

F330

Tri-axial Force Balance Accelerograph



User Manual

V1
2023/08

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Version Record

Date	Description	Author
20230808	First Version 1.00	Tina

1. Features

The pALERT F330 is an advanced P-wave early warning seismometer. In addition to the P-wave early warning function of the first-generation Palert, it also features recording, intelligent alerts (LINE, MQTT), and improved performance. The built-in 24-bit ADC and low-noise Microelectromechanical Systems (MEMS) accelerometer module significantly enhance the signal-to-noise ratio. Its applications extend beyond the original earthquake secondary disaster prevention to serve as the front-end sensing device for Rapid Structural Health Diagnosing systems for rapid structural safety diagnosis after earthquakes.

In terms of hardware, the pALERT F330 includes a three-axis MEMS accelerometer, three sets of TTL DO points that can connect to external devices, 10/100MHz network communication capabilities, and an embedded small information display LCD. It has an IP67 waterproof rating and can continue operating for three hours on internal batteries in the absence of external power.

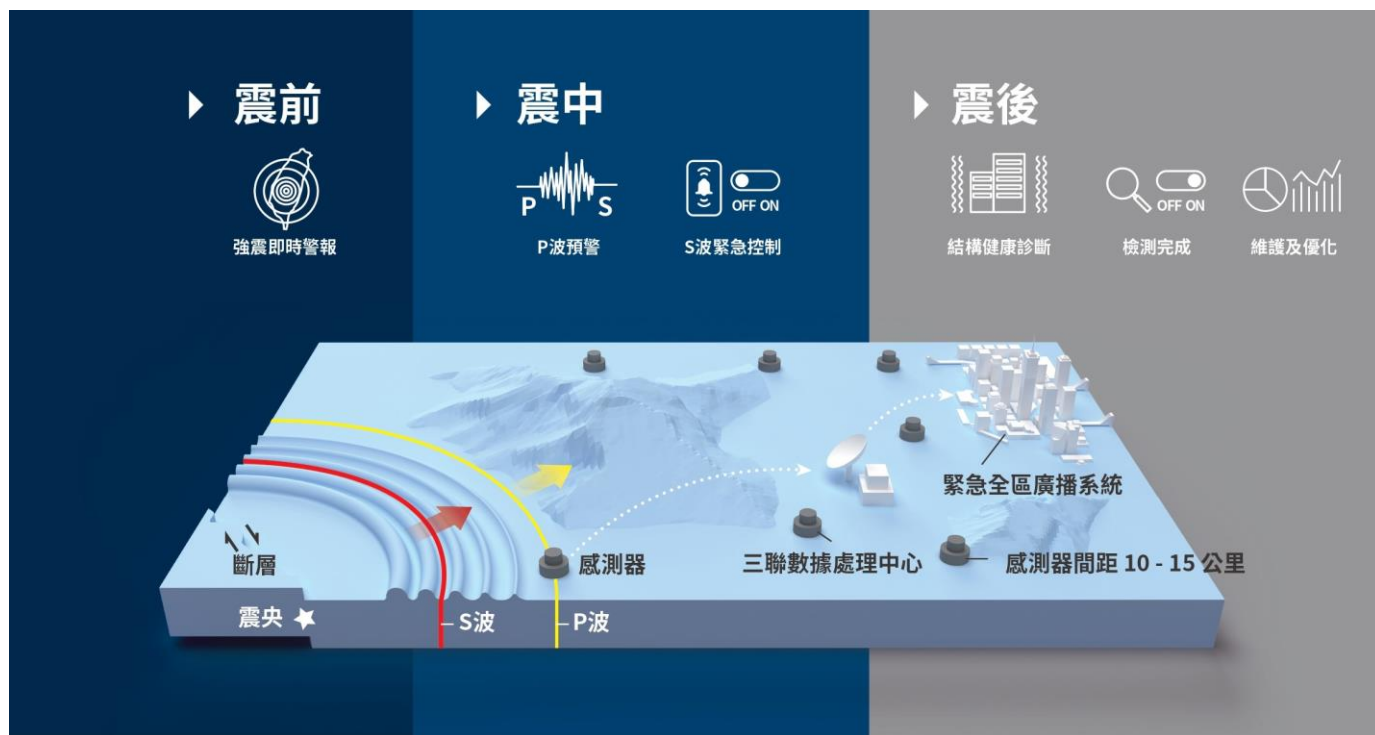
In terms of software functionality, in addition to the original Palert earthquake discrimination technology (Pd, PGA, STA/LTA), the signal sampling rate has been increased from the original 100 sps to 1000 sps. With the built-in low-pass filter, users can choose from 50, 100, 200, 500, or 1000 data points per second. In terms of data recording, users can choose event-triggered recording mode, continuous recording, or scheduled recording. In terms of connection functionality, in addition to providing TCP server functionality, it also offers TCP client and Administration server functionality. 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-bit or 24-bit resolution streaming packets.

Regarding seismic intensity levels, it supports MMI, KMA, JMA, GB/T, and the ten-level seismic intensity levels issued by the Central Weather Bureau (CWB). For earthquake alerts, it supports the LINE and MQTT communication protocols for group communication. It also synchronously supports the Modbus TCP industrial communication protocol, allowing connection to up to ten computers or hosts simultaneously, facilitating integration into factory or smart building monitoring systems.

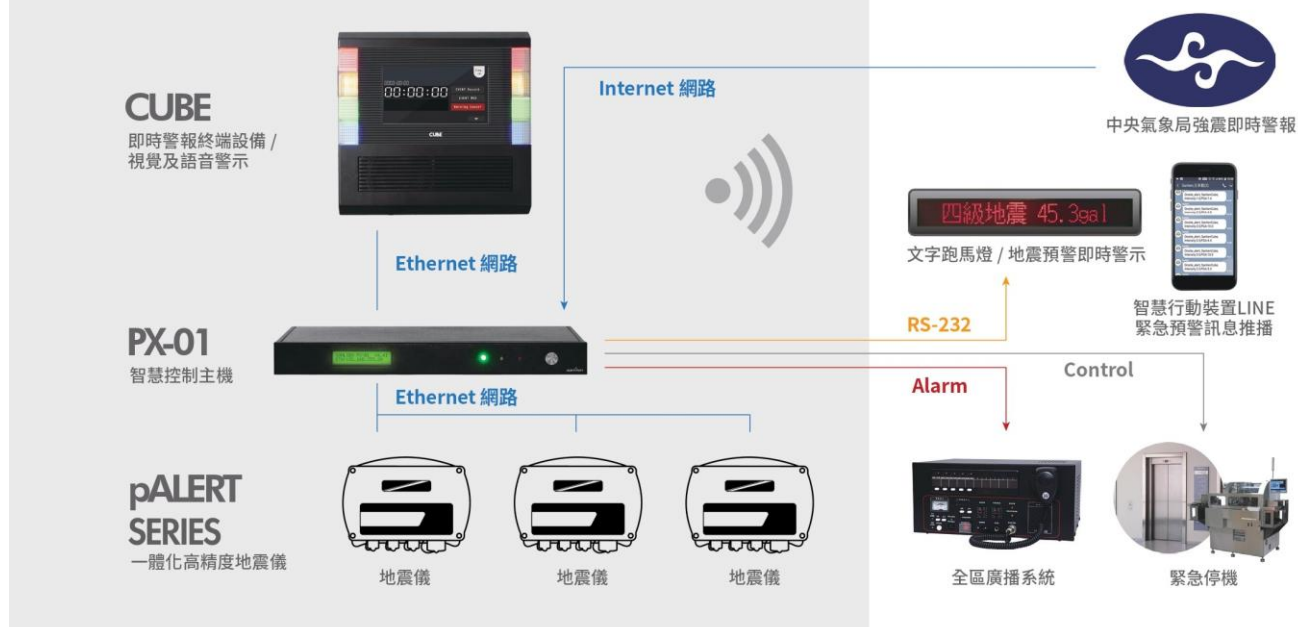
For users unfamiliar with control software, waveform reading can be performed through the local application software Palert Early Warning System or more detailed operations using SanDAS.

Our company also provides the Cube touchscreen human-machine interface, which is ideal for on-site earthquake early warning. In factory areas, we offer the rack-mounted integrated host PX-01 for disaster prevention systems. For further requirements, please visit our company website at <http://www.sanlien.com>.

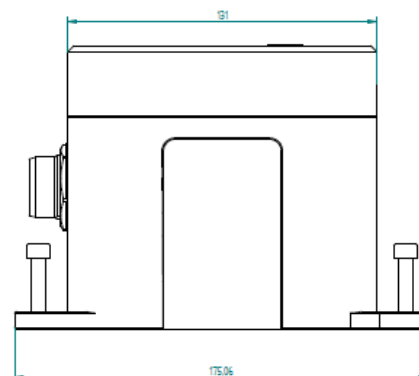
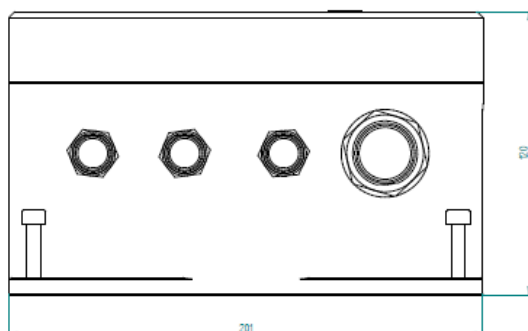
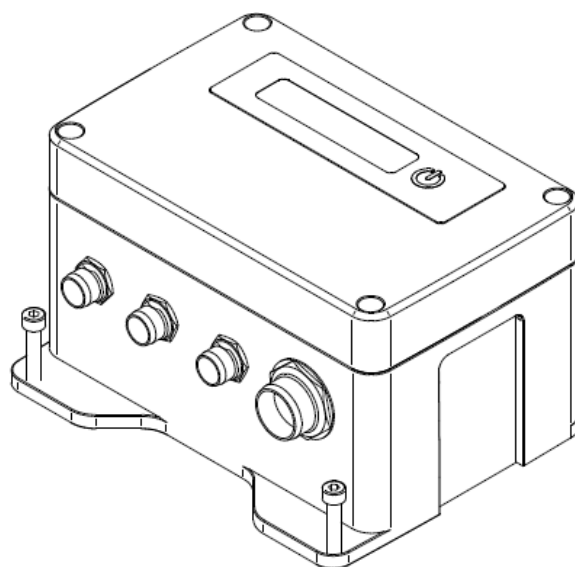
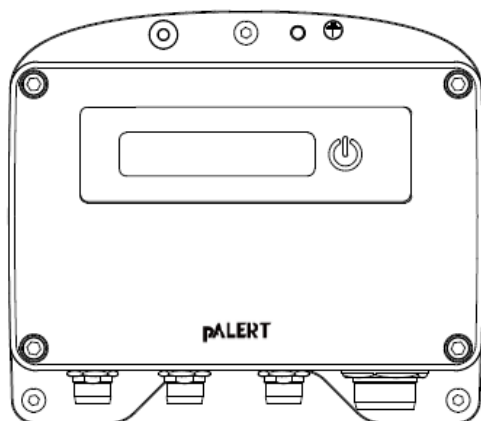
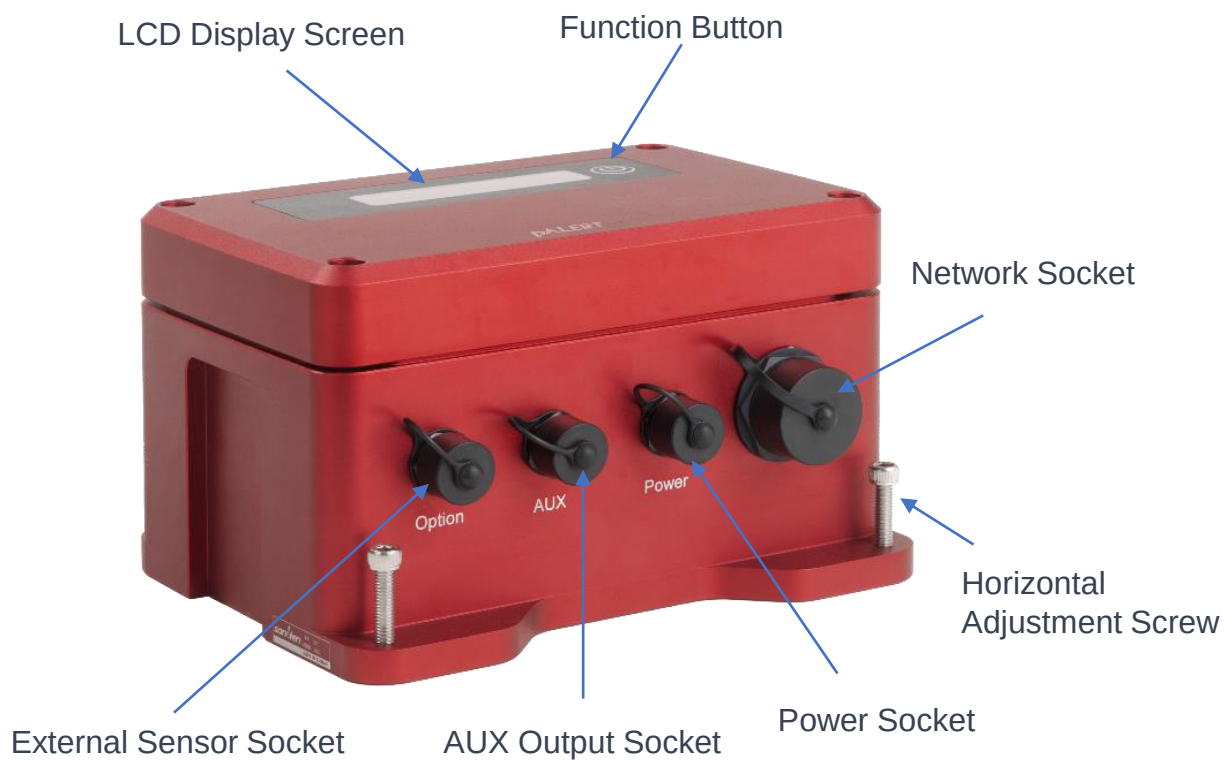
2. System Diagram



系統架構圖



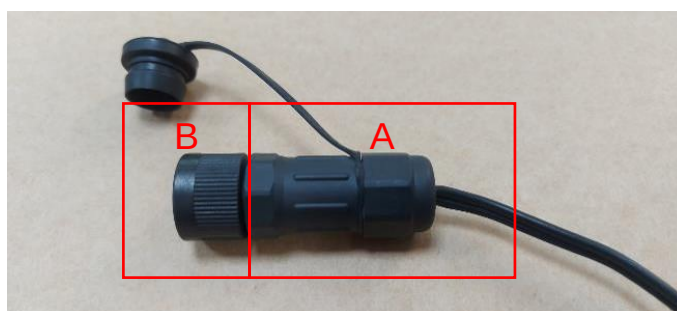
3. Hardware



3-1 Waterproof Quick Connector

3-1-1 Insertion/Removal Method

The pALERT F330 utilizes a waterproof quick connector with an anti-misinsertion feature. Users only need to press the connector until a "click" sound is heard, indicating that the connector is locked. To remove the connector, grip at point A in the diagram and rotate counterclockwise at point B using your thumb and forefinger, allowing the connector to be detached.



3-1-2 Power On and Power Off

When external power is supplied, the pALERT F330 will automatically power on. If external power is removed, the internal battery will continue to supply power, allowing the instrument to operate continuously. To power off, you can do so in the following ways:

- Press the button for 12 seconds.
- Remote control via the Modbus communication protocol.
- Internal battery voltage depletion.
- Ground the 9th pin of the external sensor socket

3-2 LCD Display Screen

The LCD display screen has 20 characters and 2 lines, providing users with real-time information about the instrument.

3-2-1 Backlight

To save power consumption, the backlight is normally turned off during operation. However, it will automatically turn on in the following two situations:

1. When the user presses a button.
2. When the system detects an event or a connection anomaly.

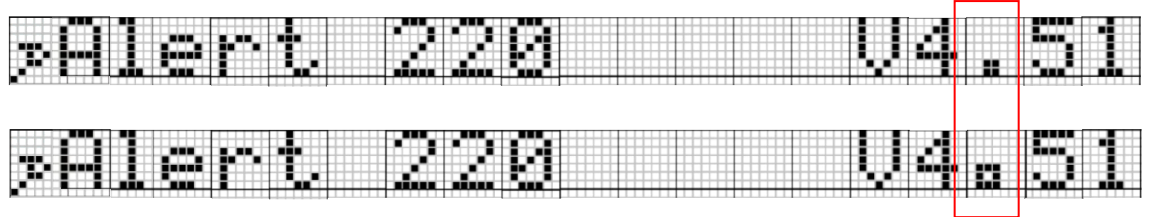
Once the above events cease, the backlight will automatically turn off according to the user's configured duration.

