syntax and example：
[SERVICE]
SERVICE_DOMAIN 192.168.255.100
SERVICE_DIR /service

5-2-3-64 *[SINGLE_RELAY_MODE]*

Set whether the DO outputs are consolidated into a single output or individual outputs. The system default is NO, where each DO is controlled independently without interference. If set to YES, when DO3 is turned on, DO2 and DO1 will be forcefully turned off. When DO2 is activated, DO1 will be forcefully turned off.

Syntax and example：
[SINGLE_RELAY_MODE]
YES

Explanation:

- Set DO to consolidate into a single output.

5-2-3-65 *[SI]*

Enabled SI (spectral intensity)，$\mathrm{SI} = \frac{1}{2.4}\int_{0.1}^{2.5} \mathrm{Sv}(\mathrm{T},\mathrm{h})\mathrm{dT}$。

Syntax and example：
[SI]
WARNING_TH 30
ACTION_TH 60
EVENT_SECOND 10
SAMPLING_TIME 60
FILE_DELAY_TIME 60

[SI] Setting Details		
Setting Item	Setting Content	Description
WARNING_TH	> 0	Warning threshold, unit: cm/second.
ACTION_TH	> 0	Action threshold, unit: cm/second.
EVENT_SECOND	>= 10	Once triggered, the duration for which the event will be maintained, unit: seconds.
SAMPLING_TIME	10 ~ 120	How often the SI value is calculated, unit: seconds.
FILE_DELAY_TIME	> 0	How often to write to a file, unit: seconds. Appropriate writing intervals can extend the lifespan of the SD card.

5-2-3-66 *[SOCKET_OPTION]*

Set the size of the TCP transmission buffer, with a default value of 5120 bytes. The configured value must be greater than 2048 bytes.

Syntax and example：

[SOCKT_OPTION]

SEND_BUF_SIZE 10240

Explanation:

- Set the TCP transmission buffer capacity to 10240 bytes.

5-2-3-67 *[STORAGE_CONFIG]*

Configure the path for data storage. This feature is supported in versions 4.51 and later.

Syntax and example：

[STORAGE_CONFIG]

USB_DIR /media/usb/

EARTHQUAKE eqEvent/

MINISEED mSeed/

LOG log/

DIN din/

ISO2631 iso2631/

DORTS dorts/

Explanation:

- Store earthquake data in /media/usb/eqEvent/
- Store miniSEED data ring in /media/usb/mSeed/
- Store system logs in /media/usb/log/
- Store DIN data in /media/usb/din/
- Store ISO2631 data in /media/usb/iso2631/
- Store DORTS data in /media/usb/dorts/

5-2-3-68 *[SWITCH_UNLOCK_CODE]*

Users can utilize this setting to configure an unlock code for buttons to prevent unauthorized access.

Syntax and example：
[SWITCH_UNLOCK_CODE]
123321

Explanation:

- Set the unlock code for the buttons to 123321, a sequence of six digits. Users must press the button in the following order: 1 second, pause; 2 seconds, pause; 3 seconds, pause; 3 seconds, pause; 2 seconds, pause; 1 second, pause to unlock.

5-2-3-69 *[TEST_MODE_CONFIG]*

This setting provides users with the ability to customize a self-test mode (press the button for 9 seconds to enter this mode, press for another 9 seconds to exit, or automatically exit after 60 seconds of inactivity). Users can use this setting to test DO.

[TEST_MODE_CONFIG] Setting Details		
Setting Item	Setting Content	Description
STAGE	0 ~ 3	You can configure up to four sets, and each set must start with STAGE. For example: STAGE 0 SWITCH_SECOND 6 RELAY_HOLD_SECOND 6 PLAY_FILE 3.wav RELAY2 ON

[TEST_MODE_CONFIG] Setting Details		
Setting Item	Setting Content	Description
SWITCH_SECOND	1 ~ 10	The duration (in seconds) to enter this STAGE by pressing the button. ◦
RELAY1 **RELAY2** **RELAY3**	ON OFF	When entering this STAGE, whether the corresponding DO should be activated (ON) or deactivated (OFF).
RELAY_HOLD_SECOND	> 0	Duration of the corresponding DO action, measured in seconds.
PLAY_FILE	Audio File Name for Playback	The local device does not support the playback of audio files. However, you can configure the keyword "eewsCancel.wav" to perform the cancel function, equivalent to pressing the button for three seconds in normal mode.

5-2-3-70 *[VWHUB_CONFIG]*

Configure the information of the FTP server for uploading event files.

Syntax ：

[VWHUB_CONFIG]

IP ftpServerIP

PORT ftpServerPort

USER userId

PASSWORD password

FTPDIR ftpServerDir

Example：

[VWHUB_CONFIG]

IP 192.168.255.100

PORT 2121

USER admin

PASSWORD adminpw

FTPDIR /

5-2-3-71 *[WATCHDOG]*

Set the delay in seconds for starting the watchdog when the program starts, with a default value of 1 second.

Syntax and example
[WATCHDOG]
5

Explanation:

- Set a delay of 1 second after booting before initiating the watchdog.
- Note: This setting involves hardware and must be configured by FAE.

5-2-3-72 *[WHITE_IP]*

Set the IP addresses allowed to communicate with the local device using the Modbus protocol. If this feature is enabled, only the specified IPs can establish a connection.

Syntax and example：
[WHITE_IP]
192.168.37.44

Explanation:

- Enable the whitelist feature, allowing only 192.168.37.44 to connect to the local device via the Modbus protocol.

5-2-3-73 *[WIRELESS_LAN_ENABLE]*

Set to display the WiFi IP on the LCD, with a default value of NO.

Syntax and example： [WIRELESS_LAN_ENABLE] NO

Explanation:

- The LCD will not display the WiFi IP.

5-2-3-74 *[ZT-2000_DO_START_POINT]*

Configure the starting Modbus point for controlling the ZT-2000 DO module produced by ICP DAS. The range is 0 to 65535.

Syntax and example： [ZT-2000_DO_START_POINT] 0

Explanation:

- Set the starting Modbus point for ZT-2000 DO to 0.

5-2-3-75 *[ZT-2000_DO_END_POINT]*

Configure the ending Modbus point for controlling the ZT-2000 DO module produced by ICP DAS. The range is 0 to 65535.

Syntax and example： [ZT-2000_DO_END_POINT] 31

Explanation:

- Set the ending Modbus point for ZT-2000 DO to 31.

5-2-3-76 *[ZT-2000_DO_ON_GAL]*

This device can directly control the ZT-2000 DO module produced by ICP DAS. This setting is for the PGA activation threshold of the ZT-2000 DO module, measured in gal, with a default value of 80.

Syntax and example： [ZT-2000_DO_ON_GAL] 8

Explanation:

- Set the PGA activation threshold for the ZT-2000 DO module to 8 gal.

5-2-3-77 *[ZT-2000_IP]*

This device can directly control the ZT-2000 DO module produced by ICP DAS. This setting is for the IP address of the ZT-2000 module.

Syntax and example： [ZT-2000_IP] 192.168.255.100

Explanation:

Set the IP address for the ZT-2000 module to 192.168.255.100.

6. Performance Configuration File Description

6.1 memsCalData

This configuration file stores calibration data for the built-in sensor. Please do not modify it arbitrarily, as it may affect the instrument's accuracy.

Syntax： SERIAL_NO serialNumber A_AXIS_OFFSET aOffset B_AXIS_OFFSET bOffset C_AXIS_OFFSET cOffset D_AXIS_OFFSET dOffset A_AXIS_1G aGain B_AXIS_1G bGain C_AXIS_1G cGain D_AXIS_1G dGain

Example：
SERIAL_NO 12235
A_AXIS_OFFSET 5
B_AXIS_OFFSET 4
C_AXIS_OFFSET -12
A_AXIS_1G 10010
B_AXIS_1G 9782
C_AXIS_1G 10101

Explanation:

- No D-axis; offsets for axes A to C are 5, 4, and -12 gal, respectively. Gains for axes A to C are 1.001, 0.9782, and 1.0101, respectively.
- The machine's serial number is 12235. Note that this configuration is similar to the [PALERT_LOCAL_MODE] SERIAL_NO function, but this configuration takes precedence.

6.2 geophoneData

This file configures the characteristics of an externally connected velocity sensor when using the fourth axis and serves as the basis for frequency compensation.

Syntax and example：
GAIN 28.3
DAMPING_RATIO 0.7
RESISTANCE 360
DAMPING_RESISTOR 10000000
MASS 0.083
FREQUENCY 4.5

Explanation:

- Velocity sensor specifications: Output gain: 28.3 V/M/Sec, damping: 0.7, no damping resistance, internal resistance: 360 ohms, mass: 83 grams, natural frequency: 4.5 Hz.

6.3 initSetup.cfg

This file stores initial settings for individual operations of the instrument.

Syntax and example： STREAM_MODE 1 STA_LTA_TH_STOP 1 STA_LTA_TH 3.5 LCD_CONTRAST 15

Explanation:

- Set the STA/LTA trigger event threshold to 3.5. The minimum stop threshold after STA/LTA triggering is 1. In the China Earthquake Administration mode, the stream mode to the server is set to 1.
- Set the LCD contrast to 15. Note that this setting is a hardware configuration and should be performed by FAE.

7. Modbus Point Table

7.2 AO (4xxxx)

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x0063	R	SYNC_FLAG	Synchronization and Connection Flags Bit 0: NTP SYNC. Bit 1: server0 connection Bit 2: server1 connection Bit 3: server2 connection Bit 8: admin. server0 connection Bit 9: admin. server1 connection Bit 10: admin. server2 connection Bit 14: GPS sync. Bit 15: time sync. with CWB EEW server
0x0064	R	A_AXIS	A-axis real-time acceleration, unit: counts, 1 gal = 16.718 counts
0x0065	R	B_AXIS	B-axis real-time acceleration, unit: counts, 1 gal = 16.718 counts
0x0066	R	C_AXIS	C-axis real-time acceleration, unit: counts, 1 gal = 16.718 counts
0x0067	R	VECTOR	Instantaneous acceleration vector in three axes, unit: counts, 1 gal = 16.718 counts. The calculation formula is $\sqrt{a^2 + b^2 + c^2}$ 。
0x0068	R	A_OFFSET	A-axis zero point compensation value, unit: counts.
0x0069	R	B_OFFSET	B-axis zero point compensation value, unit: counts.
0x006A	R	C_OFFSET	C-axis zero point compensation value, unit: counts.