3-2-2 Displayed Content

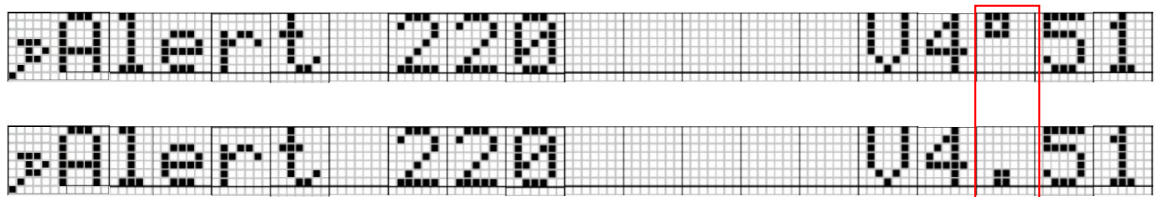
1. The first line typically displays "pALERT F330 Vx.xx" every 10 seconds, where Vx.xx represents the software version. If ADC sampling data is normal, a "." will flash for every 100 samples.
2. The second line is the message column. In the event of an occurrence or abnormality, messages will appear on this line.
3. The total display character count of 40 bytes on the LCD is also synchronized with Modbus registers. Please refer to the later section for information on Modbus registers.

3-2-3 Display Example

The following is an example of the content displayed on the first line when the local "SENSOR_TYPE" is set to Palert220. The portion highlighted in the red box will alternate its display speed according to the data sampling rate set on the local device, where the rate is in sps / 100.



If the local device has purchased the GPS function and the GPS signal is locked, the content displayed on the first line will be as follows:



3-3 Buttons

In addition to remote control using the Modbus communication protocol, the local device can also be controlled using buttons for close-range control. If you do not want the buttons to be touched and operated by unauthorized individuals, please refer to the chapter on button password protection in the configuration file section.

Note: To protect against accidental button presses and operations, please avoid pressing any buttons within 10 seconds after the successful completion of the offsetting process following startup.

3-3 Buttons

In addition to remote control using the Modbus communication protocol, the local device can also be controlled using buttons for close-range control. If you do not want the buttons to be touched and operated by unauthorized individuals, please refer to the chapter on button password protection in the configuration file section.

Note: To protect against accidental button presses and operations, please avoid pressing any buttons within 10 seconds after the successful completion of the offsetting process following startup.

3-3-1 Button Duration Explanation

When a button is pressed, the LCD will display the number of seconds, and upon release, it will indicate the button duration in seconds.

Button Duration	Description
1	Display IP address
2	Restart NTP service
3	Cancel alarm
4	Restart network, NTP service, and software
5	Display program version date
6	Restart software
7	Update software via FTP
8	Manually start recording
9	Test mode
12	Power off
Combination Button	Factory reset, please refer to 3-3-11.

3-3-2 Press for 2 seconds to restart the NTP service

If there is a persistent issue obtaining the correct time from the NTP server after adjustments to the NTP server or network, pressing for two seconds will force the system to restart the NTP service. For information on how to configure NTP, please refer to the explanation in the later section.

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

When the system detects an event, it will record and activate digital outputs (DO) based on user settings. Pressing for three seconds will cancel the event.

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

The alert F330 configuration file is only read at program startup. Therefore, any changes require a system restart to take effect. This function also restarts the network and NTP service.

3-3-5 Press for 5 seconds to display the program's version date

In addition to the software version, pALERT F330 provides control over the version date.

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

Similar to pressing for four seconds, but it only restarts the software.

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

pALERT F330 periodically adds new features. If the instrument's network settings allow access to the internet, this function enables automatic software updates. When released after seven seconds, the LCD will display "FTP updating..." and attempt to obtain the latest software in the background. If the update is successful, the system will restart automatically.

3-3-8 Press for 8 seconds to manually start recording

If you wish to manually initiate the recording function of the local device, release after pressing for eight seconds. When the LCD displays "RecStandby, press 2," press for two seconds to start recording. The LCD will show "Manual Rec..." To stop recording, press for three seconds.

3-3-9 Press for 9 seconds for test mode

When the pALERT F330's digital outputs (DO) are connected to external devices, this function can be used to test whether it can drive external devices correctly. After pressing for nine seconds, the LCD will show "Test Mode: xx." Pressing for an additional 10 seconds will enter the self-test mode, where DO1 ~ DO3 will cycle ON at a two-second interval. If you don't want to enter the self-test mode, press for nine seconds to exit, or do not press any buttons for 60 seconds to automatically exit the test mode.

3-3-10 Press for 12 seconds to shut down

After pressing for 12 seconds, the shutdown process will begin, and the system will shut down upon completion. Because the local device has an internal battery as backup power, external power must be removed to truly shut down.

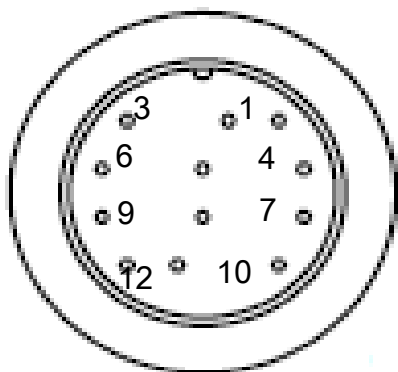
3-3-11 Factory reset

If the user forgets the device's IP and password, the factory reset function can be used to restore them. Once successful, the network IP will be restored to 192.168.255.1, and the login credentials will be pi, p@ssw0rd.

Button sequence:

The unlock code is 15162612, a total of eight digits. This means the user must press the buttons in sequence: press for 1 second, pause for 5 seconds, press for 1 second, pause for 6 seconds, press for 2 seconds, pause for 6 seconds, press for 1 second, pause for 2 seconds. (Pause for at least one second.)

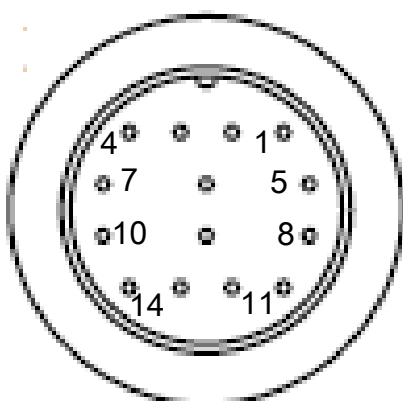
3-4 External Option Socket (Male)



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

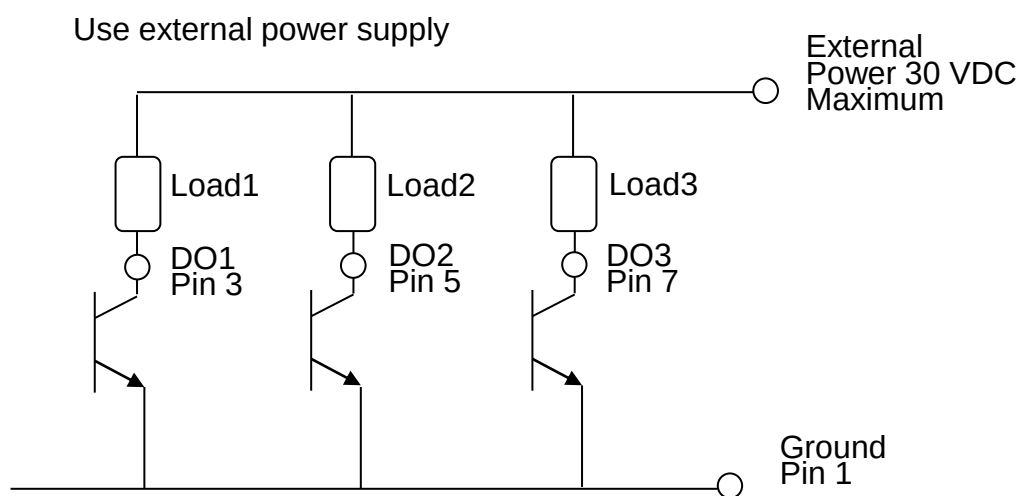
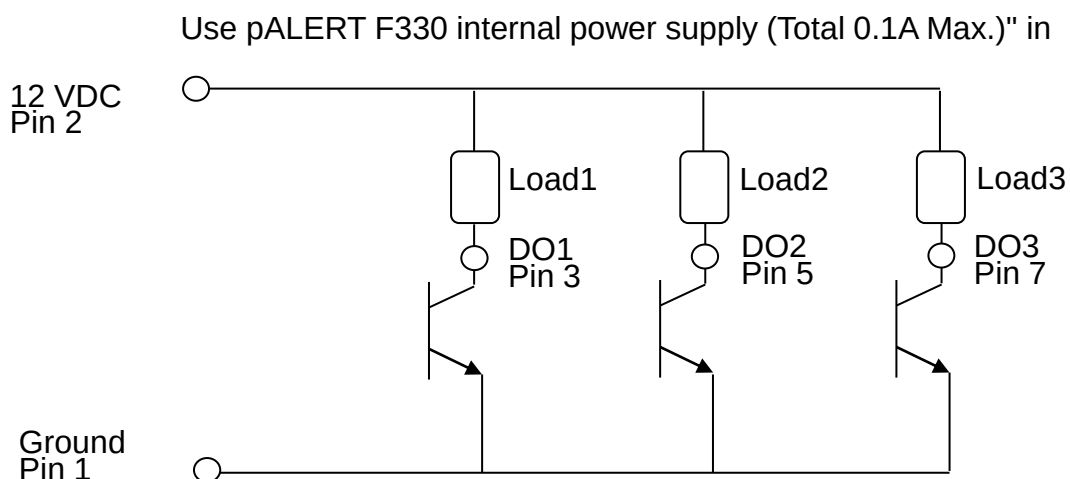
3-5 AUX Socket (Male)

3-5-1 Pin Explanation

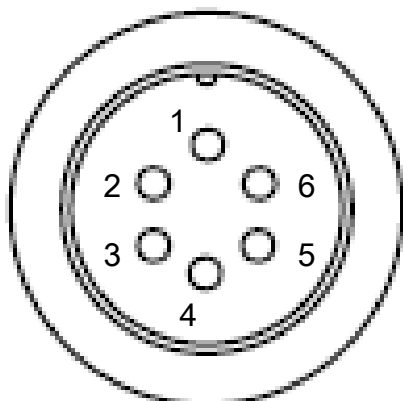


Pin	Description
1	Ground
2	12 VDC output, 0.1 A maximum
3	DO1 output, 0.1 A maximum
4	NC
5	DO2 output, 0.1 A maximum
6	NC
7	DO3 output, 0.1 A maximum
8	Ground
9	12 VDC output, 0.1 A maximum
10	DO1 output, 0.1 A maximum
11	NC
12	DO2 output, 0.1 A maximum
13	NC
14	DO3 output, 0.1 A maximum

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

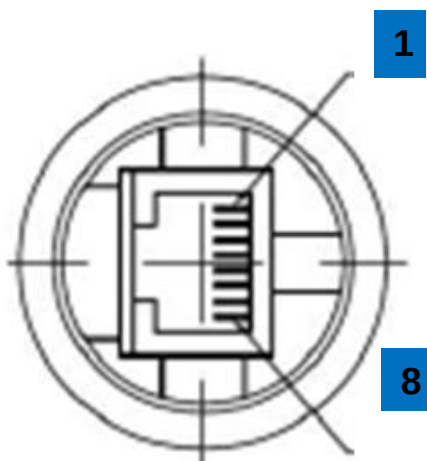


3-6 Power Socket (Male)



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

3-7 Network Socket



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

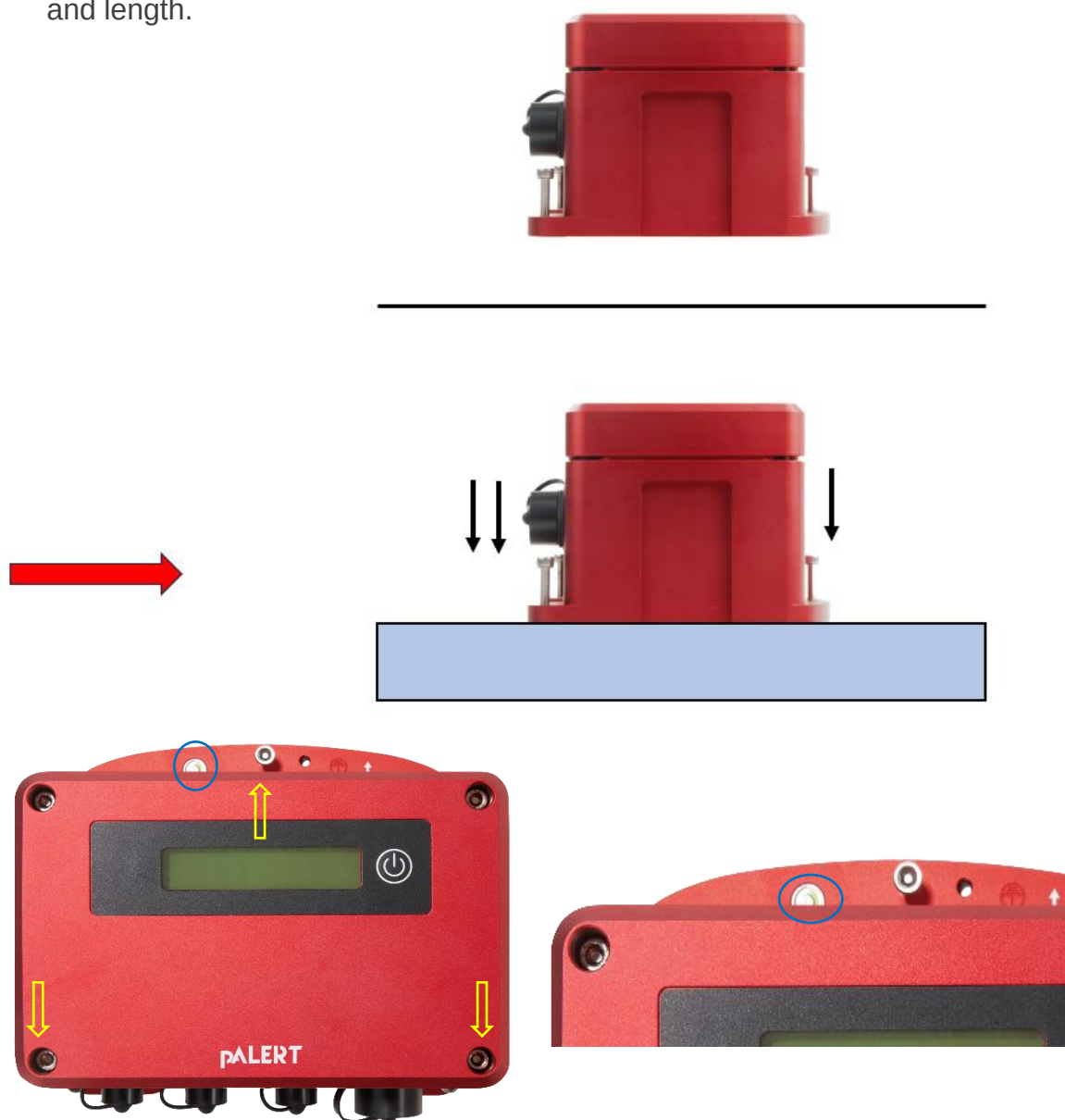
3-8 Horizontal Adjustment Screws

There are three horizontal adjustment screws, which function to secure the instrument to the ground. Please refer to the installation section below for further instructions.

4. Installation

4-1 Fixing Method

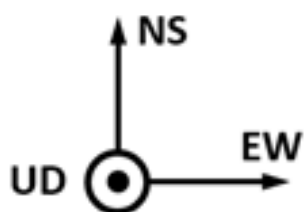
- Fix the instrument to the ground by using screws based on their diameter and length.



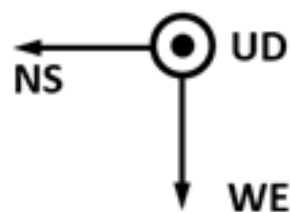
- Adjust the Three Horizontal Adjustment Screws (Yellow Arrows) to securely lock the seismometer to the ground while aligning the horizontal bubble to the center position (Blue Circle).

4-2 Installation Orientation

There are two installation methods as shown in the diagram. Users must configure the corresponding settings in the instrument's configuration file; otherwise, the calculation of Pd may be incorrect. Please refer to the section on configuration files for more information.