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x006B	R	VECTOR_GAL_MAX	When an earthquake occurs, this address will store the maximum composite acceleration value for three axis, in units of 0.1 gal. This value will be retained until the next earthquake triggers an update.
0x006C	R	INTENSITY_NOW	Real-time seismic intensity, measured in degrees. However, if the instrument is set to the China Earthquake Administration or CWB 2020 seismic intensity scale, the unit will be 0.1 degrees.
0x006D	R	INTENSITY_MAX	The maximum seismic intensity during an earthquake event, measured in degrees. However, if the instrument is set to the China Earthquake Administration or CWB 2020 seismic intensity scale, the unit will be 0.1 degrees.
0x006E	R	EVENT_FLAG	Earthquake Event Flags: Bit 1: Pd Event Bit 2:PGA Event Bit 3: STA/LTA Event
0x006F	R	LTA_FLAG	0: STA/LTA initialization in progress, unable to detect earthquakes. 1: STA/LTA detecting earthquakes normally.

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x0070	R/W	WRITE_CONFIG	0x0080: Forced program stop. 0x0180: Program restart. 0x0181: Start FTP software update. 0x0380: Write settings to initSetup.cfg. 0x0480: Read settings from initSetup.cfg. 0x0580: Perform zero calibration. 0x10C1: Reload data for the geophone.
0x0071			Reserved
0x0072	R	STA	Seconds for STA (Short-Term Average), unit: 0.1 seconds.
0x0073	R	LTA	Seconds for LTA (Long-Term Average), unit: 0.1 seconds.
0x0074	R	STALTA_THRESHOLD	STA/LTA Earthquake Detection Threshold.
0x0075			Reserved
0x0076	R	DIO_STATUS	Digital Output (DO) Status: When a Digital Output is activated, the corresponding bit value is 1. Bit 0: DO1 Bit 1: DO2 Bit 2: DO3
0x0077	R	EVENT_TIME	After detecting an STA/LTA event, the duration of the event in seconds
0x0078	R	PGA_WATCH_THRESHOLD	PGA (Peak Ground Acceleration) Alert Threshold, unit: counts, 1 gal = 16.718 counts.
0x0079			Reserved
0x007A	R	STALTA_RELAY0_THRESHOLD	Value for DO1 activation when triggered by STA/LTA, unit: 0.1 gal.
0x007B	R	STALTA_RELAY1_THRESHOLD	Value for DO2 activation when triggered by STA/LTA, unit: 0.1 gal.

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x007C	R	PGV_1S	Maximum PGV (Peak Ground Velocity) value per second, unit: 0.1 mm/sec.
0x007D			Reserved
0x007E			Reserved
0x007F	R	STALTA_VALUE	Real-time STA/LTA value, unit: 0.01.
0x0080	R	EVENT_A_MAX	During an earthquake event, Palert S303 will instantly calculate the maximum acceleration for each axis. This address represents the maximum acceleration along the A-axis, unit: counts, 1 gal = 16.718 counts."
0x0081	R	EVENT_B_MAX	When an earthquake event occurs, Palert S303 will instantly calculate the maximum acceleration for each axis. This address represents the maximum acceleration along the B-axis, unit: counts, 1 gal = 16.718 counts.
0x0082	R	EVENT_C_MAX	When an earthquake event occurs, Palert S303 will instantly calculate the maximum acceleration for each axis. This address represents the maximum acceleration along the C-axis, unit: counts, 1 gal = 16.718 counts.
0x0083	R	VENT_VECTOR_A_MAX	When an earthquake event occurs, Palert S303 will instantly calculate the acceleration vector. This address represents the maximum acceleration along the A-axis of the composite vector during the seismic event, unit: counts, 1 gal = 16.718 counts.
0x0084	R	VENT_VECTOR_B_MAX	When an earthquake event occurs, Palert S303 will instantly calculate the acceleration vector. This address represents the maximum acceleration along the B-axis of the composite vector during the seismic event, unit: counts, 1 gal = 16.718 counts.

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x0085	R	VENT_VECTOR_C_MAX	When an earthquake event occurs, Palert S303 will instantly calculate the acceleration vector. This address represents the maximum acceleration along the C-axis of the composite vector during the seismic event, unit: counts, 1 gal = 16.718 counts.
0x0086			Reserved
0x0087			Reserved
0x0088	R	PD	After detecting the P-wave, Palert S303 will begin calculating the real-time Pd value, unit: 0.001 cm.
0x0089	R	TOUC	After detecting the P-wave, Palert S303 will begin calculating the real-time tau-c value, unit: 0.001 seconds.
0x008A	R	PD_FLAG	Pd Status: Bit 5: Detection of P-wave Bit 6: Pd exceeds alert threshold Bit 7: Pd exceeds warning threshold Bit 8: Initial wave is an upward motion Bit 9: Initial wave is a downward motion
0x008B	R	PGA_10S	PGA_10S: 10-second composite vector acceleration, unit: counts, 1 gal = 16.718 counts. The calculation formula is$\sqrt{a^2 + b^2 + c^2}$
0x008C	R	EVENT_YEAR	Earthquake Event Time - Year
0x008D	R	EVENT_MONTH	Earthquake Event Time - Month
0x008E	R	EVENT_DAY	Earthquake Event Time - Day
0x008F	R	EVENT_HOUR	Earthquake Event Time - Hour
0x0090	R	EVENT_MINUTE	Earthquake Event Time - Minute
0x0091	R	EVENT_SECOND	Earthquake Event Time - Second
0x0092	R	SYSTEM_YEAR	System Time - Year
0x0093	R	SYSTEM_MONTH	System Time - Month
0x0094	R	SYSTEM_DAY	System Time - Day
0x0095	R	SYSTEM_HOUR	System Time - Hour

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x0096	R	SYSTEM_MINUTE	System Time - Minute
0x0097	R	SYSTEM_SECOND	System Time - Second
0x0098 ~ 0x009D			Reserved
0x009E	R	A_DISPLACEMENT	Real-time displacement value along the A-axis, unit: 0.001 cm (when Pd triggering function is enabled).
0x009F			Reserved
0x00A0	R		PGA Warning Threshold, unit: counts, 1 gal = 16.718 counts.
0x00A1	R		Pd Warning Threshold, unit: 0.001 cm.
0x00A2	R	TRIG_MODE	Low-Pass and Trigger Mode Selection Status: Bit 1: Activate Pd Trigger Bit 2: Activate PGA Trigger Bit 3: Activate STA/LTA Trigger Bit 6: Activate Low-Pass Filter 10 Hz Bit 7: Activate Low-Pass Filter 20 Hz Bit 8: Activate Low-Pass Filter 40 Hz Bit 9: Activate Low-Pass Filter 80 Hz Bit 6 and Bit 8 both on: Activate Low-Pass Filter 50 Hz Bit 7 and Bit 9 both on: Activate Low-Pass Filter 100 Hz Bit 10: Activate High-Pass Filter 0.1 Hz Bit 11: Activate High-Pass Filter 0.3 Hz Bit 12: Activate High-Pass Filter 0.5 Hz Bit 13: Activate High-Pass Filter 1 Hz Bit 14: Activate High-Pass Filter 2 Hz Bit 15: Activate High-Pass Filter 3 Hz
0x00A3	R	PD_WATCH_THRESHOLD	Pd Alert Threshold, unit: 0.001 cm.
0x00A4	R	MEMS_CAL0_A_AXIS	Calibration coefficient for A-axis when acceleration is 0g (unit: 0.1 gal). The value at this address is calibrated before leaving the factory.

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x00A5	R	MEMS_CAL0_B_AXIS	Calibration coefficient for B-axis when acceleration is 0g (unit: 0.1 gal). The value at this address is calibrated before leaving the factory.
0x00A6	R	MEMS_CAL0_C_AXIS	Calibration coefficient for C-axis when acceleration is 0g (unit: 0.1 gal). The value at this address is calibrated before leaving the factory.
0x00A7	R	MEMS_CAL_A_AXIS	Calibration coefficient for A-axis when acceleration is 1g (unit: 0.1 gal). The value at this address is calibrated before leaving the factory.
0x00A8	R	MEMS_CAL_B_AXIS	Calibration coefficient for B-axis when acceleration is 1g (unit: multiplier of 1g). The value at this address is calibrated before leaving the factory.
0x00A9	R	MEMS_CAL_C_AXIS	Calibration coefficient for C-axis when acceleration is 1g (unit: multiplier of 1g). The value at this address is calibrated before leaving the factory.
0x00AA	R	NTP_IP1	Network time synchronization host IP address 1.
0x00AB	R	NTP_IP2	Network time synchronization host IP address 2.
0x00AC	R	NTP_IP3	Network time synchronization host IP address 3.
0x00AD	R	NTP_IP4	Network time synchronization host IP address 4.
0x00AE	R	SYSTEM_WEEKDAY	System time, day of the week.
0x00AF	R	SERVER0_IP12	TCP Server 0 IP Address 1, 2.
0x00B0	R	SERVER0_IP34	TCP Server 0 IP Address 3, 4.
0x00B1	R	SERVER1_IP12	TCP Server 1 IP Address 1, 2
0x00B2	R	SERVER1_IP34	TCP Server 1 IP Address 3,4

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x00B3	R	IP1	Local IP Address 1 / 4.
0x00B4	R	IP2	Local IP Address 2 / 4.
0x00B5	R	IP3	Local IP Address 3 / 4.
0x00B6	R	IP4	Local IP Address 4 / 4.
0x00B7	R	NETMASK1	Local Subnet Mask 1 / 4
0x00B8	R	NETMASK2	Local Subnet Mask 2 / 4
0x00B9	R	NETMASK3	Local Subnet Mask 3 / 4
0x00BA	R	NETMASK4	Local Subnet Mask 4 / 4
0x00BB	R	GATEWAY1	Local Gateway IP Address 1 / 4.
0x00BC	R	GATEWAY2	Local Gateway IP Address 2 / 4.
0x00BD	R	GATEWAY3	Local Gateway IP Address 3 / 4.
0x00BE	R	GATEWAY4	Local Gateway IP Address 4 / 4.
0x00BF			Reserved
0x00C0	R/W	STREAM_CONTROL	Stream packet output control. Please refer to the section on stream packet formats for packet structure. 0: Do not output streaming data. 1: Output Mode 1 data packet (16 bit). 2: Output Mode 1 header. 4: Output Mode 4 data packet (miniSEED). 8: Output Mode 8 data packet (for Sanlien TAF correction). 16: Output Mode 16 data packet (24 bit).
0x00C1			Reserved
0x00C2	R	WATCH_WARNING_TIME	Alert and warning time, unit: seconds. The high byte represents the alert time; the low byte represents the warning time.
0x00C3	R	VECTOR_GAL_NOW	Real-time composite acceleration for three axes, unit: 0.1 gal.
0x00C4			Reserved
0x00C5			Reserved
0x00C6	R	VERSION	Software version
0x00C7	R	SERIAL_NO	Local serial number
0x00C8 ~ 0x00CA			Reserved