NORTHWARD



EASTWARD

5. Instrument Configuration

The pALERT F330 system is built on the Linux operating system, and thus it is divided into two major components: the Linux system services and the pALERT F330 application layer functions.

pALERT F330 Software
Linux Operating System
Hardware

5-1 Linux System Services

This section provides an explanation of the Linux system services used by pALERT F330. Users are encouraged to refer to information related to Linux systems for further details.

5-1-1 SSH Service

In the Linux system, users can use the PuTTY program to log in to the Linux system using the SSH protocol.

5-1-2 TCP/IP Service

TCP/IP Service	
Edit Configuration File	sudo nano /etc/networt/interfaces You can set the IP or obtain it through DHCP using this configuration file. Besides configuring the IP, you can also set the default DNS in this file.
Start Service	sudo /etc/init.d/networking start
Stop Service	sudo /etc/init.d/networking stop
Restart Service	sudo /etc/init.d/networking restart

DHCP Example for interfaces File:

```
auto lo
auto eth0

iface lo inet loopback
iface eth0 inet dhcp
# Uncomment the following lines for a static IP configuration
#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
```

Static IP Example for interfaces File:

```
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: As of 2021, Raspbian has adjusted the network configuration method and adopted the following approach:

TCP/IP Service	
Edit Configuration File	<code>sudo nano /etc/dhcpd.conf</code> You can configure the IP or obtain it through DHCP using this configuration file.
Start Service	<code>sudo systemctl enable dhcpd.service</code>
Stop Service	<code>sudo systemctl disable dhcpd.service</code>
Start Service	<code>sudo systemctl start dhcpd.service</code>
Stop Service	<code>sudo systemctl stop dhcpd.service</code>
Restart Service	<code>sudo systemctl restart dhcpd.service</code>

Note:

When using this method, modify `/etc/network/interfaces` by keeping only "source-directory `/etc/network/interfaces.d`." Delete or comment out the remaining configurations. If you're not using this method for network configuration and ensuring the use of a static IP, it is recommended to disable the dhcpd service.

dhcpd.conf Configuration Example 1: Using a Static 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 Configuration Example 2: Enable 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
```

dhcpcd.conf Configuration with Fallback to Default IP if DHCP Fails:

```
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 the static profile on eth0 if DHCP fails
interface eth0
fallback static_eth0
```

5-1-3 DHCP Service

DHCP Service	
Edit Configuration File	<pre>sudo nano /etc/dhcp/dhclient.conf</pre> Setting DHCP-related information through this configuration file. Such as renewal period and the default IP when unable to obtain an IP from the DHCP server.
Restart Service	<pre>sudo dhclient -r</pre>

5-1-4 DNS Service

DNS Service	
Edit Configuration File	<pre>sudo nano /etc/resolv.conf</pre> Using this configuration file to set up the domain name service (DNS). Through this method, DNS changes are not permanently stored in the system and are forgotten when the network is restarted. Therefore, if you want to store the desired DNS settings in /etc/network/interfaces, please refer to the TCP/IP service section..
Restart Service	<pre>sudo /etc/init.d/dns-clean restart</pre>

5-1-5 NTP Service

NTP Service	
Edit Configuration File	<pre>sudo nano /etc/ntp.conf</pre> Setting up network time synchronization server information through this configuration file.
Start Service	<pre>sudo /etc/init.d/ntp stop</pre>
Stop Service	<pre>sudo /etc/init.d/ntp start</pre>
Restart Service	<pre>sudo /etc/init.d/ntp restart</pre>
Querying NTP Status	<pre>ntpq -np</pre> If there is an asterisk (*) at the beginning of the displayed result, it means that the time synchronization has been successful.

```

pi@raspberrypi: ~
pi@raspberrypi:~ $ ntpq -np
      remote               refid              st t when poll reach  delay  offset  jitter
=====
162.159.200.123 10.23.8.4           3 u  2   8    1   33.929 -20.723  0.905
220.132.17.177 118.163.81.63        2 u  1   8    1    6.847  -4.076  0.844
220.133.149.235 118.163.81.63        2 u  2   8    1    9.105  -3.234  0.000
pi@raspberrypi:~ $ ntpq -np
      remote               refid              st t when poll reach  delay  offset  jitter
=====
*162.159.200.123 10.23.8.4           3 u  8   8   277   31.580 -22.076  7.425
+220.132.17.177 118.163.81.63        2 u  4   8   376    3.022 -16.273 11.054
+220.133.149.235 118.163.81.63        2 u  1   8   377    6.624  -9.878  6.614

```

5-2 pALERT F330 Software Services

5-2-1 Instrument Configuration Structure

There are six files related to the configuration, stored in the /home/pi/Desktop/vAlert/bin directory. The relationship is illustrated in Table 5-1. The vAlert8.cfg, vAlert8Common.cfg, and hardware.cfg files serve similar functions as configuration files. However, they have a priority order based on their proximity to the pALERT F330 software layer. In other words, hardware.cfg > vAlert8Common.cfg > vAlert8.cfg.

Users can take advantage of this characteristic by placing individual instrument settings in vAlert8.cfg. If you are creating a monitoring network system using pALERT F330, you can place common network settings in vAlert8Common.cfg. As for hardware.cfg, it is reserved for manufacturing-specific settings. Under normal circumstances, users are advised not to modify this file.

vAlert8.cfg	memsCalData geophoneData initSetup.cfg
vAlert8Common.cfg	
hardware.cfg	
pALERT F330 Software	

memsCalData stores the factory inspection data for the accelerometer, while geophoneData stores the factory inspection data for the geophone (this file is not needed if the instrument does not use a geophone). initSetup.cfg contains the initial settings for individual instrument operation, which is typically not required for normal use.

5-2-2 Configuration Syntax

Configuration files can be divided into two major types: single-item configurations and multiple-item configurations. Regardless of the type, each configuration item must start with "[" and end with "]", and the system determines the end of an item based on an empty line or the absence of a sub-item. Additionally, lines starting with "#" or "!" are treated as comments. Please refer to the example vAlert8.cfg file below.

Please note:

- All configurations are case-sensitive.
- For instrument compatibility, the following two lines are mandatory and should be placed at the beginning of the file:

```
[BLOCK_CONFIG_BY_ONE_ITEM]
YES
```

Here is a correct configuration example:

```
[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
```

Incorrect Configuration Example:

```
[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
FTPSPORT 22
USER palertF330
PASSWORD 1977
FTPDIR /home/data
```

In the given configuration, an empty line is used to signify the end of the configuration items under [MQTT_CONFIG]

An empty line is used to signify the end of the configuration items under [FTP_CONFIG].

In the above configuration, the system will only read the following configuration items:

```
[MQTT_CONFIG]
IP 127.0.0.1
PORT 1883
```

```
[VWHUB_CONFIG]
FTPIP 192.168.255.100
FTPSPORT 22
USER palertF330
PASSWORD 1977
FTPDIR /home/data
```

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

5-2-3-1 [ADMIN_SERVER_IP]

The [ADMIN_SERVER_IP] setting allows the local device to initiate outgoing connections. When the local IP address is a private IP and cannot be connected to from the Internet, you can configure the remote server's IP in this setting. Once a connection is established, the local device becomes a Modbus TCP server capable of receiving Modbus commands. The device can connect to a maximum of 5 Administration servers.

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

5-2-3-2 [API_CONFIG]

When an event is triggered, this configuration allows the user to call a custom application. The definition of an event is when PGA, STA/LTA, or Pd is triggered, and its intensity exceeds the voice alarm threshold. The voice alarm threshold is determined based on whether it is daytime or nighttime, and it is decided by the settings in [DAY_VOICEALARM_INTENSITY] and [NIGHT_VOICEALARM_INTENSITY]. The definition of daytime or nighttime is determined 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: When the event occurs on the rising edge, the system calls the userApiOnEventRising program.
- PD_API_PARAMETER: Used in conjunction with EARTHQUAKE_API. If set to YES, when Pd is triggered, the system calls the userApiOnEventRising API whenever PGA or PGV increases, and it includes the value of Pd.
- EARTHQUAKE_FALLING_API: When the event occurs on the falling edge, the system calls the userApiOnEventFalling program.
- DORTS_FILE_UPLOAD: When using the Taipei Metro Vibration Standard (DORTS), if set to YES, DORTS event records can be uploaded to the FTP server. For FTP server settings, refer to the [VWHUB_CONFIG] section.
- ISO2631_FILE_UPLOAD: When using the ISO 2631 vibration standard, if set to YES, ISO2631 event records can be uploaded to the FTP server. For FTP server settings, refer to the [VWHUB_CONFIG] section

5-2-3-2 [API_CONFIG]

When an event is triggered, this configuration allows the user to call a custom application. The definition of an event is when PGA, STA/LTA, or Pd is triggered, and its intensity exceeds the voice alarm threshold. The voice alarm threshold is determined based on whether it is daytime or nighttime, and it is decided by the settings in [DAY_VOICEALARM_INTENSITY] and [NIGHT_VOICEALARM_INTENSITY]. The definition of daytime or nighttime is determined 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: When the event occurs on the rising edge, the system calls the userApiOnEventRising program.
- PD_API_PARAMETER: Used in conjunction with EARTHQUAKE_API. If set to YES, when Pd is triggered, the system calls the userApiOnEventRising API whenever PGA or PGV increases, and it includes the value of Pd.
- EARTHQUAKE_FALLING_API: When the event occurs on the falling edge, the system calls the userApiOnEventFalling program.
- DORTS_FILE_UPLOAD: When using the Taipei Metro Vibration Standard (DORTS), if set to YES, DORTS event records can be uploaded to the FTP server. For FTP server settings, refer to the [VWHUB_CONFIG] section.
- ISO2631_FILE_UPLOAD: When using the ISO 2631 vibration standard, if set to YES, ISO2631 event records can be uploaded to the FTP server. For FTP server settings, refer to the [VWHUB_CONFIG] section

5-2-3-3 [AUTO_RECORD]

This configuration option provides the functionality of automatically recording upon startup or scheduling the start and stop of recording. When using this feature, be sure to disable trigger detection.

Syntax:

```
[AUTO_RECORD]
AUTO_START YES/NO
START_SECONDS startSecondsAfterStart
STOP_SECONDS stopSecondAfterStart
INTERVAL_MINUTE storeEveryNminutes
```

Example 1:

```
[AUTO_RECORD]
AUTO_START YES
```

Explanation 1:

- Automatically starts recording after the program begins.
- When using only this feature, 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 switches to a new day.

Example 2:

```
[AUTO_RECORD]
START_SECONDS 30
STOP_SECONDS 90
```

Explanation 2:

- Starts recording 30 seconds after the program begins and stops recording 90 seconds after the program begins.
- Users can modify the start and stop times in real-time using Modbus registers, in Unix Timestamp format.

Example 3:

```
[AUTO_RECORD]
INTERVAL_MINUTE 5
```

Explanation Three:

- To use this feature, please update the firmware to version 4.56 or above.
- Enable continuous recording, saving files every 5 minutes. The 5-minute algorithm is based on the system's minutes being divisible by 5, i.e., at 0, 5, 10...55 minutes.
- If the system time at the beginning of the program is 13:02:30, recording will start at 13:05:00.
- 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] Single line is sufficient.

Explanation: When this feature is enabled, the program will back up vAlert8.cfg to vAlert8Cfg.bak each time it is executed.

5-2-3-5 [BACKUP_PROGRAM]

Syntax: [BACKUP_PROGRAM] Single line is sufficient.

Explanation: When this feature is enabled, the program will back up the main program palnt.exe to palntBak.exe each time it is executed.

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

pALERT F330 can send Modbus TCP commands to activate Modbus DO devices on the network when the earthquake event exceeds a certain intensity. This functionality must be configured with three settings: [BA_HOST_IP], [BA_DOOR_INTENSITY], and [BA_DOOR_ADDRESS].

Example:

[BA_HOST_IP]

192.168.255.100

[BA_DOOR_INTENSITY]

4

[BA_DOOR_ADDRESS]

150

Explanation: This configuration automatically activates the Modbus TCP device with IP 192.168.255.100 and DO address 150 when the earthquake event exceeds intensity level 4.

5-2-3-7 [BROADCAST_PORT]

To facilitate more efficient transmission of emergency messages, this setting allows the sending of broadcast packets to the configured UDP port during earthquake events. The local device will also send time packets to this UDP port every minute.

Example:

[BROADCAST_PORT]

502

Explanation: When this feature is enabled, the device will send broadcast packets to UDP port 502 during earthquake events, and time packets will be sent to the same port every minute. This functionality can be used in conjunction with LF-01 (desktop seismic alert and CO2 display screen).

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

pALERT F330 can send Modbus TCP commands to activate Modbus DO devices on the network when the earthquake event exceeds a certain intensity. This functionality must be configured with three settings: [BA_HOST_IP], [BA_DOOR_INTENSITY], and [BA_DOOR_ADDRESS].

Example:

[BA_HOST_IP]

192.168.255.100

[BA_DOOR_INTENSITY]

4

[BA_DOOR_ADDRESS]

150

Explanation: This configuration automatically activates the Modbus TCP device with IP 192.168.255.100 and DO address 150 when the earthquake event exceeds intensity level 4.

5-2-3-7 [BROADCAST_PORT]

To facilitate more efficient transmission of emergency messages, this setting allows the sending of broadcast packets to the configured UDP port during earthquake events. The local device will also send time packets to this UDP port every minute.

Example:

[BROADCAST_PORT]

502

Explanation: When this feature is enabled, the device will send broadcast packets to UDP port 502 during earthquake events, and time packets will be sent to the same port every minute. This functionality can be used in conjunction with LF-01 (desktop seismic alert and CO2 display screen).

- 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

- Earthquake 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]

Used in conjunction with [BROADCAST_PORT] setting. After the event ends, a UDP cancel packet will be sent when the countdown of this setting's seconds expires. The default value is 5 seconds.

Example:

[BROADCAST_CANCEL_TIMER]
10

Explanation: When an event ends, and the [BROADCAST_PORT] setting is active, a UDP cancel packet will be sent after the specified countdown time in seconds (10 seconds in the provided example). This feature is designed to manage the communication of earthquake-related information.

- End Packet Format

Byte No.	Description
0 ~ 1	0 ~ 1
2, 3, 4	2, 3, 4
5	5
6	6
7	7
8 ~ 9	8 ~ 9
10 ~ 11	10 ~ 11
12	12
13 ~ 14	13 ~ 14
15 ~ 16	15 ~ 16

5-2-3-9 [CONFIG_TO_FILE]

When this feature is enabled, it will generate a configRead.txt file in the /home/pi/Desktop/vAlert/bin directory based on the three loaded configuration files: vAlert8.cfg, vAlert8Common.cfg, and hardware.cfg. Users can check this file to verify if the configured functionalities have been correctly loaded by the system.

Syntax: [CONFIG_TO_FILE] Single line is sufficient.

Explanation: Place this line at the beginning of the configuration file.

5-2-3-10 [CWB2019INTENSITY]

The Central Weather Bureau (CWB) revised and implemented a new seismic intensity scale in 2019, which took effect in 2020. The main difference is that seismic intensity below magnitude four is determined by PGA (Peak Ground Acceleration), while magnitude five and above (inclusive) use PGV (Peak Ground Velocity) to calculate intensity. If the instrument does not have any settings related to seismic intensity calculation standards, the default is the early CWB intensity scale (calculated based on PGA). This setting configures the instrument to use the CWB 2020 seismic intensity scale.

Syntax:

[CWB2019INTENSITY]
YES

Explanation: Enabling this setting configures the instrument to use the CWB 2020 seismic intensity scale, which takes into account the revised standards implemented by the Central Weather Bureau in 2019.

- Seismic Intensity Scale Calculation Standards before 2020 by CWB

Seismic Intensity	Human Perception	PGA (gal)
0	Not felt	Below 0.8
1	Weak	0.8 ~ 2.5
2	Weak	2.5 ~ 8.0
3	Weak	8.0 ~ 25
4	Moderate	25 ~ 80
5	Strong	80 ~ 250
6	Severe	250 ~ 400
7	Severe	Above 400

- CWB 2020 Seismic Intensity Scale Calculation Standards.

Seismic Intensity	Human Perception	PGA (gal)
0	Not felt	
1	Weak	
2	Weak	
3	Weak	
4	Moderate	
5 weak	Strong	15 ~ 30
5 strong	Strong	30 ~ 50
6 weak	Strong	50 ~ 80
6 strong	Severe	80 ~ 140
7	Severe	Above 140

- To correspond to the CWB 2020 Seismic Intensity Scale Standards, this device uses the following numerical values to represent:

CWB 2020 Seismic Intensity	pALERT F330 Seismic Intensity Values
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

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

In practical applications, it is desired to have different levels of control and message notification after an event trigger during the day or night. Users can define the daytime and nighttime periods for the device using these two settings, with the unit being in minutes. Midnight 00:00 is represented as 0 minutes, and 23:59 is represented as 1439 minutes.