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x00CB	R	SERVER2_IP12	TCP Server 2 IP Address 1, 2.
0x00CC	R	SERVER2_IP34	TCP Server 2 IP Address 3, 4.
0x00CD			Reserved
0x00CE			Reserved
0x00CF	R	OP_MODEX	Bit 3: CWB2020 Seismic Intensity Scale Calculation Mode.
0x00D0	R	SD03_A_MAX	A-axis maximum SD value (0.3 Hz), China Earthquake Administration mode
0x00D1	R	SD03_B_MAX	B-axis maximum SD value (0.3 Hz), China Earthquake Administration mode.
0x00D2	R	SD03_C_MAX	C-axis maximum SD value (0.3 Hz), China Earthquake Administration mode
0x00D3	R	SV03_A_MAX	A-axis maximum SV value (0.3 Hz), China Earthquake Administration mode.
0x00D4	R	SV03_B_MAX	B-axis maximum SV value (0.3 Hz), China Earthquake Administration mode.
0x00D5	R	SV03_C_MAX	C-axis maximum SV value (0.3 Hz), China Earthquake Administration mode.
0x00D6	R	SA03_A_MAX	A-axis maximum SA value (0.3 Hz), China Earthquake Administration mode
0x00D7	R	SA03_B_MAX	B-axis maximum SA value (0.3 Hz), China Earthquake Administration mode
0x00D8	R	SA03_C_MAX	C-axis maximum SA value (0.3 Hz), China Earthquake Administration mode
0x00D9	R	SD10_A_MAX	A-axis maximum SD value (1 Hz), China Earthquake Administration mode.
0x00DA	R	SD10_B_MAX	B-axis maximum SD value (1 Hz), China Earthquake Administration mode.
0x00DB	R	SD10_C_MAX	C-axis maximum SD value (1 Hz), China Earthquake Administration mode.
0x00DC	R	SV10_A_MAX	A-axis maximum SV value (1 Hz), China Earthquake Administration mode.
0x00DD	R	SV10_B_MAX	B-axis maximum SV value (1 Hz), China Earthquake Administration mode.
0x00DE	R	SV10_C_MAX	C-axis maximum SV value (1 Hz), China Earthquake Administration mode.
0x00DF	R	SA10_A_MAX	A-axis maximum SA value (1 Hz), China Earthquake Administration mode

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x00E0	R	SA10_B_MAX	B-axis maximum SA value (1 Hz), China Earthquake Administration mode
0x00E1	R	SA10_C_MAX	C-axis maximum SA value (1 Hz), China Earthquake Administration mode
0x00E2	R	SD03_A_MAX	A-axis maximum SD value (3 Hz), China Earthquake Administration mode.
0x00E3	R	SD03_B_MAX	B-axis maximum SD value (3 Hz), China Earthquake Administration mode
0x00E4	R	SD03_C_MAX	C-axis maximum SD value (3 Hz), China Earthquake Administration mode
0x00E5	R	SV03_A_MAX	A-axis maximum SV value (3 Hz), China Earthquake Administration mode.
0x00E6	R	SV03_B_MAX	B-axis maximum SV value (3 Hz), China Earthquake Administration mode.
0x00E7	R	SV03_C_MAX	C-axis maximum SV value (3 Hz), China Earthquake Administration mode.
0x00E8	R	SA03_A_MAX	A-axis maximum SA value (3 Hz), China Earthquake Administration mode.
0x00E9	R	SA03_B_MAX	B-axis maximum SA value (3 Hz), China Earthquake Administration mode.
0x00EA	R	SA03_C_MAX	C-axis maximum SA value (3 Hz), China Earthquake Administration mode.
0x00EB	R	RTD_LOOP_CNT	Internal ADC counter, system usage.
0x00EC	R/W	GLOBALEVENT	Continuous recording control. When the value at this address is 1, the system will continuously record waveform data.
0x00ED			Reserved
0x00EE	R	ADMIN_SERVER0_IP12	Admin Server 0 IP Address 1, 2
0x00EF	R	ADMIN_SERVER0_IP34	Admin Server 0 IP Address 3, 4
0x00F0	R	ADMIN_SERVER1_IP12	Admin Server 1 IP Address 1, 2
0x00F1	R	ADMIN_SERVER1_IP34	Admin Server 1 IP Address 3, 4

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x00F2 ~ 0x00F8			Reserved
0x00F9	R	D_AXIS	D-axis real-time velocity (geophone), unit: 0.01 mm/sec.
0x00FA	R	D_OFFSET	D-axis zero-point compensation (geophone).
0x00FB	R	EVENT_D_MAX	Maximum velocity along the D-axis during the seismic event, unit: counts (geophone).
0x00FC	R	MEMS_CAL0_D_AXIS	Calibration coefficient for D-axis when acceleration is 0g (unit: 0.1 gal). The value at this address is calibrated before leaving the factory (option).
0x00FD	R	MEMS_CAL_D_AXI	Calibration coefficient for D-axis when acceleration is 1g (unit: multiplier of 1g). The value at this address is calibrated before leaving the factory (option).
0x00FE	R	STALTA_THRESHOLD_STOP	Threshold value for STA/LTA event completion, unit: 0.01. Only used when set to China Earthquake Administration mode.
0x00FF	R	STALTA_RELAY2_THRESHOLD	When triggered by STA/LTA, the activation threshold for DO3 is in units of 0.1 gal.
0x0100	R	PGA_RELAY2_THRESHOLD	When triggered by PGA, the action threshold for DO3 is in units of counts, where 1 gal = 16.718 counts.
0x0101			Reserved
0x0102	R/W	POWER_OFF_BUTTON	Duration of the remote control button in seconds.
0x0103	R/W	POWER_OFF_CNT	Currently accumulated duration of the button in seconds
0x0104	R/W	LOCAL_PORT_STREAMING	To send real-time packets to the TCP port, 1 for sending, 0 for stopping, please refer to the above [LOCAL_STREAM_DEBUG] setting.

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x0105	R/W	RECORDING_START_TIME	Scheduled recording start time, Unix timestamp.
0x0107	R/W	RECORDING_STOP_TIME	Scheduled recording end time, Unix timestamp.
0x0109			Reserved
0x010A	R	ERR_CNT	The number of errors detected by the system.
0x010B	R	VECTOR_GAL_EVENT_SECOND	During an event, the three-axis composite acceleration per second, unit: 0.1 gal.
0x010C	R	A_COUNT_EVENT_SECOND	During an event, the A-axis component value of the maximum composite acceleration per second, unit: counts.
0x010D	R	B_COUNT_EVENT_SECOND	During an event, the B-axis component value of the maximum composite acceleration per second, unit: counts.
0x010E	R	C_COUNT_EVENT_SECOND	During an event, the C-axis component value of the maximum composite acceleration per second, unit: counts.
0x010F	R	INTENSITY_NOW_EVENT_SECOND	During an event, the maximum seismic intensity per second.
0x0110	R	VECTOR_VELOCITY_MAX	Maximum composite velocity value, unit: 0.1 mm/sec.
0x0111	R	SAMPLING_RATE	Sampling rate, unit: samples per second.
0x0112	R	VELOCITY_A	A-axis component real-time velocity value, unit: 0.1 mm/sec.
0x0113	R	VELOCITY_B	B-axis component real-time velocity value, unit: 0.1 mm/sec.
0x0114	R	VELOCITY_C	C-axis component real-time velocity value, unit: 0.1 mm/sec.
0x0115	R	VELOCITY_A_MAX	The A-axis component value of the maximum composite velocity, unit: 0.1 mm/sec.

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x0116	R	VELOCITY_B_MAX	The B-axis component value of the maximum composite velocity, unit: 0.1 mm/sec.
0x0117	R	VELOCITY_C_MAX	The C-axis component value of the maximum composite velocity, unit: 0.1 mm/sec.
0x0118	R	VECTOR_VELOCITY_EVENT_SECOND	During an event, the three-axis composite velocity per second, unit: 0.1 mm/sec.
0x0119	R	VELOCITY_A_EVENT_SECOND	During an event, the A-axis component value of the maximum composite velocity per second, unit: 0.1 mm/sec.
0x011A	R	VELOCITY_B_EVENT_SECOND	During an event, the B-axis component value of the maximum composite velocity per second, unit: 0.1 mm/sec.
0x011B	R	VELOCITY_C_EVENT_SECOND	During an event, the C-axis component value of the maximum composite velocity per second, unit: 0.1 mm/sec.
0x011C 0x011D	R	VELOCITY_A_FLOAT_SECOND	During an event, the A-axis component value of the maximum composite velocity per second, in floating-point format, unit: mm/sec.
0x011E 0x011F	R	VELOCITY_B_FLOAT_SECOND	During an event, the B-axis component value of the maximum composite velocity per second, in floating-point format, unit: mm/sec.
0x0120 0x0121	R	VELOCITY_C_FLOAT_SECOND	During an event, the C-axis component value of the maximum composite velocity per second, in floating-point format, unit: mm/sec.
0x0122 ~ 0x018E			Reserved
0x018F	R	PCB_TEMP	PCB temperature, unit: 0.01℃

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x0190	R	EXT_VOLT	External power supply voltage, unit: 0.01 V.
0x0191	R	INT_BAT_VOLT	Internal battery voltage, unit: 0.01 V.
0x0192	R	RTC_BAT_VOLT	Internal RTC battery voltage, unit: 0.01 V.
0x0193	R/W	LCD_CONTRAST	LCD contrast adjustment, ranging from 0 to 100.
0x0194	R/W	SENSOR_STATUS	Sensor OK: bit0 ~ bit3 (ch 0 ~ 3) Sensor Noise: bit4 ~ bit7 (ch 0 ~ 3) 0: OK, 1: Noise p.s. The result will be updated based on: Program initial: the very first exect 0 second. Interval: every 1440 minutes after initial.
0x0195	R/W	SD_NG	Boot storage media check result, 1 for abnormal, 0 for normal.
0x031E	R/W	REMOTE_RELAY	Digital Output (DO) output control. Bit 0 ~ 3: DO1 ~ DO4.
0x0383 0x0384	R	DISP_A_FLOAT_EVENT_MAX	During an event, the maximum displacement value of the A-axis component, in floating-point format, unit: micrometers (um).
0x0385 0x0386	R	DISP_B_FLOAT_EVENT_MAX	During an event, the maximum displacement value of the B-axis component, in floating-point format, unit: micrometers (um).
0x0387 0x0388	R	DISP_C_FLOAT_EVENT_MAX	During an event, the maximum displacement value of the C-axis component, in floating-point format, unit: micrometers (um).
0x0389 0x038A	R	VECTOR_DISP_FLOAT_EVENT_SECOND	During an event, the three-axis composite velocity per second, unit: micrometers (um).
0x038B 0x038C	R	DISP_A_FLOAT_EVENT_SECOND	During an event, the A-axis component displacement per second, in floating-point format, unit: micrometers (um).

Modbus AO Point Table (4XXXX)			
Register	**R/W**	**Label**	**Description**
0x038D 0x038E	R	DISP_B_FLOAT_EVENT_SECOND	During an event, the B-axis component displacement per second, in floating-point format, unit: micrometers (um).
0x038F 0x0390	R	DISP_C_FLOAT_EVENT_SECOND	During an event, the C-axis component displacement per second, in floating-point format, unit: micrometers (um).
0x0391 0x0392	R	DISP_A_FLOAT_SECOND	A-axis component displacement per second, in floating-point format, unit: micrometers (um).
0x0393 0x0394	R	DISP_B_FLOAT_SECOND	B-axis component displacement per second, in floating-point format, unit: micrometers (um).
0x0395 0x0396	R	DISP_C_FLOAT_SECOND	C-axis component displacement per second, in floating-point format, unit: micrometers (um).

7.3 AI (3xxxx)

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x00A8	DORTS_RELAY_REG	DORTS DO output status
0x00A9	ISO2631_RELAY_REG	ISO2631 DO Output Status
0x00B3	INSTRUMENT_CODE	11: pALERT S303 Taiwan mode 12: pALERT S303 China mode 14: Palert220
0x00C7 ~ 0x00DB	MBUS_LCD_MAP_ADDR	LCD real-time display of characters, total 2 * 20 characters.
0x018F	GPS_LOCK	GPS signal lock
0x0190	GPS_QTY	Number of satellites locked

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x0191	GPS_ANTENNA	Antenna status, this function is not NMEA standard, so this function is not guaranteed, only for reference. 0: NG 1: OK
0x0192	GPS_LAT_DEG	Latitude - degrees (+ is North, - is South)
0x0193	GPS_LAT_MIN	Latitude - minutes
0x0194	GPS_LAT_SEC	Latitude - 0.01 seconds
0x0195	GPS_LON_DEG	Longitude - Degree (+ is East, - is West)
0x0196	GPS_LON_MIN	Longitude - minutes
0x0197	GPS_LON_SEC	Longitude - 0.01 sec
0x0199	NTP_ST	Stratum of the NTP server, 16 is not available.
0x019A	NTP_T	Type of NTP server. u: unicast or manycast client, b: broadcast or multicast client, l: local clock, s: symmetric node (for backup), A: opt-in server, B: broadcast server, M: multicast server, last synchronization to current time in seconds.
0x019B	NTP_WHEN	The last synchronization time to the present, in seconds.
0x019C	NTP_POLL	The frequency of synchronization in seconds.
0x019D	NTP_REACH	An 8-bit left shift register value to test if the connection to the server is possible. 377 indicates that the connection is stable.
0x019E	NTP_DELAY	Is in floating point number format. The round trip time in milliseconds for communication from the local to the remote node or server.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x01A0	NTP_DELAY_INT	In integer format. Round trip time from local to remote nodes or servers in milliseconds.
0x01A1	NTP_OFFSET	Floating-point format. The time offset between the host and the NTP server. The closer the offset is to 0, the closer the time between the host and the NTP server is, in milliseconds.
0x01A3	NTP_OFFSET_INT	In integer format. Round trip time from local to remote nodes or servers in milliseconds.
0x01A4	NTP_JITTER	In floating-point format. Offset between the host and NTP server times. The closer the offset is to 0, the more closely aligned the host and NTP server times are, in milliseconds.
0x01A6	NTP_JITTER_INT	In integer format. Average deviation from the NTP server, in milliseconds. The smaller the absolute value of this number, the more accurate the device's time.
0x01F3	SI_YEAR	Enable SI calculation. Year of SI value occurrence.
0x01F4	SI_MONTH	Enable SI calculation. Month of SI value occurrence.
0x01F5	SI_DAY	Enable SI calculation. Day of SI value occurrence.
0x01F6	SI_HOUS	Enable SI calculation. Hour of SI value occurrence.
0x01F7	SI_MINUTE	Enable SI calculation. Minute of SI value occurrence.
0x01F8	SI_SECOND	Enable SI calculation. Second of SI value occurrence.
0x01F9	SI_PEAK	Maximum value of SI, in units of 0.01.
0x01FA	SI_REALTIME	Real-time value of SI, in units of 0.01.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x0333	ISO_DATA_COUNTER	Counter for updating ISO2631 data.
0x0334	ISO_XY_GAL	Horizontal composite vector value of ISO2631, in units of 0.1 gal.
0x0335	ISO_Z_GAL	Vertical value of ISO2631, in units of 0.1 gal.
0x0336	ISO_XY_DB	Horizontal composite vector value of ISO2631, in units of 0.01 dB.
0x0337	ISO_Z_DB	Vertical value of ISO2631, in units of 0.01 dB.
0x0338	ISO_MAX_DB	Maximum value of ISO2631, in units of 0.01 dB.
0x0339	ISO_DB_LATCH	Maximum value of ISO2631 (Hold), in units of 0.01 dB
0x033A		Reserved
0x033B		Reserved
0x033C	ISO_RELAY	Output status of ISO2631 DO
0x0347	DORTS_DATA_CONUTER	Counter for updating DORTS data
0x0348	DORTS_2HZ_DB	2 Hz dB value of DORTS, in units of 0.01 dB
0x0349	DORTS_4HZ_DB	4 Hz dB value of DORTS, in units of 0.01 dB
0x034A	DORTS_8HZ_DB	8 Hz dB value of DORTS, in units of 0.01 dB
0x034B	DORTS_16HZ_DB	16 Hz dB value of DORTS, in units of 0.01 dB
0x034C	DORTS_31P5HZ_DB	31.5 Hz dB value of DORTS, in units of 0.01 dB

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x034D	DORTS_63HZ_DB	63 Hz dB value of DORTS, in units of 0.01 dB.
0x034E	DORTS_MAX_DB	Maximum dB value of DORTS, in units of 0.01 dB.
0x034F	DORTS_DB_LATCH	Maximum (Hold) dB value of DORTS, in units of 0.01 dB.
0x0350	DORTS_RELAY	Output status of DORTS DO
0x0351		Reserved
0x0352		Reserved
0x2773	RELAY1_PGA	PGA activation value for DO1, in units of 0.1 gal
0x2774	RELAY2_PGA	PGA activation value for DO2, in units of 0.1 gal
0x2775	RELAY3_PGA	PGA activation value for DO3, in units of 0.1 gal
0x2776		Reserved
0x2777	RELAY1_PGV	PGV activation value for DO1, in units of 0.1 mm/sec
0x2778	RELAY2_PGV	PGV activation value for DO2, in units of 0.1 mm/sec
0x2779	RELAY3_PGV	PGV activation value for DO3, in units of 0.1 mm/sec
0x277A		Reserved
0x277B	RELAY1_INTENSITY	Seismic intensity trigger threshold for DO1
0x277C	RELAY2_INTENSITY	Seismic intensity trigger threshold for DO2
0x277D	RELAY3_INTENSITY	Seismic intensity trigger threshold for DO3

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x277E ~ 0x2782		Reserved
0x2783	SINGLE_RELAY_MODE	0: Each set of DO is individually controlled 1: DO is configured for consolidated single output
0x2784	RELAY_BLINK_MODE	0: No flashing for DO output 1: Flashing at 0.5 seconds when DO output is ON
0x2785	RELAY_CONTROL_BY_ERR	0: System errors do not affect DO output 1: Compound control of DO based on system error detection, refer to the explanation in [RELAY_CONTROL_BY_ERR] above
0x2786	RELAY_RESET_BY_MANUAL	0: DO automatically resets after event output 1: DO reset requires a 3-second button press

8. Web User Interface

The instrument provides a web-based user interface, offering basic users a simple setup and operational platform. Please refer to other manuals for detailed instructions on the web user interface.

9. Streaming Packet Format

9-1 Mode 1, 2

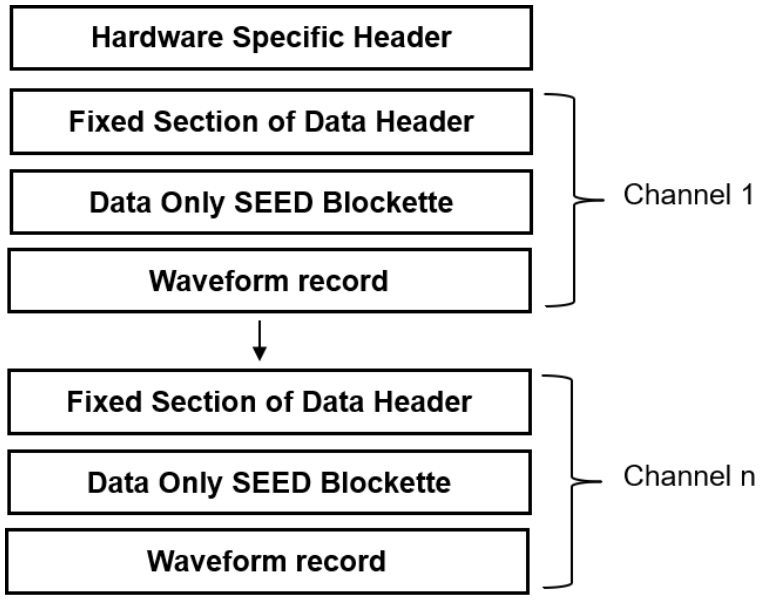
Mode 1	Mode 2	Integer Number	Description (Value in parentheses indicate Palert Modbus registers addresses)
▲	▲	0	Packet type 1: Normal streaming packet 119: P wave streaming packet 300: Pd within 3 seconds after P wave 1191: Pd watch streaming packet 1192: Pd warning streaming packet
▲	▲	1	Event flag (111)
▲	▲	2	system time-year (147)
▲	▲	3	system time-month (148)
▲	▲	4	system time-day (149)
▲	▲	5	system time-hour (150)
▲	▲	6	system time-minute (151)
▲	▲	7 (high byte)	system time-second (152)
▲	▲	7 (low byte)	system time-10 msecond
▲	▲	8	event time-year (141)
▲	▲	9	event time-month (142)
▲	▲	10	event time-day (143)
▲	▲	11	event time-hour (144)
▲	▲	12	event time-minute (145)
▲	▲	13 (high byte)	event time-second (146)
▲	▲	13 (low byte)	event time-10 msecond
▲	▲	14	Serial number (200)
▲	▲	15	Reserved
▲	▲	16	PGV within 1 second (125)
▲	▲	17	Reserved
▲	▲	18	PGA within 10 seconds (140)
▲	▲	19	Reserved
▲	▲	20	Pd warning threshold (162)
▲	▲	21	PGA warning threshold (161)
▲	▲	22	Reserved
▲	▲	23	Pd flag (139)
▲	▲	24	Pd watch threshold (164)
▲	▲	25	PGA watch threshold (121)