Syntax and Example:

[DAY_BEGIN_MINUTE]

480

[DAY_END_MINUTE]

1020

Explanation:

- [DAY_BEGIN_MINUTE] is set to 480, which, when divided by 60, equals 8. This represents the daytime starting at 8:00.
- [DAY_END_MINUTE] is set to 1020, which, when divided by 60, equals 17. This represents the daytime ending at 17:00.
- This setting defines the daytime period from 8:00 to 17:00.
- The default system daytime range is 7:00 to 18:00.

5-2-3-12 [DAY_VOICEALARM_INTENSITY]

During the daytime period, after an earthquake event trigger, set the seismic intensity threshold for sending messages. For the definition of daytime and nighttime periods, please refer to [DAY_BEGIN_MINUTE] and [DAY_END_MINUTE].

Example:

```
[DAY_VOICEALARM_INTENSITY]
1
```

Explanation: When the seismic intensity of an earthquake event during the daytime is greater than or equal to intensity level one, the system will execute message notifications.

5-2-3-13 [DORTS_VIBRATION]

This device can optionally purchase the calculation functionality for Taipei Metro's Vibration Standard (DORTS).

Syntax:

```
[DORTS_VIBRATION]
BUILDING_TYPE buildingType
WARNING_DB warningDb
MAXIMUM_LATCH YES/NO
```

- BUILDING_TYPE, Range 1 ~ 6

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

DORTS Vibration Standard

Octave Center Frequency Hz	Precision Instrument Facility	Large Auditorium	Television Station	Apartment Complex	Commercial Building	Industrial Factory
2	32	49	58	62	67	74
4	35.5	53	60	54	69	76
8	38	57	63	64	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

- WARNING_DB: Since the DORTS standard only provides a single threshold, this setting can provide a warning when vibration approaches the threshold. The default value is -6 dB. When combined with [SINGLE_RELAY_MODE] for DO, three different DO output conditions can be generated.

DO Output	Vibration Conditions
DO1	Normal
DO2	Warning
DO3	Exceeds DORTS Vibration Standard

- If you do not wish to use the warning function, you can set this value to greater than or equal to 0.

- **MAXIMUM_LATCH:** This setting provides a latch function for vibration events. When set to YES and a vibration event occurs (vibration exceeds the warning value), the output of the Digital Output (DO) will remain latched (even after a reboot) unless the user cancels the alarm (by pressing the button for three 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]

The system can automatically delete log files under /home/pi/Desktop/vAlert/rec directory to ensure sufficient working space. The unit is 4 kB. When the storage space falls below this configured value, the system will clear 20 oldest files at a time. The default value is 262144, approximately $262144 * 4 = 1048$ MB.

Syntax:

```
[DISK_MIN_SPACE]
384000
```

Explanation:

The system's minimum storage space is set to $384000 * 4 = 1,536,000$ kB.

5-2-3-15 [EVENT_FILE_MAX_LENGTH_IN_SECOND]

This setting provides the functionality of setting the maximum duration for log files. When the recording exceeds this duration, the file will automatically close, and a new file will be created. The default value is 60 seconds.

Syntax:

```
[EVENT_FILE_MAX_LENGTH_IN_SECOND]
100
```

5-2-3-16 [EVENT_FILE_FORMAT]

pALERT F330 provides two recording formats, namely, compressed CSV format and miniSEED format.

Syntax:

```
[EVENT_FILE_FORMAT]  
miniSEED/mseed
```

Example 1:

```
[EVENT_FILE_FORMAT]  
miniSEED
```

- Explanation 1: Select the miniSEED recording format.

Example 2:

```
[EVENT_FILE_FORMAT]  
Mseed
```

- Explanation 2: Select the miniSEED recording format.

Example 3:

```
[EVENT_FILE_FORMAT]  
CSV
```

- Explanation 3: Select the CSV recording format.

5-2-3-17 [EVENT_FILE_OPTION]

This feature defines detailed settings for event log files.

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 the Packet Number check for Palert Mode 1 packets. If the device detects non-consecutive packet numbers, it will immediately display "PacketErr[%d]" on the LCD. If there are recorded event files, "#PacketLoseCnt: %d" will appear at the beginning of the file indicating the count of lost packets.
- This feature is crucial for calculating HAZUS RSHD. If packets are incomplete, the file is considered incomplete, and the calculation result will be incorrect. Therefore, if using HAZUS RSHD, set this feature to YES.
- Set the recording file to use the fixed-point format. The default data format for recorded files is 4F10.3, which is a fixed-point format with three decimal places. If you want the data to display smaller values, set it to NO, and the data format will be in floating-point format.

5-2-3-18 [FTP_CONFIG]

This configuration allows the device to perform software updates over the network. It defines the information for the remote software update FTP server. When the seventh button is pressed, the device will attempt to update to new software based on these settings.

Example:

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

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

This configuration is used to define the IP address of the FTE-D04, which is an earthquake message display.

Example:

```
[FTE-D04_IP]
192.168.255.123
```

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

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

This configuration is used to define the interval at which the FTE-D04 receives heartbeat signals to confirm its operational status. The unit is in seconds. The FTE-D04 will periodically check for the presence of heartbeat signals from the host. If it does not receive them, it will trigger a warning signal.

Example:

```
[FTE-D04_HEART_BEAT_INTERVAL]
4
```

Explanation: Set the host to send a heartbeat signal to the FTE-D04 every four seconds.

5-2-3-21 [GEOPHONE]

The pALERT F330's fourth axis can be equipped with a geophone to measure velocity. This configuration allows compensation for low-frequency geophones down to 1 Hz, saving users the cost of purchasing low-frequency geophones.

Example:

```
[GEOPHONE]
COMPENSATION YES
```

Explanation: If frequency compensation is enabled, compensation will be applied based on the parameters set in /home/pi/Desktop/vAlert/bin/geophoneData.

- geophoneData Configuration

Item	Description
DAMPING_RATIO	Damping Ratio
DAMPING_RESISTOR	Damping Resistor (10000000 if no damping resistor)
FREQUENCY	Natural Frequency in Hertz
GAIN	Output Sensitivity in volts per meter per second
MASS	Mass Block Weight in kilograms
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]

pALERT F330 supports a GPS module, and this configuration defines the related GPS settings. These settings are typically pre-configured properly before the device leaves the factory, so any modifications needed should be assisted by the FAE (Field Application Engineer) from Sanlien Technology.

Example:

```
[GPS]
USB_PORT 1
BAUD 9600
PPS_PIN 40
```

5-2-3-23 [GPIO_CONFIG]

This configuration defines the hardware connection information. These settings are typically pre-configured properly before the device leaves the factory, so any modifications needed should be assisted by the FAE (Field Application Engineer) from 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: Use the unused AUDIO_RELAY_PIN as RELAY4_PIN. pALERT F330 defaults to 3 sets of Digital Outputs (DO).

Example 2:

```
[GPIO_CONFIG]
CPU_RESET_PIN 29
CPU_RESET_END_LEVEL 1
```

Explanation 2:

- RPi controls the voltage level of GPIO.29 to reset the CPU. Ensure the actual pinout of the hardware.
- Incorrect configuration of CPU_RESET_END_LEVEL may cause the CPU to be reset during shutdown. Do not modify this parameter without proper understanding.

5-2-3-24 [HEIGHT]

This configuration specifies the altitude at which the instrument is installed, measured in meters. This information is stored in Modbus registers for user queries.

Example:

```
[HEIGHT]
35
```

5-2-3-25 [ISO_2631]

This configuration allows the option to purchase the ISO 2631 vibration standard calculation feature.

Syntax:

```
[ISO_2631]
LOCATION_TYPE 0~3
MAXIMUM_LATCH YES/NO
```

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/sec²
- MAXIMUM_LATCH: This setting provides a locking feature for vibration events. When set to YES and a vibration event occurs (exceeding the warning threshold), the DO output will remain active indefinitely (even after a reboot), unless the user cancels the alarm (pressing the button for three seconds or through Modbus control).

5-2-3-26 [JMA]

Adopting the seismic intensity scale of the Japan Meteorological Agency (JMA). Please note that when using the JMA seismic intensity scale, the sampling rate must be set to 200 SPS.

Explanation of JMA seismic intensity scale grades:

JMA Intensity Scale	pALERT F330 Intensity Value
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:

- Calculate the required time-domain seconds for the frequency-domain to determine seismic intensity. It is recommended to set the ringSeconds value to 10 seconds.
- Because the JMA Seismic Intensity Scale uses frequency-domain-weighted calculations for seismic intensity, there must be sufficient time-domain data for accurate computation.

5-2-3-27 [KMA_INTENSITY]

Adopt the seismic intensity scale standard of the Korea Meteorological Administration (KMA).

Syntax:

```
[KMA_INTENSITY]
YES/NO
```

5-2-3-28 [LINE]

Use LINE messaging for notifications. When an event occurs, the system will send messages based on the settings in 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 F330
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, and this information will appear in the LINE message.
- For Chinese messages, the intensity thresholds for publishing messages are one during the day and four 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 on the device is fixed at 20 * 2; please keep this setting.
- DISPLAY_CONFIG allows choosing whether to display the contents of the settings. In this example, it is set not to display (default is NO).
- DISPLAY_ON_ERR allows choosing whether to turn on the LCD backlight when there is an error message. In this example, the backlight is turned on (default is YES).
- BRIGHTNESS_ON_ERR can set the backlight brightness when the LCD is flashing. 0 is off, and 100 is the brightest.

5-2-3-30 [LCD_TITLE]

This setting allows users to customize the name displayed on the first line of the LCD. The default is "pAlert F330," and the maximum length is 14 characters.

Syntax:

```
[LCD_TITLE]
pAlert F330
```

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

This setting allows pALERT F330 to send event messages to the LF-01 desktop seismic display screen. The LF-01's CO2 and temperature/humidity information is captured and stored in the Modbus register. If [BA_HOST_IP] is configured, the LF-01's door output ([BA_DOOR_ADDRESS]) will be activated when CO2 concentration exceeds 2000 ppm and deactivated when it falls below 1000 ppm.

Syntax:

```
[LF-01_IP]
192.168.255.11
```

5-2-3-32 [LISTEN_PORT]

This setting allows the user to modify the default port (502) for the Modbus TCP/UDP server.

Syntax:

```
[LISTEN_PORT]
503
```

In this example, the Modbus TCP server will use port 503 for communication.

5-2-3-33 [LOCAL_LATITUDE], [LOCAL_LONGITUDE]

The latitude and longitude of the instrument installation are stored in Modbus registers for user reference.

Example:

[LOCAL_LATITUDE]

24.973065

[LOCAL_LONGITUDE]

121.548529

5-2-3-34 [LOCAL_STREAM_DEBUG]

The instrument provides the capability to output data packets to a TCP port in text format. This TCP port can be the local machine itself (127.0.0.1). If you want to view continuous waveforms on a webpage, it is recommended to use the default values. This feature supports up to five sets of ports, with default values as follows:

[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 for real-time data output:

```
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: By default, webpages display data from three axes. To view the waveform of the fourth axis, enable this feature. This setting is set to NO by default.

5-2-3-35 [MINISEED_SERVER]

Starting from version 4.56, the instrument supports the miniSEED Server function. This feature requires the external ringserver program, which will be automatically downloaded after a system update. To use this feature, you need to configure [PALERT_LOCAL_MODE] with STATION_NET, STATION_NAME, STATION_CH_NAME, STATION_CH_GEO_NAME, and STATION_LOCATION.

```
[MINISEED_SERVER]
IP ringserverIp
PORT ringserverPort
```

Example:

```
[MINISEED_SERVER]
```

```
IP 127.0.0.1
```

```
PORT 18000
```

Explanation:

- The IP address of the ringserver is set to the local machine, i.e., 127.0.0.1.
- The port for the ringserver is set to 18000.

5-2-3-36 [MODBUS_TCP_DO]

This configuration allows the real-time transmission of the local DO (Digital Output) status to remote Modbus devices over the network, supporting control 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 status of the local DO to the Modbus TCP devices at the specified IP addresses and ports, with corresponding DO addresses.

5-2-3-37 [MQTT_CONFIG]

This configuration enables the dissemination of messages through MQTT when an event is triggered and exceeds the specified threshold.

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:

- Using the local machine as the MQTT broker with port 1883.
- The LOCATION is set to BUILDING1, and the published topic is sanLien/BUILDING1/EEWS/ONSITE.
- Message thresholds for sending are set to 1 for daytime and 4 for nighttime earthquakes.

5-2-3-38 [MMI_INTENSITY]

This configuration allows the use of the MMI (Modified Mercalli Intensity) seismic intensity standard.

Syntax:

[MMI_INTENSITY]
PGA/PGV/YES/NO
1/2/YES/NO

Explanation:

- For firmware version 4.65 and later:
 - 1) PGA: Utilizes MMI PGA for seismic intensity calculation.
 - 2) YES: Utilizes MMI PGA for seismic intensity calculation.
 - 3) PGV: Utilizes MMI PGV for seismic intensity calculation.
- For firmware version 4.64 and earlier:
 - 1) 1: Utilizes MMI PGA for seismic intensity calculation.
 - 2) YES: Utilizes MMI PGA for seismic intensity calculation.
 - 3) 2: Utilizes MMI PGV for seismic intensity calculation.

MMI PGA Seismic Intensity Scale

Seismic Intensity	PGA (gal)
1	Below 1.7
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	Above 1240

MMI PGV Seismic Intensity Scale

Seismic Intensity	PGA (gal)	PGV (mm/s)
1	Below 1.67	Below 1
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		Above 1161

5-2-3-39 [MAIN_PORT_INTERFACE]

The device uses the default Linux network interface for network connections. Users can modify this setting to use a different network interface (Note: This setting should be performed by an FAE engineer, as incorrect configuration can result in the system not functioning properly).

Example:

```
[MAIN_PORT_INTERFACE]
Eth0
```

Explanation: Uses eth0 as the network communication interface.

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

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

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:

- pALERT F330 checks if the time is synchronized with the NTP server approximately every 10 seconds. If it hasn't synchronized in about 300 seconds (RESET_TH set to 3), the NTP service is restarted.
- RTC_TO_SYSTEM_TIME set to YES means that when the system is not synchronized with the NTP server, the RTC time is written into the Linux system time as soon as the reset counter increases by one.
- If some applications cannot synchronize with the NTP server, setting ERR_IF_TIME_NOT_SYNC to YES treats it as an error and displays it on the LCD; if set to NO, it is not treated 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 setting may render the system's RTC inoperable.
- FAKE_PPS is set to NO by default. Setting it to YES indicates that the system time is the source of the NTP server and the system time source includes a clock with 1 PPS. Some network devices require an NTP server source clock with 1 PPS, and this setting is needed. The /etc/ntp.conf file must have the following settings:

```
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 calibration. If the time difference with the NTP server time exceeds the set threshold value, the NTP service will be restarted.

5-2-3-41 [NCREE_HOST]

This setting enables communication with the NCREE EEW (Earthquake Early Warning) network protocol.

[NCREE_HOST] Settings		
Setting Details	Setting Content	Explanation
IP	IP:port	Station code, provided by NCREE.
STATION_NUMBER	Integer	Enable NCREE triggering function. If this function is enabled, other earthquake-related triggering logic will be automatically turned off.
NCREE_TRIG	YES NO	Choose to record event files or continuous records.
RECORD_DRIVE_N_BY_EVENT	YES NO	Continuous recording in miniSeed format, event files in CSV format.
LTA_CONSTANT	Floating Point Number	Constant for NCREE algorithm's LTA.
STA_POINT	Integer	Data count for calculating STA.
TRIG_THRSH_UP_PT	Integer	Data count for the first-stage triggering threshold.
TRIG_THRSH_DOWN_PT	Integer	Data count for the end of the first-stage triggering threshold.
TRIG_THRSH_UP	Floating Point Number	Trigger threshold.
TRIG_THRSH_DOWN	Floating Point Number	End of trigger threshold.
WIN_TRIG_PT	Integer	Data count for the second-stage triggering threshold.
WIN_TRIG_THRSH_DOWN_PT	Integer	Data count for the end of the second-stage triggering threshold.