Mode 1	Mode 2	Integer Number	Description (Value in parentheses indicate Palert Modbus registers addresses)
▲	▲	26	Intensity now (109)
▲	▲	27	Intensity maximum (110)
▲	▲	28	PGA within 1 second
▲	▲	29	Reserved
▲	▲	30	tau-c (138)
▲	▲	31	Trig mode (163)
▲	▲	32	Reserved
▲	▲	33	Durations for watch and warning (195)
▲	▲	34	Firmware version
▲	▲	35 ~ 38	reserved
▲	▲	39 ~ 40	Server 0 IP address (176~177)
▲	▲	41 ~ 42	Server 1 IP address (178~179)
▲	▲	43 ~ 46	NTP server IP address (171~174)
▲	▲	47	Reserved
▲	▲	48	Connection flag (100)
▲	▲	49	D I/O status (119)
▲	▲	50	Reserved
▲	▲	51	Pd in vertical axis (137) (0.001cm)
▲	▲	52	Pv in vertical axis (136) (0.01cm/sec)
▲	▲	53	Pa in vertical axis (counts/sec^2)
▲	▲	54	Maximum vector in earthquake (108)
▲	▲	55	Maximum a axis acceleration in earthquake (129)
▲	▲	56	Maximum b axis acceleration in earthquake (130)
▲	▲	57	Maximum c axis acceleration in earthquake (131)
▲	▲	58	Maximum a axis acceleration of vector in earthquake (132)
▲	▲	59	Maximum b axis acceleration of vector in earthquake (133)
▲	▲	60	Maximum c axis acceleration of vector in earthquake (134)
▲	▲	61 ~69	CEB, PGA, PGV, PGD
▲	▲	70	Synchronized Character 0x3033
▲	▲	71	Synchronized Character 0x3035
▲	▲	72	Synchronized Character 0x3135

Mode 1	Mode 2	Integer Number	Description (Value in parentheses indicate Palert Modbus registers addresses)
▲	▲	73	Synchronized Character 0x3031
▲	▲	74	Packet Length
▲	▲	75 ~ 78	Reserved
▲	▲	79	OP_MODEX
▲	▲	80 ~ 88	SA_MAX
▲	▲	89	PACKET_NO
▲	▲	90	NTP offset in 0.01 ms (pALERT not support)
▲	▲	91 ~ 95	Reserved
▲	▲	96	INSTRUMENT_CODE
▲	▲	97	VECTOR_VELOCITY_MAX
▲	▲	98	SI_PEAK
▲	▲	99	Sampling Rate
▲		100	a axis Acceleration of Record 1
▲		101	b axis Acceleration of Record 1
▲		102	c axis Acceleration of Record 1
▲		103	Pd of Record 1
▲		104	Displacement of Record 1
▲		..	..
▲		595	a axis Acceleration of Record 100
▲		596	b axis Acceleration of Record 100
▲		597	c axis Acceleration of Record 100
▲		598	Pd of Record 100
▲		599	Displacement of Record 100

9-2 mode 4

Mode 4 is a variation in miniSEED format. MiniSEED is the current mainstream format for storing seismic data, consisting of a header, blockettes, and data. The Mode 4 packet is based on these features, and the packet format is as follows:



The "Hardware Specific Header" contains information specific to the pALERT S303.

No.	Field name	Byte
0	Packet type	2
1	Packet length	2
2	Device type	1
3	Number of channels	1
4	CRC16	2
5	Firmware version	2
6	Serial number	2
7	Connection flag	2
8	Trigger flag	2
9	Operation mode	2
10	DI/O status	2
11	Filter & Trigger mode	2
12	NTP server IP	4
13	TCP server0 IP	4
14	TCP server1 IP	4
15	TCP server2 IP	4
16	Admin. Server0 IP	4
17	Admin. Server1 IP	4
18	pALERT S303 IP	4
19	Subnet mask	4
20	Gateway	4
21	Synchronized Character (0x03051501)	4
	padding	2

miniSEED format:

No.	Field name	Type	Byte	Comment
0	Sequence number	Decimal	6	
1	Data header/quality indicator	ASCII	1	
2	Reserved	Binary	1	
3	Station code	ASCII	5	Left justify pad with space
4	Location code	ASCII	2	Left justify pad with space
5	Channel code	ASCII	3	Left justify pad with space
6	Network code	ASCII	2	
7	Record start time	Binary	10	Year (2 bytes) Day (2 bytes) Hour (1 byte) Minute (1 byte) Second (1 byte) Unused (1 byte) Fracture (2 bytes, unit 0.0001)
8	Number of samples	Binary	2	
9	Sample rate factor	Binary	2	>0: Sample/second <0: Seconds/sample =0: For ASCII data
10	Sample rate multiplier	Binary	2	>0: Multiplication factor <0: Division factor
11	Activity flags	Binary	1	
12	I/O and clock flags	Binary	1	[Bit 0]: Station volume parity error possibly present [Bit 1]: Long record read (possibly no problem) [Bit 2]: Short record read (record padded) [Bit 3]: Start of time series [Bit 4]: End of time series [Bit 5]: Clock locked

No.	Field name	Type	Byte	Comment
13	Data quality flags	Binary	1	[Bit 0]: Amplifier saturation detected [Bit 1]: Digitizer clipping detected [Bit 2]: Spikes detected [Bit 3]: Glitches detected [Bit 4]: Missing/padded data present [Bit 5]: Telemetry synchronization error [Bit 6]: A digital filter may be charging [Bit 7]: Time tag is questionable
14	Number of blockettes that follow	Binary	1	In our case, most be 1.
15	Time correction	Binary	4	It should be zero.
16	Beginning of data	Binary	2	Offset in bytes to the beginning of data. If using STEIM compression, it should be 64; or it should be 56.
17	First blockette	Binary	2	Offset in bytes to the first data blockette in this data record.
18	Blockette type-1000	Binary	2	Data only SEED (1000).
19	Next blockette's byte number	Binary	2	It should be zero.
20	Encoding Format	Binary	1	11: STEIM 2 Compression.
21	Word order	Binary	1	0: Little endian order. 1: Big endian order.
22	Data record length	Binary	1	The exponent (as a power of two) of record length for this block.
23	Reserved	Binary	1	
24	Real data record length	Binary	2	Record length is flexible that could save the save storage space.
25	Waveform record			

For more information about miniSEED, please refer to SEEDManual.

http://www.fdsn.org/pdf/SEEDManual_V2.4.pdf

9-3 mode 8

Byte number	Description
0	Sync. character: 0x03
1	Sync. character: 0x05
2	Sync. character: 0x15
3	Sync. character: 0x01
4 ~ 5	Packet length = sampling rate * 2 + 30
6 ~ 7	Sampling rate
8 ~ 9	Packet no.
10	Channel
11	Sensor type, V or A
12 ~ 13	Sensitivity V: 10000 counts / 100 mm A: 16384 counts / g
14 ~ 17	Packet time in Unix format
18	Packet time in ms
30 ~ 31	16 bit data 0
31 ~ 32	16 bit data 1
	…
30 + (sampling rate * 2)	16 bit data (sampling rate)

9-4 mode 16

The packet format for mode 16 can be divided into four main parts:

Definition	Length	Note
Fixed	11 bytes	
Header	N bytes	Up to 255 bytes, depending on the Fixed definition
Data	N bytes	Up to 65535 bytes, depending on the Fixed definition
CRC16	2 byte	

11 bytes	N bytes	N byres	2 byte
Fixed	Header	Data	CRC16

Fixed:

Definition	Length	Note
Synchronization (SYNC)	4 bytes	[0] = 0x53 (S) [1] = 0x59 (Y) [2] = 0x4E (N) [3] = 0x43 ©
Packet Number PacketNo	2 bytes	0～65535
Header Length HeaderLen	1 byte	0~255
Data Length DataLen	2 bytes	0 ~ 65535
Total Packet Length PacketLen	2 bytes	0 ~ 65535 (includes CRC16)

SYNC				PacketNo		HeaderLen	DataLen		PacketLen	
0x53	0x59	0x4E	0x43							

Header

Definition	Length	Note
UnixTime	5 bytes	If 4 bytes are used, an overflow issue will occur in 2038.
0.1 Msec	2 bytes	The range is from 0 to 9999, where 10 represents 1 millisecond.
SyncFlag	1 byte	Bit 0: NTP synchronization; 0 for failure, 1 for success.
Scale	4 bytes	Float format The system is based on meters. 0.01 represents the current input in centimeters. 0.001 represents the current input in millimeters. Velocity or acceleration depends on the sensor type.

Definition	Length	Note
SPS	2 bytes	Users can configure the sampling rate through the web interface. Setting 100 represents 100 SPS.
SensorType	1 byte	Factory setting, cannot be modified. 0: AC217 1: AC220 2: Geophone 3: pALERT S303 4: Palert S3 5: DMS24
ChannelCnt	1 byte	Factory setting, cannot be modified. 1: 1 axis 2: 2 axis 3: 3 axis 4: 4 axis
Serial Number	4 bytes	Device serial number, factory setting, cannot be modified.
NTP offset	4 bytes	Float format NTP offset in ms

Data (float)Take 1 axis as an example

4 bytes	4 bytes	4 bytes	…	4 bytes
X1	X2	X3	…	Xn

Data (float)Take 2 axis as an example

4 bytes	4 bytes	4 bytes	4 bytes	…	4 bytes	4 bytes
X1	Y1	X2	Y2	…	Xn	Yn

Data (float)Take 3 axis as an example

4 bytes	4 bytes	4 bytes	4 bytes	4 bytes	4 bytes	…	4 bytes	4 bytes	4 bytes
X1	Y1	Z1	X2	Y2	Z2	…	Xn	Yn	Zn

Validation (2 bytes)

CRC16

Take pALERT S303 sampling rate 200sps, 3-axis output data 200 strokes each, the 2nd packet for example, serial number 4649.The Linux system used is Little Endian.

Byte Position	Value	Note
0	0x53	S
1	0x59	Y
2	0x4E	N
3	0x43	C
4	0x02	PacketNo: 0x0002
5	0x00	
6	0x18	HeaderLen: 24➔0x18
7	0x 60	DataLen 2400➔0x0960
8	0x 09	
9	0x85	PacketLen: (11+24+4*3*200+2) = 2437➔0x0985
10	0x09	
11	0x37	UnixTime: 2022/03/30 @ 05:57:11 (UTC) ➔1648619831 seconds since Jan 01 1970. (UTC) 1648619831➔0x6243F137
12	0xF1	
13	0x43	
14	0x62	
15	0x00	
16	0x9C	Msec (0～9999) 0.502(s)➔5020(0.1ms)➔0x139C
17	0x13	
18	0x01	Time synchronization
19	0x0a	0.01➔ 3c23d70a Represents the current length unit in cm
20	0xd7	
21	0x23	
22	0x3c	

Byte Position	Value	Note
23	0xC8	200sps➔0x00C8
24	0x03	
25	0x03	pALERT S303
26	0x03	3-axis output
27	0x29	S/N 4649 ➔ 0x00001229
28	0x12	
29	0x00	
30	0x00	
31	0xF4	0.026➔0x3CD4FDF4 NTP offset is 0.026 ms
32	0xFD	
33	0xD4	
34	0x3C	
31		X[0]
32		
33		
34		
35		Y[0]
36		
37		
38		
39		Z[0]
40		
41		
42		
		…
2419		X[199]
2420		
2421		
2422		
2423		Y[199]
2424		
2425		
2426		
2427		Z[199]
2428		
2429		
2430		
2431		CRC16
2432		

10. Share Memory Ring Data Format

pALERT S303 utilizes Linux Share Memory with a key value of 2000 for data exchange with other applications. Users are required to include the file "palertShm.h". The Share Memory data format consists of two parts: header and data.

Type	Bytes	Description

Header	65536	typedef struct{
		int counter; // increase by 1 if wrtPacketNo is added
		uint16_t wrtPacketNo;
		uint16_t wrtIndex; // write index in wrtPacketNo
		char ringSeconds;
		
		// for DORTS, Department Of Rapid Transit Systems, Taipei
		int dortsCalCounter;
		char dortsDbFreqType; // 0 - 5
		char quitFlag;
		char valid;
		char dortsDbResult[4]; // bit0: normal, bit1: warning, bit2: Action
		float dortsDbFreq[4][6];
		float warningDb; // dbWeighting + warningDb, warningDb should be negative.
		time_t dortsTime;
		int samplingRate;
		} shmRingHeader_t;
		
		**********
		ISO2631, Offset 1024 bytes
		**********
		typedef struct{
		// for ISO 2631 & BS threshold
		int isoCalCounter;
		char isoType; // 0 - 3
		char quitFlag;
		char valid;
		char isoRmsResult[2]; // bit0: normal, bit1: warning, bit2: Action, [0] is xy, [1] is z axis.
		float isoRawRms[2]; // r.m.s, [0] is xy, [1] is z axis.
		float isoDb[2]; // dB value standard: 10e-6, [0] is xy, [1] is z axis.
		time_t isoTime;
		int samplingRate;
		} iso2631_t;

Type	Bytes	Description
Data		typedef struct{ char waveCh; time_t waveTime; float wave[SHM_RING_SPS]; } shmRing_t; SHM_RING_SPS為1000
Total Length		65536 + sizeof(shmRing_t) * ringChs * ringSeconds For ringChs, ringSeconds, please refer to RING_CHANNELS, RING_SECONDS and RING_FILTERED settings in [PALERT_LOCAL_MODE].

11. RTD packet format

16 bit no checksum

Byte	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
data	0x0A	0x0D	XH	XL	YH	YL	ZH	ZL

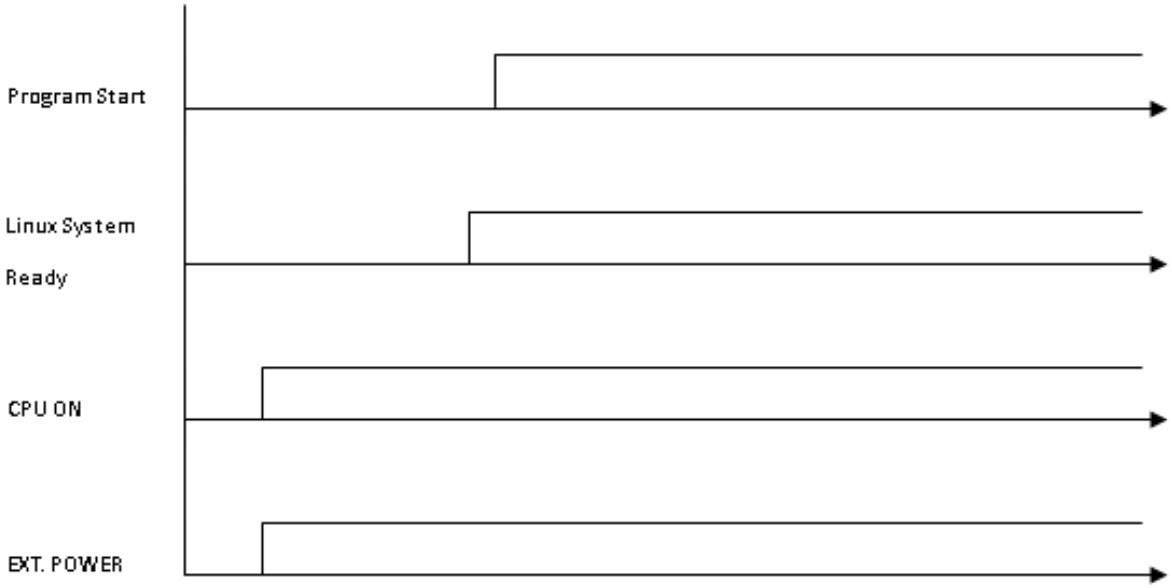
16 bit with checksum

Byte	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
data	0x0A	0x0D	XH	XL	YH	YL	ZH	ZL	checkSum

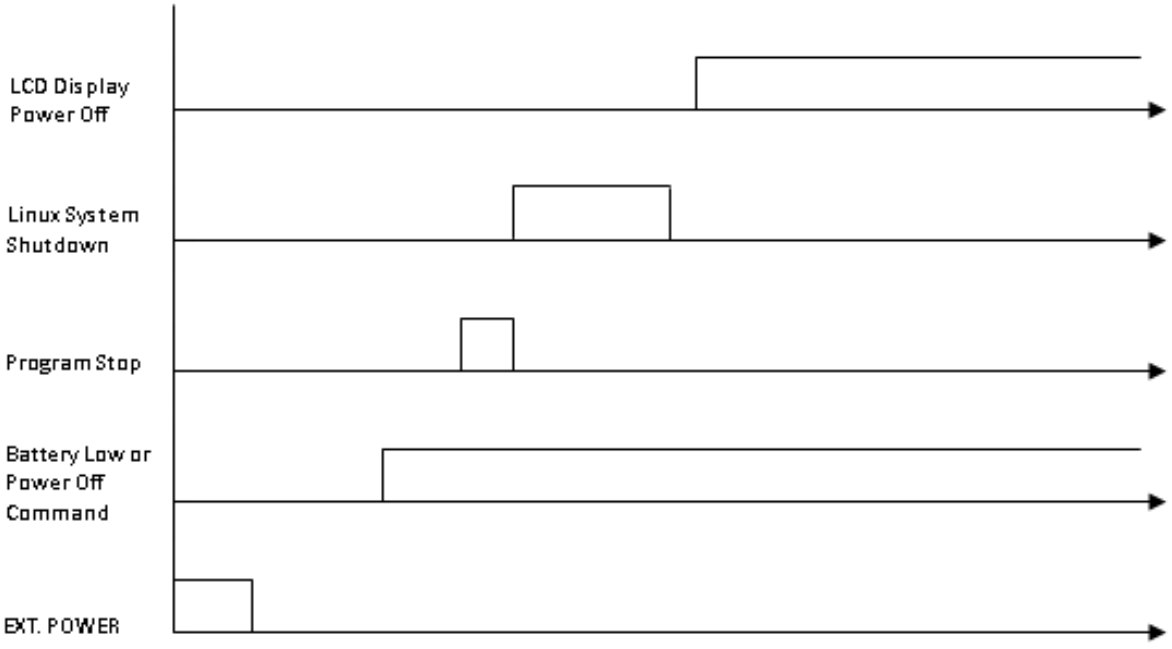
checkSum = 0x0A + 0x0D + XH + XL + YH + YL + ZH + ZL