Example 1:

```
[NCREE_HOST]
IP 192.168.255.100:26000
STATION_NUMBER 65535
```

Explanation 1:

- Send real-time earthquake event information to the NCREE host, with the IP as 192.168.255.100 and the port as 26000.
- The station code is 65535, and the station code must be in the range of 0 to 65535.
- Because the NCREE triggering function is not enabled, the built-in earthquake triggering logic of the system will provide 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:

- Send real-time earthquake event information to the NCREE host, with the IP as 192.168.255.100 and the port as 26000.
- The station code is 65535, and the station code must be in the range of 0 to 65535.
- Enable NCREE triggering logic, automatically turning off other built-in earthquake triggering logic.
- Enable record event file mode.
- LTA is fixed at 0.3.
- Use a continuous stream of 80 data points to calculate STA.
- If STA/LTA reaches the trigger threshold of 3.5 (TRIG_THRSH_UP) and the continuous data points reach 10 (TRIG_THRSH_UP_PT), it is considered the first-stage trigger. If the continuous data points reach 20 (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 the continuous data points reach 20 (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 the continuous data points reach 50 (WIN_TRIG_THRSH_DOWN_PT), it is considered the end of the second-stage trigger.

5-2-3-42 [NET_DEVICE]

The system provides support for the COAP protocol, enabling the broadcasting of messages over the network through the COAP protocol when an event is triggered.

Syntax:

[NET_DEVICE]

YES/NO

Explanation:

- If set to "YES," the system is configured to utilize the COAP protocol for broadcasting messages over the network when an event is triggered.
- If set to "NO," the COAP protocol functionality is disabled.

The COAP protocol of this device			
GET	PUT	OPTION	PAYLOAD
	V	\global\heartbeat	time=Unix timestamp Send once every 9 seconds of each minute.
	V	\global\ews\onsite	int=5&exercise=0
	V	\global\relay	set=ff
	V	\global\ews\cancel	time=Unix timestamp

5-2-3-43 [NIGHT_VOICEALARM_INTENSITY]

During the night period, after an earthquake event is triggered, set the intensity threshold for sending messages. 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 seismic intensity of a nighttime earthquake event is greater than or equal to the "Weak 5" level, the system will execute the message sending process. (Assuming the intensity scale is set to the CWB 2020 intensity scale)

5-2-3-44 [OSMOS_OASYS]

The device supports the functionality of 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 the IP address 192.168.255.100 and port 10001.
- When connecting to the OASYS host, there must be two authentication files, osm_palert.crt and osm_palert.key, in the /home/pi/Desktop/vAlert/bin directory.

5-2-3-45 [PALERT_LOCAL_MODE]

Regarding the local settings for the device, including sensor, sampling, filtering, triggering, etc., the rules are similar to those described above. The details will be presented in a table for simplified explanation.

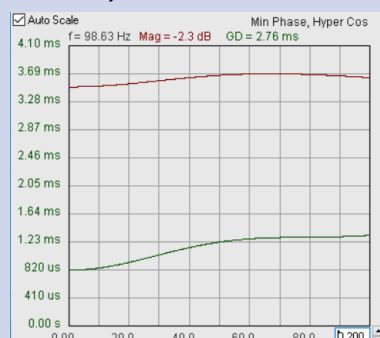
Syntax:

[PALERT_LOCAL_MODE]

Setting Item Setting Content

[PALERT_LOCAL_MODE] Setting Detail

Setting Details	Setting Content	Explanation
AUTO_OFFSET	TRTC YES NO	Selects the method for automatic zeroing. YES means always open automatic zeroing, TRTC means automatic zeroing under normal conditions but no zeroing during events, NO means no automatic zeroing.
CEB_MODE	YES NO	When set to YES, it means the device uses the protocol of the China Earthquake Administration.
CEB_SEND_TIME_OUT_USEC	> 5,000	The waiting time for data transmission when the network communication between the device and CEB server is busy, in microseconds (10 ⁻³ seconds).
CEB_COMP_FILTER	YES NO	Enables compensation filter: Bandpass, Hyper, 1000 sps, Fc: 0.14, BW: 0.5 Num Taps:25, Window:off, Hyper Cosine:0.5, Min. phase. (Version 4.56)



[PALERT_LOCAL_MODE] Setting Detail		
Setting Details	Setting Content	Explanation
COUNT_TO_GALL	Floating Point Number	Default value: 2924.0291. Note: This setting must be operated by FAE personnel; incorrect settings may result in the system not working.
COUNT_TO_VOLT	Floating Point Number	Default value: 3355443. Note: This setting must be operated by FAE personnel; incorrect settings may result in the system not working.
CPU_BPS_460800	YES NO	The transmission speed of the internal CPU, default is NO. Note: This setting must be operated by FAE personnel; incorrect settings may result in the system not working.
CPU_DATA_ALIGNMENT	YES/NO	Note: This setting must be operated by FAE personnel; incorrect settings may result in the system not working.
CPU_RTC_PPS_ENABLE	YES/NO	This setting informs whether the Linux system's time setting checks the internal CPU's PPS signal. Default is NO. Note: This setting must be operated by FAE personnel; incorrect settings may result in the system not working.
CPU_SLIP_TIMEOUT_TICK		Note: This setting must be operated by FAE personnel; incorrect settings may result in the system not working.
CPU_STATUS_DISPLAY_INTERVAL	≥ 5	The LCD will display CPU temperature, external voltage, battery voltage, and RTC battery voltage according to the set seconds. Default value is 60 seconds.
DATA_PORT	ttyAMA0	Set the data port for the internal ADC of the device. Default is ttyAMA0. Note: This setting must be operated by FAE personnel; incorrect settings may result in the system not working.

[PALERT_LOCAL_MODE] Setting Detail		
Setting Details	Setting Content	Explanation
DESPIKE	Float	Note: This setting must be operated by FAE personnel; incorrect settings may result in the system not working.
DOWN_SAMPLING_BY_AVRG	YES/NO	Set the mode for downsampling. Default is YES, which uses high-speed sampling, low-pass filtering, and then averaging.
EVENT_MAX_SECONDS	≥ 60	The maximum duration of an event. When it exceeds this time, the system will attempt to re-zero and clear all earthquake event flags. Default value is 180 seconds.
EVENT_MIN_SECONDS	> 0	The minimum duration of an earthquake event. After triggering an event, the earthquake flag will be maintained for at least this duration. Default value is 10 seconds.
EXT_POWER_LOW_TH	< 50	When the voltage of the external power source is below this value, the LCD will display an error message. Default value is 10 volts.
FILTER_CEB_MODE	YES/NO	Enable special filtering specifications for CEB. Default is YES.
FIR_MODE	YES/NO	Adopt FIR or IIR filtering. Default is NO.
GEO_CH_4	YES/NO	Set whether the fifth axis of the device's log file records displacement or velocity. Default is NO.
GEOPHONE_OK_TH	≥ 10	When using the fourth axis as a velocity sensor, set the minimum signal count value for self-testing. Default is 1000 counts.

[PALERT_LOCAL_MODE] Setting Detail																																					
Setting Details	Setting Content	Explanation																																			
LPF	10, 20, 40, 50, 80, 100 (Hz)	Set the frequency for the low-pass filter in Hz. If not used, set to 0. The device can choose to use IIR or FIR filters, each with different characteristics. IIR Butterworth <table> <tr> <th>Frequency</th> <th>Order</th> <th>HI_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> FIR Raised Cos <table> <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>90</td> <td>32</td> </tr> <tr> <td>100</td> <td>32</td> </tr> </table>	Frequency	Order	HI_ORDER	10	4	8	20	4	14	40	4	14	50	4	12	80	4	12	100	4	12	Frequency	Order	10	32	20	32	40	32	50	32	90	32	100	32
Frequency	Order	HI_ORDER																																			
10	4	8																																			
20	4	14																																			
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20	32																																				
40	32																																				
50	32																																				
90	32																																				
100	32																																				
LPF_HI_ORDER	YES/NO	If using LPF, choose a higher filter order, as indicated in the table above. Default is YES.																																			
MINIMUM_OFF SET_GAL	>= 0.1	Set the minimum value for successful boot zero-point self-correction. The system will continue zero-point correction until it succeeds, in units of gal. Default is 5.																																			
MEMS_4G	YES/NO	Choose whether to use the 4G version of the sensor. Default is NO. Note: This setting must be compatible with the hardware.																																			
MODE	CHINA/INTERNATIONAL	Choose whether to use the China Earthquake Administration version. Default is INTERNATIONAL.																																			

[PALERT_LOCAL_MODE] Setting Detail		
Setting Details	Setting Content	Explanation
MOUNT_MODE	NORTHWARD/EASTWARD	Instrument installation orientation. Default is NORTHWARD. The axes representation in the log file is as follows: a: UD direction b: NS direction c: EW direction d: Auxiliary axis, determined by user installation.
MSEEDFILE_VALID_DAY	≥ 1 and ≤ 120	In China Earthquake Administration mode, the system stores a miniSEED format file every day in the /home/pi/Desktop/vAlert/rec directory, with filenames starting with mseedFileYYYYMMDD. This setting determines the number of days these files will be kept. Default is 90 days.
PD_TRIG_ENABLE	YES/NO	Enable Pd trigger monitoring for seismic events (P-wave displacement) mode. Default is NO.
PD_WATCH_THRESHOLD	≥ 0.01	Set the alert threshold for P-wave displacement in centimeters. Default is 0.2 cm, and triggering will activate DO1.
PD_WARNING_THRESHOLD	≥ 0.01	Set the warning threshold for P-wave displacement in centimeters. Default is 0.3 cm, and triggering will activate DO2.
PGA_TRIG_ENABLE	YES/NO	Enable PGA trigger monitoring for seismic events mode. Default is NO.
PGA_WATCH_THRESHOLD	≥ 0	Set the alert threshold for PGA triggering in gal. Default is 9999 gal, and triggering will activate DO1.
PGA_WARNING_THRESHOLD	≥ 0	Set the warning threshold for PGA triggering in gal. Default is 9999 gal, and triggering will activate DO2.

[PALERT_LOCAL_MODE] Setting Detail		
Setting Details	Setting Content	Explanation
RECORD_RAW	YES/NO	Set the log file waveform data to be unfiltered. Default is NO.
RING_CHANNELS	1 ~ 4	The machine provides users with direct access to sensor data through Linux's shared memory, with a Key ID of 2000. The default value of this setting is 3. For data format, refer to the relevant shared memory ring section below.
RING_SECONDS	5 ~ 200	Set the length of sensor data stored in shared memory, in seconds. Default is 0, meaning this feature is not enabled.
RING_FILTERED	YES/NO	Set whether the data in shared memory is filtered. Default is NO.
RTC_BATTERY_LOW_TH	< 10	When the voltage of the RTC battery is below this value, the LCD will display an error message. Default is 2.5V.
RTC_SOURCE	RPI/CPU	Set whether the RTC is controlled by the CPU or RPI. Default is RPI. Note that this setting must be configured by FAE based on hardware, and incorrect settings can lead to system errors.
RTD_FROM_FILE	Waveform_File_Name	Added in version 4.56. Set to replace sensor data with an input file. This function is for research purposes and should not be used in general. The file format is CSV with three floating-point data per line, in gal. Sampling rates are based on settings such as SPS1000, SPS400.
RTD_CHECKSUM	YES/NO	The machine can send sensor RTD data via TCP port. This setting determines whether the data packet has an error-checking byte. Default is NO. Refer to the explanation in the following sections for the RTD packet format.

[PALERT_LOCAL_MODE] Setting Detail		
Setting Details	Setting Content	Explanation
RTD_IP	IP:PORT	Set the IP and Port number of the remote TCP port. If you are not using this feature, you can comment out or delete this setting.
RTD_BITS	16/24	Choose between 16 or 24 bits for the RTD packet. Default is 16; 24-bit is not yet supported.
SAMPLING_RATE	50/100/200/400/500/1000	Choose the data sampling rate of the system (per second). Default is 100. SPS1000 does not support 400. SPS400 does not support 500 and 1000. If the system does not have SPS1000 or SPS400 settings, the maximum sampling rate is 200.
SENSOR_TYPE	PALERT220/PALERTV10/PALERTV11	Choose the type of sensor. Default has no such setting. Note that this is a hardware-related setting and must be confirmed and operated by FAE. Incorrect settings can cause the system to fail.
SERIAL_NO	0 ~ 65535	Set the serial number of the machine, which can only be a numeric type. This setting will also be placed in the Modbus points. It is recommended to use a range of 0 to 65535. The serial number is set at the factory, and if the user changes it, it is recommended to retain the original serial number for future reference during calibration.
SERVER_IP	IP1:PORT1/IP2:PORT2/IP3:PORT3	Set the information for up to three servers for the machine's active external connections, including IP address and port.

[PALERT_LOCAL_MODE] Setting Detail		
Setting Details	Setting Content	Explanation
SERVER_PASSWORD	PASSWORD1/PASSWORD2/PASSWORD3	If the machine is set to the China Earthquake Administration mode, this setting provides the corresponding connection password for the server.
SERVER_STREAM_MODE_TAIWAN	1/2/4/8/16	Set the default streaming output packet format after connecting to the server. Refer to the explanation in the following sections for information on streaming packet formats.
SPIKE_DATA	FIRST_DATA/INTER_DATA	Choose the method of excluding spikes by using the first data or filling with the average.
SPS400/SPS1000	YES/NO	Set the data transmission speed of the CPU. Note that this setting is related to hardware and must be set by FAE. Incorrect settings can cause the system to fail.
SPS_CH0 SPS_CH1 SPS_CH2 SPS_CH3	50 、 100 、 200 、 400 、 500 、 1000	Special settings for the China Earthquake Administration allow different sampling rates to be set for different channels, but it is not recommended for regular users. Specifically, SPS1000 does not support 400, and SPS400 does not support 500 and 1000. If the system is not configured with SPS1000 or SPS400, it means that the maximum sampling rate is 200.

[PALERT_LOCAL_MODE] Setting Detail		
Setting Details	Setting Content	Explanation
STATION_NET	Up to 2 half-width characters	miniSEED uses SCNL to identify the station. S represents Station, which is the station name. C represents Channel. If the user sets it as HL, the three axes output will be HLZ, HLN, HLE. N represents Network, which is the monitoring network code. L represents Location, which is the vertical position of the station. In the context of your settings: STATION_NAME corresponds to S. STATION_CH_NAME corresponds to the three axes of C. STATION_CH_GEO_NAME corresponds to the fourth axis of C. STATION_NET corresponds to N. STATION_LOCATION corresponds to L.
STATION_NAME	Up to 5 half-width characters	
STATION_CH_NAME	Up to 2 half-width characters	
STATION_CH_GEO_NAME	Up to 2 half-width characters	
STATION_LOCATION	Up to 2 half-width characters	
STA_LTA_TRIG_ENABLE	STA_LTA_TRIG_ENABLE	Enable or disable the use of STA/LTA trigger detection mode.
STA_WIDTH	STA_WIDTH	Set the time duration of STA in seconds, recommended value is 2.
LTA_WIDTH	LTA_WIDTH	Set the time duration of LTA in seconds, recommended value is 40.
STA_LTA_THRESHOLD	STA_LTA_THRESHOLD	Set the trigger threshold of STA/LTA (positive edge), recommended value is 3.
STA_LTA_STOP_THRESHOLD	STA_LTA_STOP_THRESHOLD	Set the stop threshold for STA/LTA triggered events (negative edge), recommended value is 1
STA_LTA_EVENT_TIME	STA_LTA_EVENT_TIME	Set the duration of events after STA/LTA trigger in seconds, recommended value is 30.

[PALERT_LOCAL_MODE] Setting Detail		
Setting Details	Setting Content	Explanation
STA_LTA_RELAY 1	STA_LTA_RELAY 1	Set the activation threshold of local DO1 after STA/LTA event trigger, in gal.
STA_LTA_RELAY 2	STA_LTA_RELAY 2	Set the activation threshold of local DO2 after STA/LTA event trigger, in gal.
STA_LTA_RELAY 3	> 0	Set the activation threshold for local DO3 after STA/LTA event trigger, measured in gal. These three sets of DOs can be independently controlled.
STREAMING_IN_MSEC	0 ~ 1000	Configure the time duration of streaming packets in China Seismological Bureau mode. This setting also affects streaming packets in Mode 4 and 8. The unit is milliseconds, with a recommended value of 1000.
STREAM_TRIG_PACKET	YES NO	If set to YES and Pd trigger mode is enabled, and if Mode 1 or 2 streaming packet output is selected, a Mode 2 packet will be transmitted at the trigger moment. Another Mode 2 packet will be sent 3 seconds later. This is useful for remote P-wave early warning functionality. The default value is NO. Note: Mode 2 packet refers to the header part of Mode 1.
VECTOR_INTENSITY	YES NO	When using the old version of CWB seismic intensity standards (before 2020), you can choose to calculate seismic intensity in either horizontal or three-axis modes. The default value is NO.
VECTOR_RMS	YES NO	Set to use RMS, and the data will be stored in the Modbus point PALERT_VECTOR. The default value is NO.