12. Timing Chart

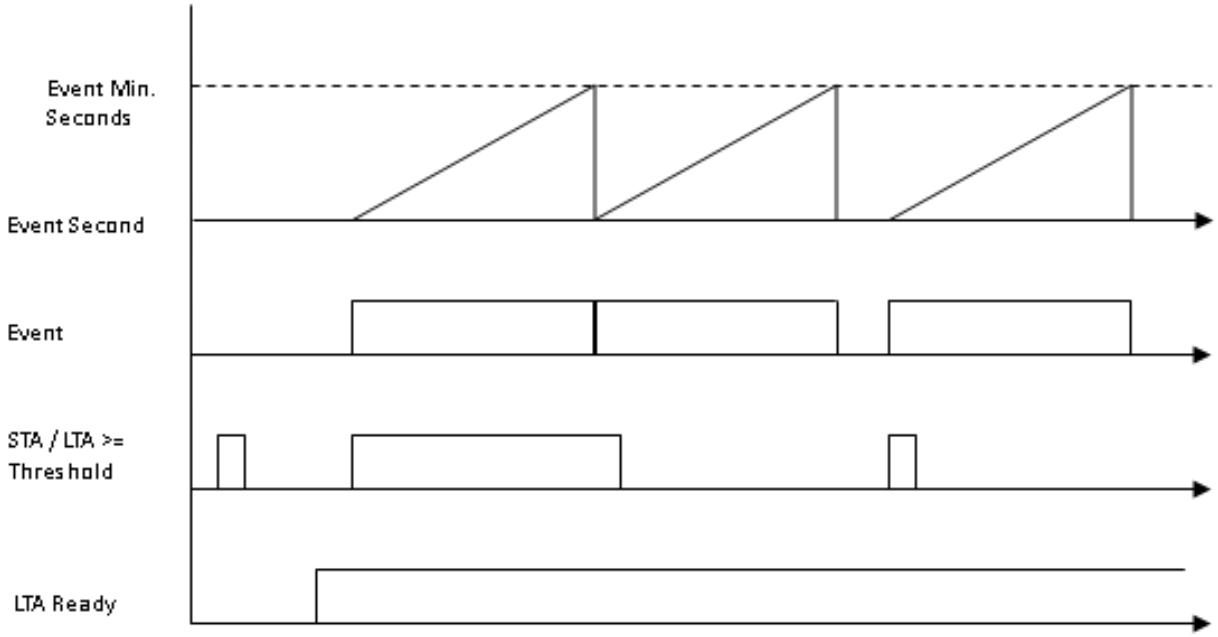
12-1 Power On Timing Chart



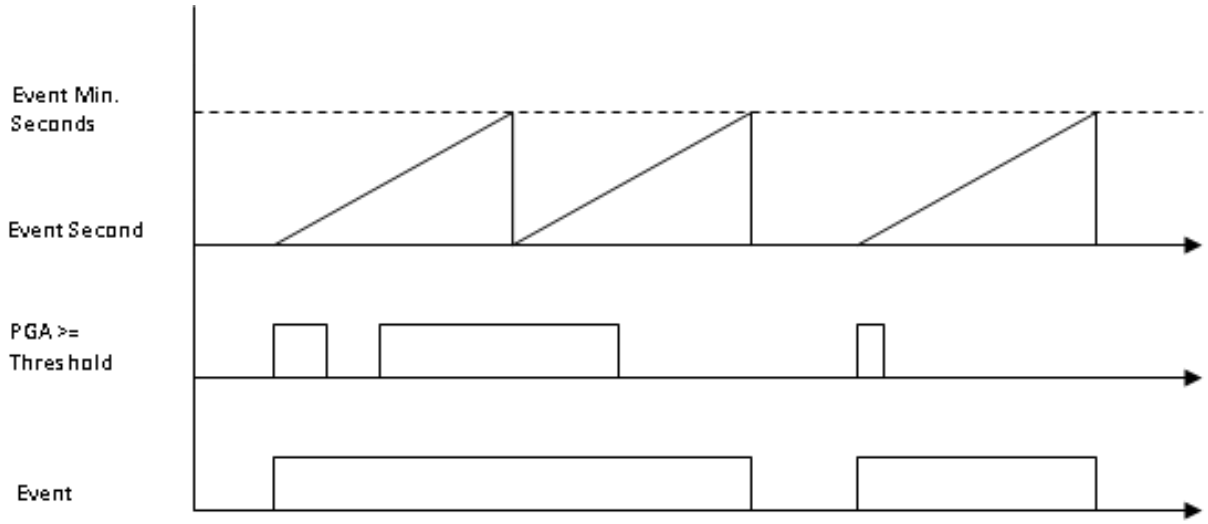
12-2 Shutdown Timing



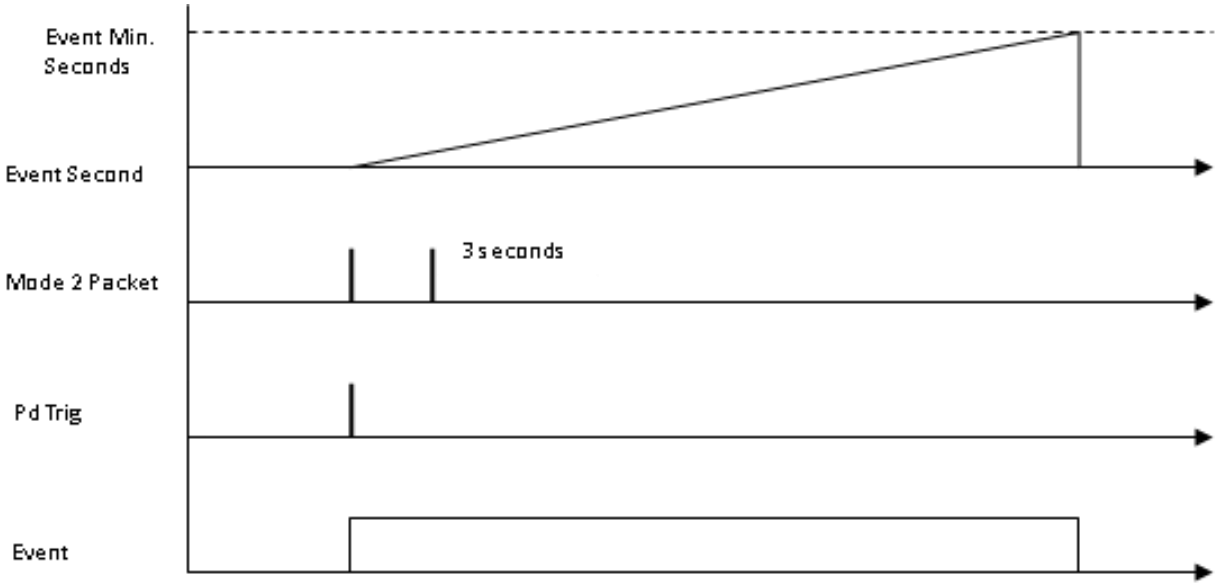
12-3 STA / LTA Seismic Timing Chart



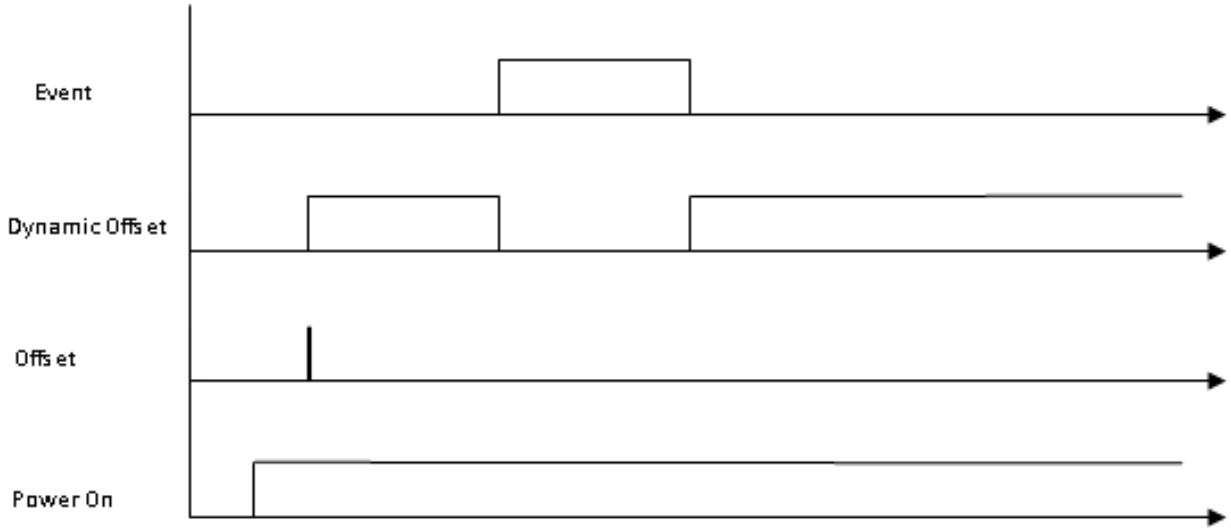
12-4 PGA Seismic Timing Chart



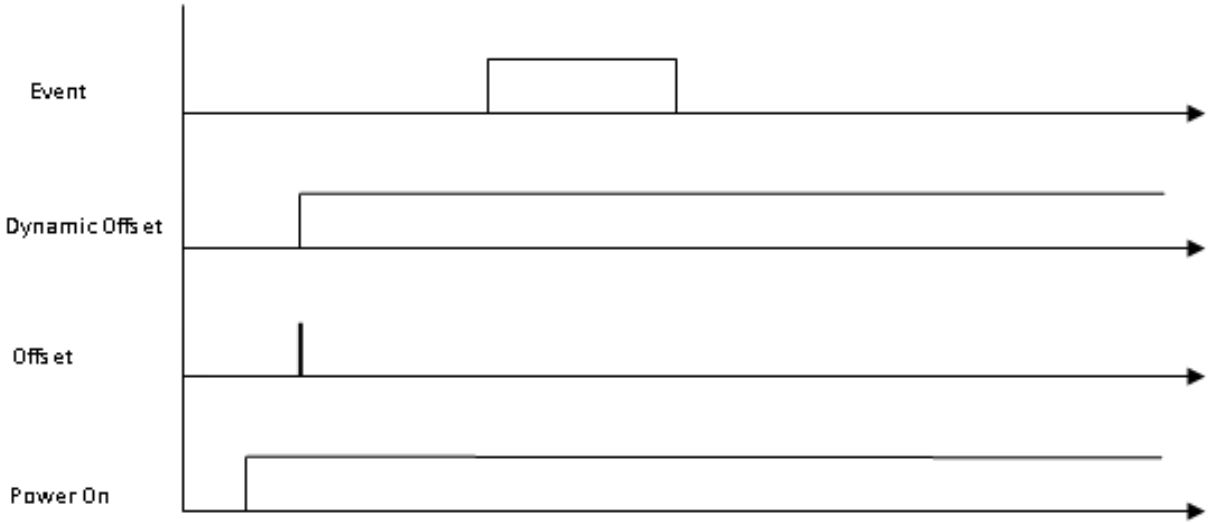
12-5 Pd Seismic Detection Timing Diagram



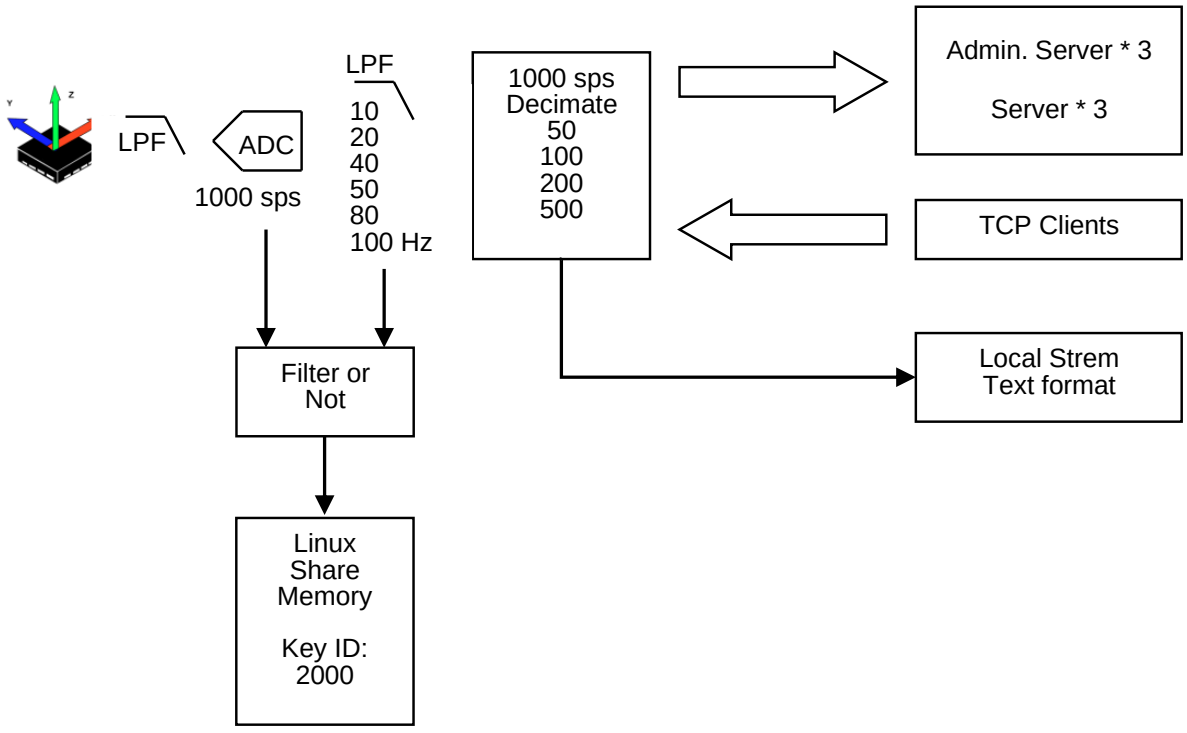
12-6 Zeroing Process (AUTO_OFFSET = TRTC)

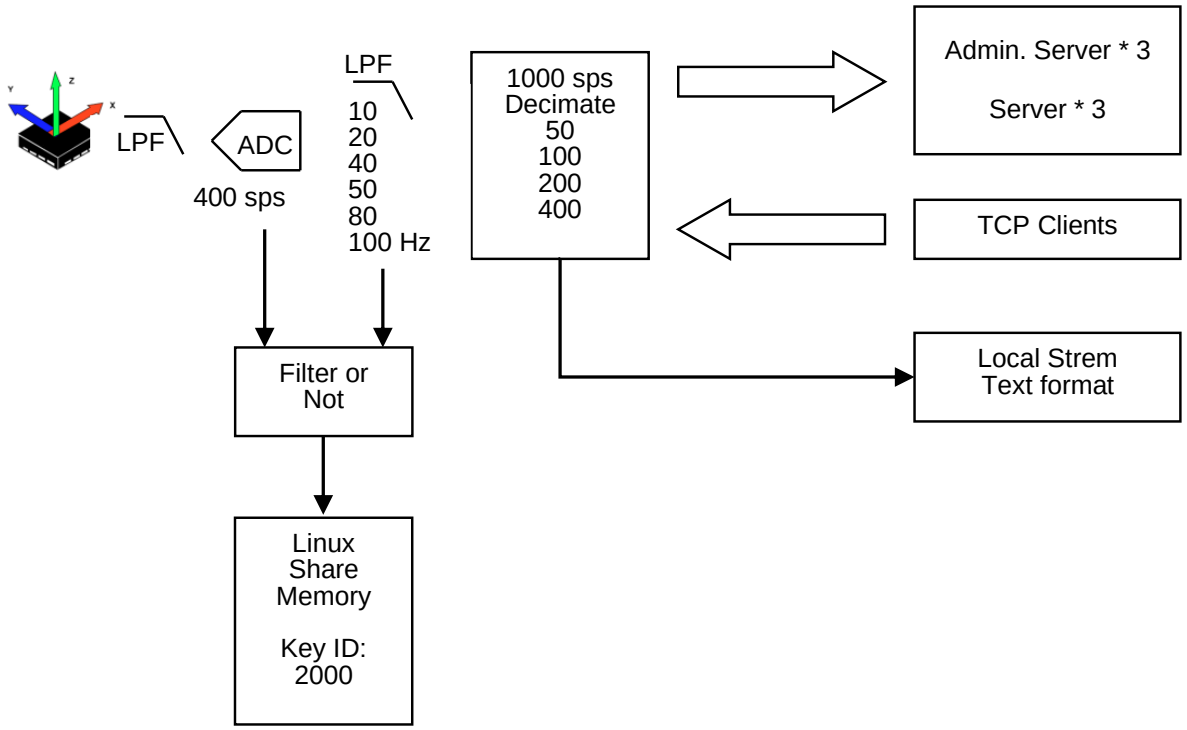


12-7 Zeroing Process (AUTO_OFFSET = YES)



13. Data Flow System Diagram





14. Wi-Fi (Wi-Fi, Wireless Fidelity) AP (Access Point) mode

The pALERT S303, manufactured in 2021, is equipped with Wi-Fi AP mode. To facilitate pALERT S303 management, the wireless network can be set to AP mode.

Key Information:

- Setting pALERT S303's wireless network to AP mode will disable its connection to other access points via wireless networks.
- Each pALERT S303's SSID (Service Set Identifier) is unique and includes the hardware serial number.
- How to enable pALERT S303's wireless network AP mode:
    - sudo systemctl enable hostapd
    - sudo systemctl start hostapd
- How to disable pALERT S303's wireless network AP mode:
    - sudo systemctl stop hostapd
    - sudo systemctl disable hostapd
- To prevent users from using pALERT S303's wired network for internet access through the pALERT S303 wireless network, wireless network forwarding to the wired network is not configured.

Using pALERT S303's Wireless Network AP Mode:

- Users can connect to pALERT S303 using the wireless network feature on their computer or phone. The default password is p@ssw0rd, which can be modified as needed, but the modified password must be recorded.
- After connecting to pALERT S303, its IP address is 192.168.15.1. Users can open the device's webpage using a web browser on their phone or computer.

15. DO Action Logic Diagram

The output of DO1~3 is controlled by OR logic with seven settings in two major categories: Trigger Logic and Control Types.

Trigger Logic settings are in [PALERT_LOCAL_MODE] under:

PGA_TRIG_ENABLE

PD_TRIG_ENABLE

STA_LTA_TRIG_ENABLE

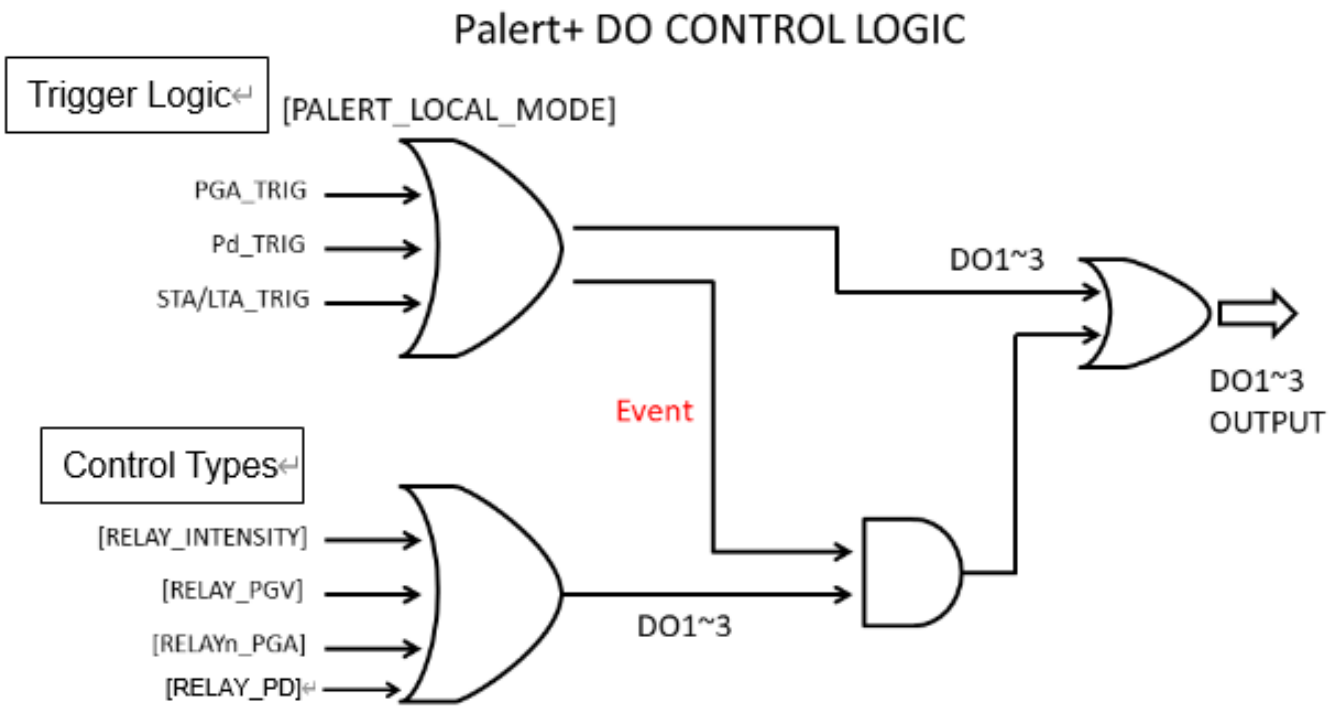
Each trigger setting outputs the corresponding DO based on its individual configuration. For example, if PD triggers, the output will be generated based on PD_WATCH_THRESHOLD (DO1) and PD_WARNING_THRESHOLD (DO2).

Control Type settings are as follows, and they only take effect when the trigger logic detects an event. If you don't want the control type to take effect, set the value to 99999.[RELAY_INTENSITY]

[RELAY_PD]

[RELAY_PGV]

[RELAYn_PGA] (where n represents 1 to 3)



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