[PALERT_LOCAL_MODE] Setting Detail		
Setting Details	Setting Content	Explanation
VECTOR_RMS_SECOND	1 ~ 30	This setting determines the time duration for RMS calculation, with the unit in seconds, and the default value is 1.
WATCH_TIME	5 ~ 255	Set the duration of the warning period after Pd and PGA events are triggered.
WARNING_TIME	5 ~ 255	Set the duration of the alert period after Pd and PGA events are triggered.
ZEROING_PERIOD_IN_MINUTE	> 1	Set whether to activate periodic zeroing calculation, with the unit in minutes. If you are not using this feature, you can delete this line. It is recommended to enable this feature if AUTO_OFFSET is not activated, and the suggested value is 60 minutes.
ZEROING_DATA_LENGTH	> 400	Set the number of data points required for automatic zeroing.

5-2-3-46 [PRE_EVENT_SECOND]

Set the number of seconds for the seismic record's "pre-event" recording. The maximum value is 200, and the default is 20.

Syntax and Example:

```
[PRE_EVENT_SECOND]
10
```

Explanation: Sets the pre-event recording duration to 10 seconds for seismic records.

5-2-3-47 [POST_EVENT_SECOND]

Set the number of seconds for recording seismic events "after" the occurrence. The maximum value is 600, and the default is 20.

Syntax and Example:

```
[POST_EVENT_SECOND]
10
```

Explanation: This configuration sets the duration for recording seismic events "after" the occurrence 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 FAE. Incorrect settings may result in the system not functioning properly. The default value is YES.

Syntax:

```
[POWER_OFF_SWITCH_EXIST]
YES/NO
```

5-2-3-49 [RECORD_INTENSITY]

Set the intensity threshold value for initiating seismic event recording. Can be used in conjunction with the settings in [PRE_EVENT_SECOND] and [POST_EVENT_SECOND].

Syntax and Example:

```
[RECORD_INTENSITY]
```

```
5.1
```

Explanation: Set the activation threshold for seismic recording to a magnitude of 5.1 (CWB 2020 seismic scale).

5-2-3-50 [RECORD_PGA]

Set the PGA threshold value for initiating seismic event recording. Can be used in conjunction with the settings in [PRE_EVENT_SECOND] and [POST_EVENT_SECOND]. This setting has the same effect as [RECORD_INTENSITY], and both operate with OR logic, meaning recording is triggered if either condition is met.

Syntax and Example:

```
[RECORD_PGA]
```

```
8.5
```

Explanation: Set the activation threshold for seismic recording to start whenever PGA is greater than or equal to 8.5 gal.

5-2-3-51 [RELAY_INTENSITY]

Set the intensity thresholds for DO actions during seismic events. This setting performs an OR operation with the results of calculations from the [PALERT_LOCAL_MODE] settings PD_TRIG_ENABLE, PGA_TRIG_ENABLE, and STA_LTA_TRIG_ENABLE. Please 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 trigger intensities for DO1 to DO3 to be, respectively, for a magnitude 1 earthquake, a magnitude 3 earthquake, and a weak magnitude 5.1 earthquake.

5-2-3-52 [RELAY_PD]

Set the Pd thresholds for DO actions during seismic events. The unit is centimeters. This setting performs an OR operation with the results of calculations from the [PALERT_LOCAL_MODE] settings PD_TRIG_ENABLE, PGA_TRIG_ENABLE, and STA_LTA_TRIG_ENABLE. Please refer to section 15 for the logic diagram of DO actions.

Syntax:

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

Example:

```
[RELAY_PD]
RELAY1 0.2
RELAY2 0.3
RELAY3 0.35
```

Explanation:

Set the trigger Pd values for DO1 to DO3 to be 0.2 cm, 0.3 cm, and 0.35 cm, respectively.

5-2-3-53 [RELAY_PGV]

Set the velocity value thresholds for DO actions during seismic events. The unit is mm/second. This setting performs an OR operation with the results of calculations from the [PALERT_LOCAL_MODE] settings PD_TRIG_ENABLE, PGA_TRIG_ENABLE, and STA_LTA_TRIG_ENABLE. Please 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 trigger velocity values for DO1 to DO3 to be 1.5 mm/sec, 15 mm/sec, and 30 mm/sec, respectively.

5-2-3-54 [RELAY_RESET_BY_MANUAL]

After the seismic event concludes, the DO will automatically reset. Users can configure it to manual reset mode (press the button for three seconds or remotely control it through the Modbus protocol). The default value is NO.

Syntax and Example:

```
[RELAY_RESET_BY_MANUAL]
YES
```

Explanation: Set the DO to require manual reset.

5-2-3-55 [RELAY1_GAL]

Set the threshold for DO1 action during a seismic event based on PGA. This setting, combined with the calculations from [PALERT_LOCAL_MODE] options PD_TRIG_ENABLE, PGA_TRIG_ENABLE, and STA_LTA_TRIG_ENABLE, results in an OR operation. Please refer to section 15 for the logic diagram of DO actions.

Syntax and Example:

[RELAY1_GAL]

8.5

Explanation: Set the PGA threshold for DO1 action during a seismic event to 8.5 gal.

5-2-3-56 [RELAY2_GAL]

Set the threshold for DO2 action during a seismic event based on PGA. This setting, combined with the calculations from [PALERT_LOCAL_MODE] options PD_TRIG_ENABLE, PGA_TRIG_ENABLE, and STA_LTA_TRIG_ENABLE, results in an OR operation. Please refer to section 15 for the logic diagram of DO actions.

Syntax and Example:

[RELAY2_GAL]

80

Explanation: Set the PGA threshold for DO2 action during a seismic event to 80 gal.

5-2-3-57 [RELAY3_GAL]

Set the threshold for DO3 action during a seismic event based on PGA. This setting, combined with the calculations from [PALERT_LOCAL_MODE] options PD_TRIG_ENABLE, PGA_TRIG_ENABLE, and STA_LTA_TRIG_ENABLE, results in an OR operation. Please refer to section 15 for the logic diagram of DO actions.

Syntax and Example:

[RELAY3_GAL]

250

Explanation: Set the PGA threshold for DO3 action during a seismic event to 250 gal.

5-2-3-58 [RELAY_CONTROL_BY_ERR]

When the system detects any errors, such as low external voltage, abnormal NTP, etc., DO1 will turn off, and DO2 will turn on. If everything is normal, DO1 will turn on, 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 for 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 output status of DO through Modbus (REMOTE_RELAY, 0x031E). Note that even if allowed, the output of DO is the logical OR result with the Modbus points.

Syntax and Example:

[REMOTE_CONTROL]
RELAY NO

Explanation:

Set the local device to not allow control of DO through Modbus. The default setting is YES.

5-2-3-61 [REPLAY]

Configure the local device to read a specific waveform file and simulate the settings parameters based on the data from the waveform file, such as Relay control, filtering effects, etc. The filenames for specific waveform files are aData.txt, bData.txt, cData.txt, and they should be accompanied by the correct sampling rate settings.

Syntax and Example:

[REPLAY]
RELAY NO

5-2-3-62 [RESTORE_IP_WHILE_IP_ERROR]

When dynamic IP acquisition is set, if the system acquires an incorrect 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] - Single line.

Explanation:

- Enable the functionality to restore network settings from backup file and restart the network.
- If not using this feature, you can delete this line.

5-2-3-63 [SERVICE]

Set the local machine to actively contact the service server every 60 seconds and check for any updates. The checking process involves the following steps:

1. Prioritize the user-defined server connection. If it fails or there is no service requirement, use palertService.sanlien.com.
2. Send GET /index.php?inst= px01SerialNo HTTP/1.1.
3. Check the response message service_code
 - 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);
4. System call: system(buf).

Syntax and Example:

```
[SERVICE]
SERVICE_DOMAIN 192.168.255.100
SERVICE_DIR /service
```

5-2-3-64 [SINGLE_RELAY_MODE]

Configure the output of Digital Outputs (DO) to be either consolidated into a single output or individual outputs. The system default is NO, meaning each DO is independently controlled without interference. If set to YES, when DO3 is activated, DO2 and DO1 will be forced to turn off, and when DO2 is activated, DO1 will be forced to turn off.

Syntax and Example:

```
[SINGLE_RELAY_MODE]
YES
```

Explanation: Set DO to consolidated single output.

5-2-3-65 [SI]

Enable Spectral Intensity (SI), where $SI = \frac{1}{2.4} \int_{0.1}^{2.5} Sv(T, h) dT$

Syntax and Example:

```
[SI]
WARNING_TH 30
ACTION_TH 60
EVENT_SECOND 10
SAMPLING_TIME 60
FILE_DELAY_TIME 60
```

[SI] Settings		
Setting Detail	Setting Content	Description
WARNING_TH	> 0	Warning threshold, unit: centimeters per second.
ACTION_TH	> 0	Action threshold, unit: centimeters per second.
EVENT_SECOND	>= 10	Duration of the triggered event, unit: seconds.
SAMPLING_TIME	10 ~ 120	Interval for calculating SI values, unit: seconds.
FILE_DELAY_TIME	> 0	Interval for writing data 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 specified value must be greater than 2048 bytes.

Syntax and Example:

```
[SOCKET_OPTION]
SEND_BUF_SIZE 10240
```

Explanation: Set the TCP transmission buffer capacity to 10240 bytes.

5-2-3-67 [STORAGE_CONFIG]

Set the path for data storage, 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:

- Earthquake data is stored in /media/usb/eqEvent/.
- MiniSEED data ring is stored in /media/usb/mSeed/.
- System logs are stored in /media/usb/log/.
- DIN data is stored in /media/usb/din/.
- ISO2631 data is stored in /media/usb/iso2631/.
- DORTS data is stored in /media/usb/dorts/.

5-2-3-68 [SWITCH_UNLOCK_CODE]

Users can use this setting to configure the unlock code to prevent unauthorized access to the buttons.

Syntax and Example:

```
[SWITCH_UNLOCK_CODE]
123321
```

Explanation: Set the unlock code for the buttons to be 123321, meaning users must press the buttons in sequence for 1 second, pause for 2 seconds, press for 3 seconds, pause for 3 seconds, press for 2 seconds, pause for 1 second to unlock

5-2-3-69 [TEST_MODE_CONFIG]

This setting provides users with the ability to customize a self-test mode (enter the mode by pressing the button for 9 seconds, exit the mode by pressing for 9 seconds again, or automatically exit the mode if no button is pressed for 60 seconds). Users can use this setting to test the digital outputs (DO).

[TEST_MODE_CONFIG] Settings		
Setting Detail	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
SWITCH_SECOND	1 ~ 10	The duration, in seconds, to enter this stage by pressing the button.
RELAY1 RELAY2 RELAY3	ON OFF	Whether the corresponding DO is activated or deactivated upon entering this stage.
RELAY_HOLD_SECOND	> 0	The duration, in seconds, for the corresponding DO action.
PLAY_FILE	File name for playing audio	The device does not support playing audio files, but you can set the keyword "eewsCancel.wav," which functions as the cancel action equivalent to pressing the button for three seconds in normal mode.

5-2-3-70 [VWHUB_CONFIG]

Configure information for uploading event files to an FTP server.

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 /
```

Explanation:

- Set the FTP server's IP to 192.168.255.100.
- The connection port is set to 2121.
- The user ID is "admin," and the password is "adminpw."
- Uploaded files will be placed in the root directory ("/") on the FTP server.

5-2-3-71 [WATCHDOG]

Configure the delay, in seconds, before activating the watchdog when the program starts. The default value is 1 second.

Syntax and Example:

```
[WATCHDOG]
5
```

Explanation: Set a delay of 5 seconds after startup before activating the watchdog.

- Note: This setting is hardware-related and must be configured by an FAE.

5-2-3-72 [WHITE_IP]

Configure the IPs allowed to communicate with the device using the Modbus protocol. If this feature is enabled, only the listed IPs will be able to establish a connection.

Syntax and Example:

```
[WHITE_IP]
192.168.37.44
```

Explanation: Enable the whitelist feature, allowing only the IP address 192.168.37.44 to connect to the device using the Modbus protocol.

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

This setting allows the device to directly control the ZT-2000 DO module produced by ICPDAS. It specifies the Modbus starting point for the ZT-2000 DO module, with a range from 0 to 65535.

Syntax and Example:

```
[ZT-2000_DO_START_POINT]
0
```

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

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

This setting allows the device to directly control the ZT-2000 DO module produced by ICPDAS. It specifies the Modbus ending point for the ZT-2000 DO module, with a range from 0 to 65535.

Syntax and Example:

```
[ZT-2000_DO_END_POINT]
31
```

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

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

This setting enables the device to directly control the ZT-2000 DO module produced by ICPDAS. It specifies the PGA activation threshold for 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.

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

This setting allows the device to directly control the ZT-2000 DO module produced by ICPDAS. It specifies the Modbus starting point for the ZT-2000 DO module, with a range from 0 to 65535.

Syntax and Example:

```
[ZT-2000_DO_START_POINT]
0
```

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

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

This setting allows the device to directly control the ZT-2000 DO module produced by ICPDAS. It specifies the Modbus ending point for the ZT-2000 DO module, with a range from 0 to 65535.

Syntax and Example:

```
[ZT-2000_DO_END_POINT]
31
```

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

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

This setting enables the device to directly control the ZT-2000 DO module produced by ICPDAS. It specifies the PGA activation threshold for 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 setting allows the device to directly control the ZT-2000 DO module produced by ICPDAS. It specifies the IP address of the ZT-2000.

Syntax and Example:

[ZT-2000_IP]

192.168.255.100

Explanation: Set the IP address of the ZT-2000 to 192.168.255.100.

6. Performance Configuration File Explanation

6.1 memsCalData

This configuration file stores calibration data for the built-in sensor. Please refrain from making arbitrary modifications, as doing so may impact 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 is present. The offsets for the A, B, and C axes are 5, 4, and -12 gal, respectively.
- The gains for the A, B, and C axes are 1.001, 0.9782, and 1.0101, respectively.
- The machine's serial number is 12235.
- Please note that this configuration is similar to the functionality of [PALERT_LOCAL_MODE] SERIAL_NO, but this configuration takes precedence.

6.2 geophoneData

When an external velocity sensor is used as the fourth axis, this file is configured to define its characteristics. It 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:

- Specifications for the velocity sensor:
 - Output gain: 28.3 V/M/Sec
 - Damping ratio: 0.7
 - No damping resistor
 - Internal resistance: 360 ohms
 - Mass: 83 grams
 - Natural frequency: 4.5 Hz

6.3 initSetup.cfg

This file stores the 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 triggering event threshold to 3.5.
- Set the minimum stop threshold for events triggered by STA/LTA to 1.
- When in the mode of the China Earthquake Administration, set the stream mode to 1 for communication with the server.
- 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 axes, 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: PGAEvent(PeakGround Acceleration) Bit 3: STA/LTA Event (Short-Term Average/Long-Term Average)
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
0x006F	R	LTA_FLAG	0: STA/LTA initialization in progress, unable to detect earthquakes. 1: STA/LTA detecting earthquakes normally.
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 F330 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 F330 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 F330 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 F330 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 F330 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
0x0086			Reserved
0x0087			Reserved
0x0088	R	PD	After detecting the P-wave, Palert F330 will begin calculating the real-time Pd value, unit: 0.001 cm.
0x0089	R	TOUC	After detecting the P-wave, Palert F330 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_THRESH OLD	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 0 IP Address 1, 2
0x00B2	R	SERVER1_IP34	TCP Server 0 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.
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 triple 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 STALTA event completion, unit: 0.01. Only used when set to China Earthquake Administration mode.
0x00FF	R	STALTA_RELAY2_THRESHOLD	When triggered by STALTA, 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
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°C

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 exact 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 Relay output status
0x00A9	ISO2631_RELAY_REG	ISO2631 Relay output status
0x00B3	INSTRUMENT_CODE	1: PX01 Taiwan mode 2: Cube 3: PX-02
0x00C7 ~ 0x00DA	MBUS_LCD_MAP_ADDR	LCD real-time display characters, a total of 2 * 20 characters.
0x018F	GPS_LOCK	GPS signal lock
0x0190	GPS_QTY	Number of satellites locked
0x0191	GPS_ANTENNA	Antenna status. Note that this feature is not guaranteed as it is not an NMEA standard; it is for reference only. 0: NG (Not Good) 1: OK (Good)
0x0192	GPS_LAT_DEG	Latitude - degrees (+ for North, - for South)
0x0193	GPS_LAT_MIN	Latitude - minutes
0x0194	GPS_LAT_SEC	Latitude - 0.01 seconds
0x0195	GPS_LON_DEG	Longitude - degrees (+ for East, - for West)
0x0196	GPS_LON_MIN	Longitude - minutes
0x0197	GPS_LON_SEC	Longitude - 0.01 seconds
0x0199	NTP_ST	NTP server stratum level, 16 means unavailable.

7.3 AI (3xxxx)

Modbus AO Point Table (3xxxx) Read Only		
Register	Label	Description
0x019B	NTP_WHEN	NTP server stratum level, 16 means unavailable. Synchronization frequency, unit: seconds.
0x019C	NTP_POLL	Time elapsed since the last synchronization to the present, unit: seconds.
0x019D	NTP_REACH	An 8-bit left-shift register value used to test whether the connection to the server is stable. 377 indicates a stable connection.
0x019E	NTP_DELAY	In floating-point format. Round trip time from local to remote node or server communication, unit: milliseconds.
0x01A0	NTP_DELAY_INT	In integer format. Round trip time from local to remote node or server communication, unit: milliseconds.
0x01A1	NTP_OFFSET	In floating-point format. Time offset between the host and NTP server, the closer the offset is to 0, the closer the time between the host and NTP server, unit: milliseconds.
0x01A3	NTP_OFFSET_INT	In integer format. Time offset between the host and NTP server, the closer the offset is to 0, the closer the time between the host and NTP server, unit: 0.01 milliseconds.
0x01A4	NTP_JITTER	In floating-point format. Average deviation from the NTP server, unit: milliseconds. The smaller the absolute value of this value, the more accurate the device's time.
0x01A6	NTP_JITTER_INT	In integer format. Average deviation from the NTP server, unit: milliseconds. The smaller the absolute value of this value, the more accurate the device's time.

Modbus AO Point Table (3xxxx) Read Only		
Register	Label	Description
0x01F3	SI_YEAR	Enable SI calculation, occurrence time of SI value - year.
0x01F4	SI_MONTH	Enable SI calculation, occurrence time of SI value – month.
0x01F5	SI_DAY	Enable SI calculation, occurrence time of SI value – day.
0x01F6	SI_HOUS	Enable SI calculation, occurrence time of SI value – hour.
0x01F7	SI_MINUTE	Enable SI calculation, occurrence time of SI value – minute.
0x01F8	SI_SECOND	Enable SI calculation, occurrence time of SI value – second.
0x01F9	SI_PEAK	Maximum value of SI, unit: 0.01
0x01FA	SI_REALTIME	Real-time value of SI, unit: 0.01.
0x0333	ISO_DATA_COUNTER	Data update counter for ISO2631.
0x0334	ISO_XY_GAL	Horizontal composite vector value for ISO2631, unit: 0.1 gal.
0x0335	ISO_Z_GAL	Vertical value for ISO2631, unit: 0.1 gal.
0x0336	ISO_XY_DB	Horizontal composite vector value for ISO2631, unit: 0.01 dB
0x0337	ISO_Z_DB	Vertical value for ISO2631, unit: 0.01 dB.
0x0338	ISO_MAX_DB	Maximum value for ISO2631, unit: 0.01 dB.
0x0339	ISO_DB_LATCH	Maximum value for ISO2631 (held), unit: 0.01 dB.
0x033A		Reserved
0x033B		Reserved

Modbus AO Point Table (3xxxx) Read Only		
Register	Label	Description
0x033C	ISO_RELAY	DO output status for ISO2631.
0x0347	DORTS_DATA_COUNTER	Data update counter for DORTS.
0x0348	DORTS_2HZ_DB	2 Hz dB value for DORTS, unit: 0.01 dB.
0x0349	DORTS_4HZ_DB	4 Hz dB value for DORTS, unit: 0.01 dB.
0x034A	DORTS_8HZ_DB	8 Hz dB value for DORTS, unit: 0.01 dB.
0x034B	DORTS_16HZ_DB	16 Hz dB value for DORTS, unit: 0.01 dB
0x034C	DORTS_31.5HZ_DB	31.5 Hz dB value for DORTS, unit: 0.01 dB.
0x034D	DORTS_63HZ_DB	63 Hz dB value for DORTS, unit: 0.01 dB.
0x034E	DORTS_MAX_DB	maximum dB value for DORTS, unit: 0.01 dB.
0x034F	DORTS_DB_LATCH	maximum (held) dB value for DORTS, unit: 0.01 dB.
0x0350	DORTS_RELAY	DO output status for DORTS.
0x0351		Reserved
0x0352		Reserved
0x2773	RELAY1_PGA	PGA activation value for DO1, unit: 0.1 gal.
0x2774	RELAY2_PGA	PGA activation value for DO2, unit: 0.1 gal.
0x2775	RELAY3_PGA	PGA activation value for DO3, unit: 0.1 gal.
0x2776		Reserved
0x2777	RELAY1_PGV	PGV activation value for DO1, unit: 0.1 mm/sec.

Modbus AO Point Table (3xxxx) Read Only		
Register	Label	Description
0x2778	RELAY2_PGV	PGV activation value for DO2, unit: 0.1 mm/sec.
0x2779	RELAY3_PGV	PGV activation value for DO3, unit: 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.
0x277E ~ 0x2782		Reserved
0x2783	SINGLE_RELAY_MODE	0: Individual control of three sets of DO. 1: Aggregated single output for DO
0x2784	RELAY_BLINK_MODE	0: No flashing for DO output. 1: When DO output is ON, it flashes for 0.5 seconds.
0x2785	RELAY_CONTROL_BY_ERR	0: System errors detected do not affect the output of DO. 1: DO is compound-controlled by the system's detection of errors, please refer to the explanation of the [RELAY_CONTROL_BY_ERR] setting.
0x2786	RELAY_RESET_BUTTON_MANUAL	0: After the event output, DO is automatically reset by the system. 1: The reset of DO requires a three-second button press.

8. Web Operating Interface

The local device provides a web-based operating interface, offering basic users a simple setup and operational functionality. Please refer to other manuals for details on the web operating 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

Mode 1	Mode 2	Integer Number	Description (Value in parentheses indicate Palert Modbus registers addresses)
▲	▲	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)	system time-hour (150)
▲	▲	13 (low byte)	system time-minute (151)
▲	▲	14	event time-second (146)
▲	▲	15	event time-10 msecond
▲	▲	16	Serial number (200)
▲	▲	17	Reserved
▲	▲	18	PGV within 1 second (125)
▲	▲	19	Reserved
▲	▲	20	PGA within 10 seconds (140)
▲	▲	21	Reserved
▲	▲	22	Pd warning threshold (162)
▲	▲	21	PGA warning threshold (161)
▲	▲	22	Reserved

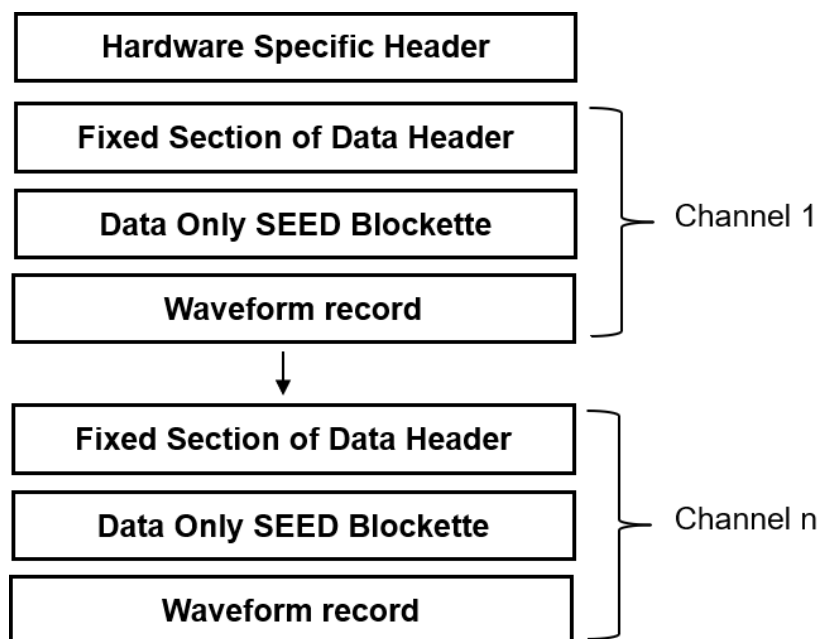
Mode 1	Mode 2	Integer Number	Description (Value in parentheses indicate Palert Modbus registers addresses)
▲	▲	23	Pd flag (139)
▲	▲	24	Pd watch threshold (164)
▲	▲	25	PGA watch threshold (121)
▲	▲	26	Intensity now (109)
▲	▲	27	Intensity maximum (110)
▲	▲	28	PGA within 1 second
▲	▲	29	Reserved
▲	▲	30	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)

Mode 1	Mode 2	Integer Number	Description (Value in parentheses indicate Palert Modbus registers addresses)
▲	▲	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
▲	▲	73	Synchronized Character 0x3031
▲	▲	74	Packet Length

Mode 1	Mode 2	Integer Number	Description (Value in parentheses indicate Palert Modbus registers addresses)
▲	▲	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 corresponds to the MiniSEED format, which is the predominant data storage format in seismology. It consists of a header, blockettes, and data. The Mode 4 packet is based on these features, and its format is as follows:



The Hardware Specific Header contains information specific to Palert+ hardware.

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

No.	Field name	Byte
16	Admin. Server0 IP	4
17	Admin. Server1 IP	4
18	Palert+ 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	

No.	Field name	Type	Byte	Comment
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
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

No.	Field name	Type	Byte	Comment
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			

Regarding Miniseed, please refer to the SEED Manual at the following link:
[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 primarily divided into four parts.

Definition	Length	Remark
Fixed	11 bytes	
Header	N bytes	According to the "Fixed" definition, the maximum length is 255 bytes.
Data	N bytes	According to the "Fixed" definition, the maximum length is 65535 bytes
CRC16	2 byte	

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

Fixed:

Definition	Length	Remark
SYNC	4 bytes	[0] = 0x53 (S) [1] = 0x59 (Y) [2] = 0x4E (N) [3] = 0x43 (C)
Packet No	2 bytes	0 ~ 65535
Header Length	1 byte	0~255
Data Length	2 bytes	0 ~ 65535
Packet Length	2 bytes	0 ~ 65535 , total length include CRC16

SYNC				Packet No		Header Length	Data Length		Packet Length	
0x53	0x59	0x4E	0x43							

Header:

Definition	Length	Remark
UnixTime	5 bytes	If 4 bytes are used, there will be an overflow issue in the year 2038.
0.1 Msec	2 bytes	0 - 9999 The value 10 represents 1 millisecond.
SyncFlag	1 byte	Bit 0: NTP synchronization, 0 for failure, 1 for success.
Scale	4 bytes	The system uses meters as the reference unit. 0.01 represents the input in centimeters. 0.001 represents the input in millimeters. The units for velocity or acceleration depend on the sensor type.
SPS	2 bytes	Users can configure the sampling rate via the web interface. Setting it to 100 means 100 samples per second (100 sps).
SensorType	1 byte	The factory default settings cannot be modified. 0: AC217 1: AC220 2: Geophone 3: Palert+ 4: Palert S3 5: DMS24
ChannelCnt	1 byte	The factory default settings cannot be modified. 1: 1-axis 2: 2-axis 3: 3-axis 4: 4-axis
Serial Number	4 bytes	Device serial number, user-configurable via the web interface.

Data (float)

- Illustrated here for 1 axis

4 bytes	4 bytes	4 bytes	...	4 bytes
X1	X2	X3	...	Xn

- Illustrated here for 2-axis

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

- Illustrated here for 3-axis

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

At a sampling rate of 200 sps with the pALERT F330, and with each of the three-axis outputting 200 data points, taking the example of the second packet with a sequence number of 4649. The Linux system used is in Little Endian format.

Byte Position	Value	Remarks
0	0x53	S
1	0x59	Y
2	0x4E	N
3	0x43	C
4	0x02	PacketNo: 0x0002
5	0x00	
6	0x18	HeaderLen: 20→0x18

Byte Position	Value	Remarks
7	0x 60	DataLen 2400 → 0x0960
8	0x 09	
9	0x7F	PacketLen: (11+24+4*3*200+2) = 2437 → 0x0985
10	0x09	
11	0xB9	UnixTime: 2022/03/30 @ 05:57:11 (UTC) →1648619831 seconds since Jan 01 1970. (UTC) 1648619831 → 0x6243F137
12	0x0F	
13	0xFB	
14	0x5D	
15	0x00	
16	0xC4	Msec (0~9999) 0.502(s) → 5020(0.1ms) → 0x139C
17	0x09	
18	0x01	Time Synchronization
19	0x0a	0.01 → 3c23d70a It represents the current length unit in centimeters (cm).
20	0xd7	
21	0x23	
22	0x3c	
23	0xE8	200 sps → 0x00C8
24	0x03	
25	0x03	pALERT F330
26	0x03	3-axis output
27	0xC8	S/N 4649 → 0x00001229
28	0x4E	
29	0x00	
30	0x00	

Byte Position	Value	Remarks
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. Ring Data Format for Shared Memory

The pALERT F330 exchanges data with other applications through Shared Memory in Linux, with a key value of 2000. Users must include the file `palertShm.h`. The data format for Shared Memory is divided into two parts: header and data.

Type	Bytes	Explanation
Header	65536	<pre> 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; </pre>

Type	Bytes	Explanation
Data		<pre>typedef struct{ char waveCh; time_t waveTime; float wave[SHM_RING_SPS]; } shmRing_t;</pre> SHM_RING_SPS is 1000
Total Length		$65536 + \text{sizeof}(\text{shmRing_t}) * \text{ringChs} * \text{ringSeconds}$ Regarding ringChs and ringSeconds, please refer to the [PALERT_LOCAL_MODE] settings for RING_CHANNELS, RING_SECONDS, and RING_FILTERED.

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

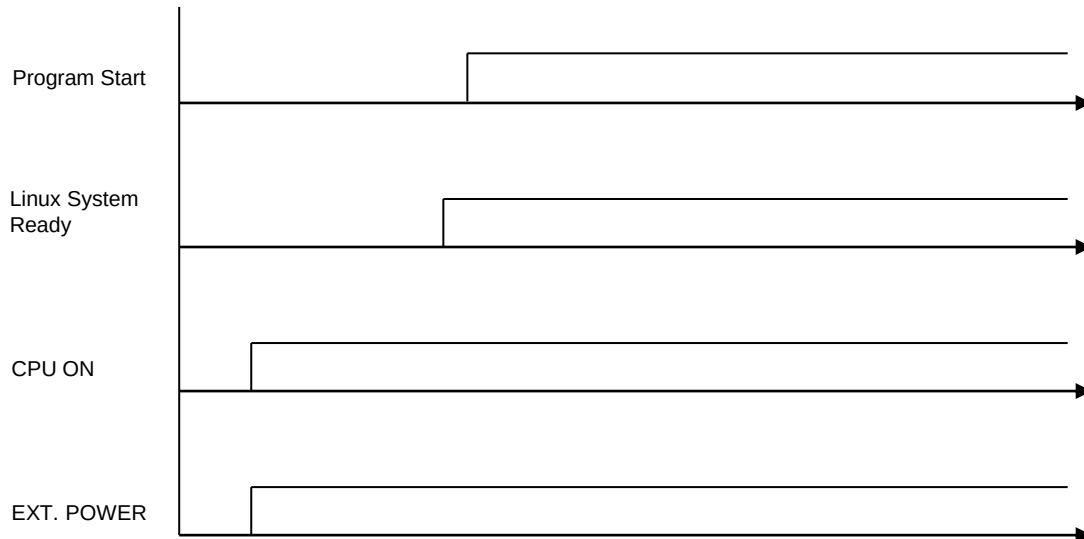
- 16-bit with checksum

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

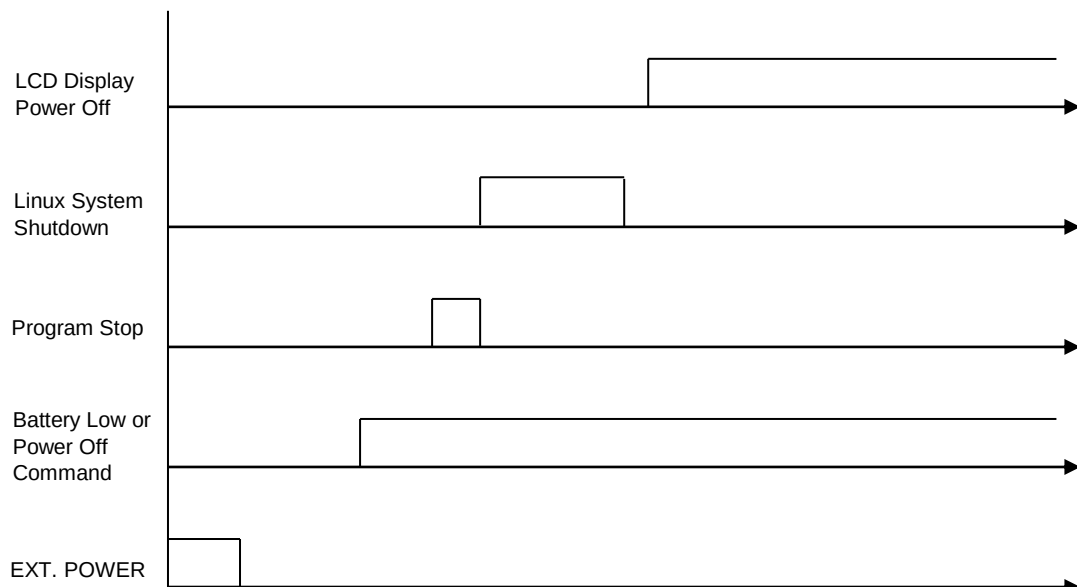
$$\text{checksum} = 0x0A + 0x0D + XH + XL + YH + YL + ZH + ZL$$

12. Time Sequence Diagram

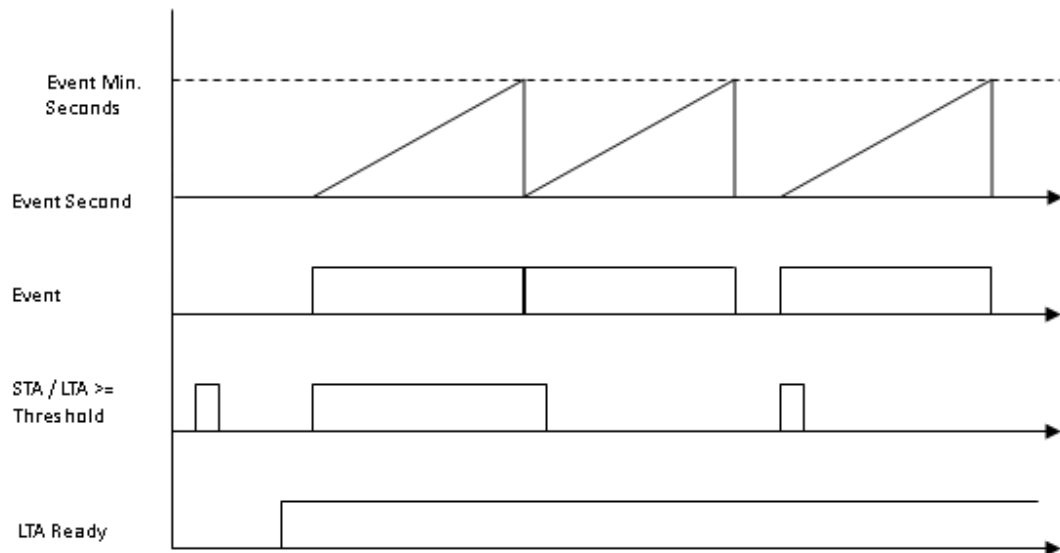
12-1 Power-On Sequence Diagram



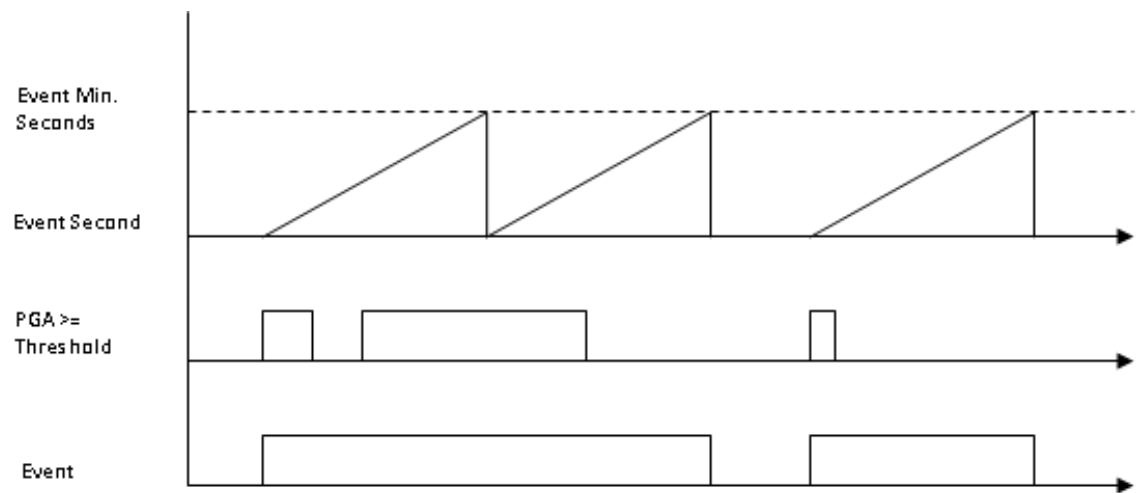
12-1 Power-Off Sequence Diagram



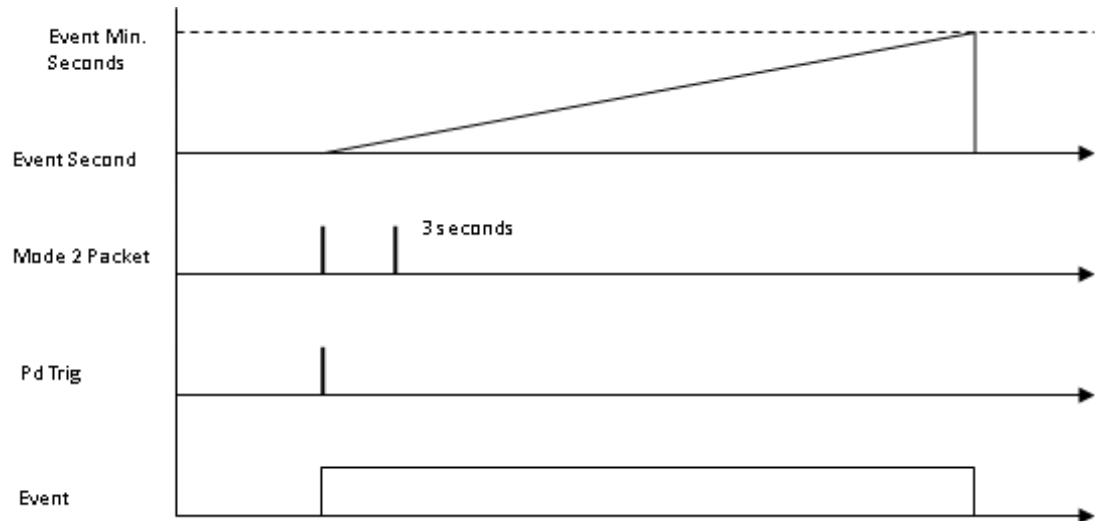
12-3 STA / LTA Earthquake Detection Timing Diagram



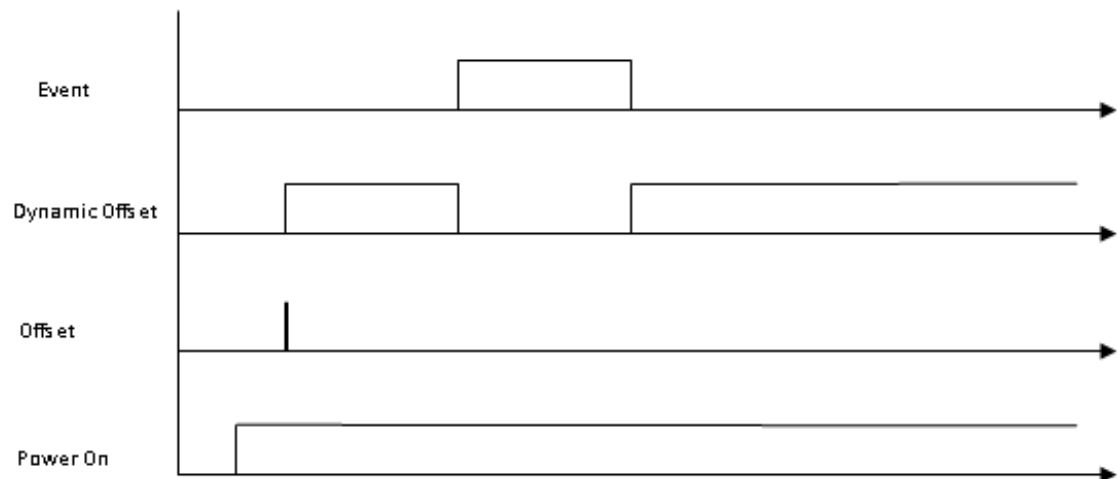
12-4 PGA Earthquake Detection Timing Diagram



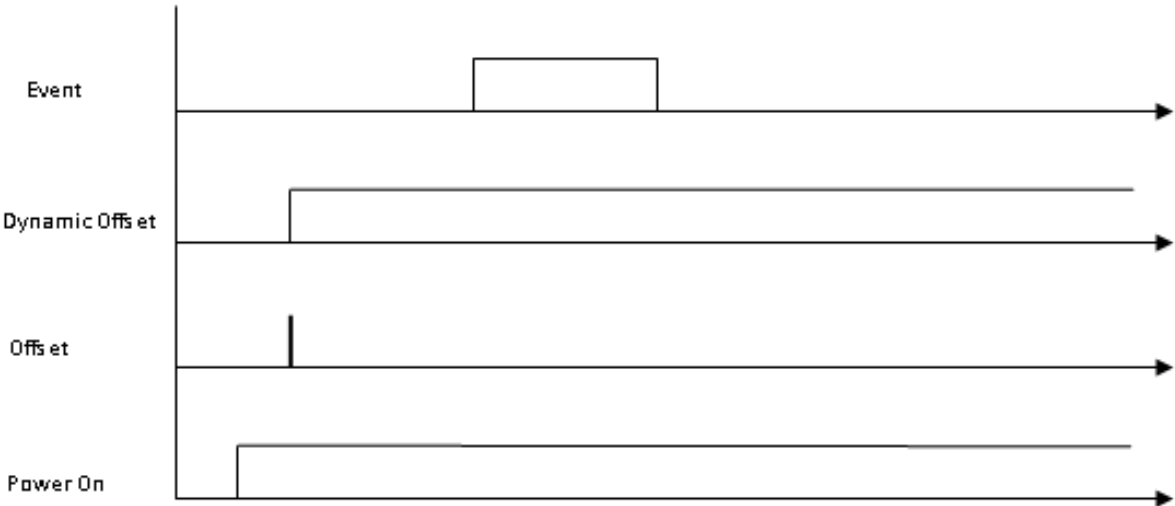
12-5 Pd Earthquake Detection Timing Diagram



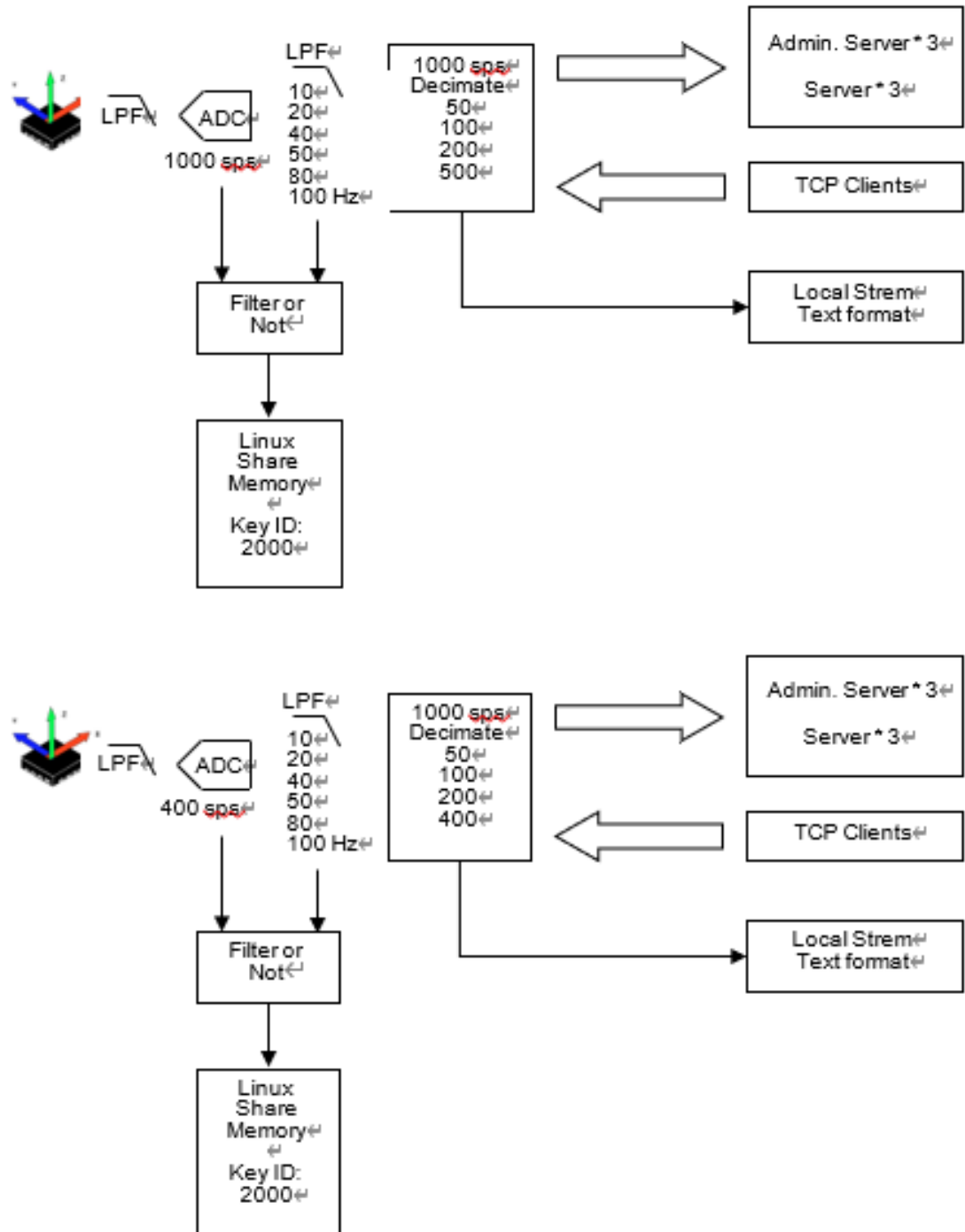
12-6 Zeroing Process (AUTO_OFFSET = TRTC)



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 F330 manufactured in 2021 comes with Wi-Fi AP mode for easy management. To facilitate the management of pALERT F330, you can enable the Wireless Network AP mode.

Key Points:

- When the wireless network of pALERT F330 is set to AP mode, pALERT F330 will not be able to connect to other APs via wireless network.
- The SSID (Service Set Identifier) of each pALERT F330 is unique and includes the hardware serial number.
- How to enable pALERT F330 Wi-Fi AP mode:
 - `sudo systemctl enable hostapd`
 - `sudo systemctl start hostapd`

How to disable pALERT F330 Wi-Fi AP mode:

- `sudo systemctl stop hostapd`
- `sudo systemctl disable hostapd`
- To prevent users from using pALERT F330's Wi-Fi AP to access the wired internet, the wireless network is not forwarded to the wired network during configuration.

Usage of pALERT F330's Wi-Fi AP feature:

- Use the Wi-Fi functionality on your computer or mobile device to connect to pALERT F330. The default password is p@ssw0rd. You can modify the password according to your needs, but be sure to record the changed password.
- After connecting to pALERT F330, its IP address is 192.168.15.1. Use the web browser on your mobile device or computer to open the device's webpage.

15. DO Action Logic Diagram

The output of DO1~3 is determined by an OR logic control based on two major categories and seven settings, which are divided into trigger logic and control types:

1. Trigger Logic Settings:

- PGA_TRIG_ENABLE
- PD_TRIG_ENABLE
- STA_LTA_TRIG_ENABLE

When any of the trigger settings are activated, the corresponding DO output is generated based on the individual settings. For example, if PD triggers, it will produce the DO1 output based on PD_WATCH_THRESHOLD and DO2 output based on PD_WARNING_THRESHOLD.

2. Control Type Settings:

- [RELAY_INTENSITY]
- [RELAY_PD]
- [RELAY_PGV]
- [RELAYn_PGA] (where n represents 1~3)

The control type settings only take effect when trigger logic detects an event. If you don't want the control types to take effect, set the values to 99999.



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