Sanlien Technology Corp.

CUBE

Onsite Control & Display Interface

User Manual

V1.07
2022/03

Be the frontier of environmental monitoring

www.sanlien.com

Menu

Version Record

Date	Description	Author
20201203	■ Initial Version 1.00	Ching
20201222	■ Revision: Mode16 Description	Ting
20210407	■ Added FAKE_PPS, V4.51 ■ Added user-customizable file storage path, V4.51 ■ Added [HAZUS_RSHD], V4.56	Ching
20210408	■ Added [HAZUS_RSHD] Threshold Reference Table ■ Added AP mode explanation	Ting
20210617	■ v1.05 Firmware 4.59 ■ Added PACKET_NO in MODE 1 packet ■ Added [EVENT_FILE_OPTION] ■ Added [REMOTE_CONTROL] ■ Description of factory reset button function	Ting
20211125	■ "V1.06 Firmware 4.61 ■ Supplemented continuous event detection logic ■ Added NTP OFFSET_TH to control NTP time synchronization quality ■ Removed Modbus point mapping for the first five Palert 200 Bytes Header	Ting
20220322	■ V1.07 Firmware 4.63 ■ Added [RELAY_PD]	

1. Features

CUBE is a centralized seismic alarm recorder and display device developed based on experience in earthquake disaster prevention applications. It can interface with up to 30 seismic instruments via a network. In terms of output, it provides an interface for integration with a voice broadcasting system, enabling voice broadcasts and control of devices such as elevators through the built-in three-out-of-two event detection mechanism. The triggered event records can be used in conjunction with the Rapid Structural Health Diagnosing (it's optional) to assess the safety of structures. Additionally, when using different recording modes, it can be applied to bridge safety and vibration monitoring. The device also offers external rainfall measurement functionality for on-site rainfall monitoring.

CUBE is designed with high efficiency and low power consumption. It includes 16 GB of internal storage space. Users can monitor the device's operation status in real-time through the LCD panel and three LEDs. The internal battery automates power management, shutting down automatically after a certain time when external power is interrupted and powering up automatically when external power is restored. The design allows for wall mounting without the need for additional heat dissipation mechanisms. The front features a 7-inch Human-Machine Interface (HMI) displaying earthquake and rapid building health diagnosis information. Additionally, it has a built-in speaker for local area warning voice announcements. The all-voltage design allows users to apply the device in various voltage scenarios.

Offers the option to enable earthquake early warning services. Currently, the device supports communication protocols for connecting to the CWB (Central Weather Bureau), Sanlien, and NCREE earthquake early warning servers.

Sends alert messages through Line and MQTT, and SCADA systems can connect to the device via the Modbus communication protocol.

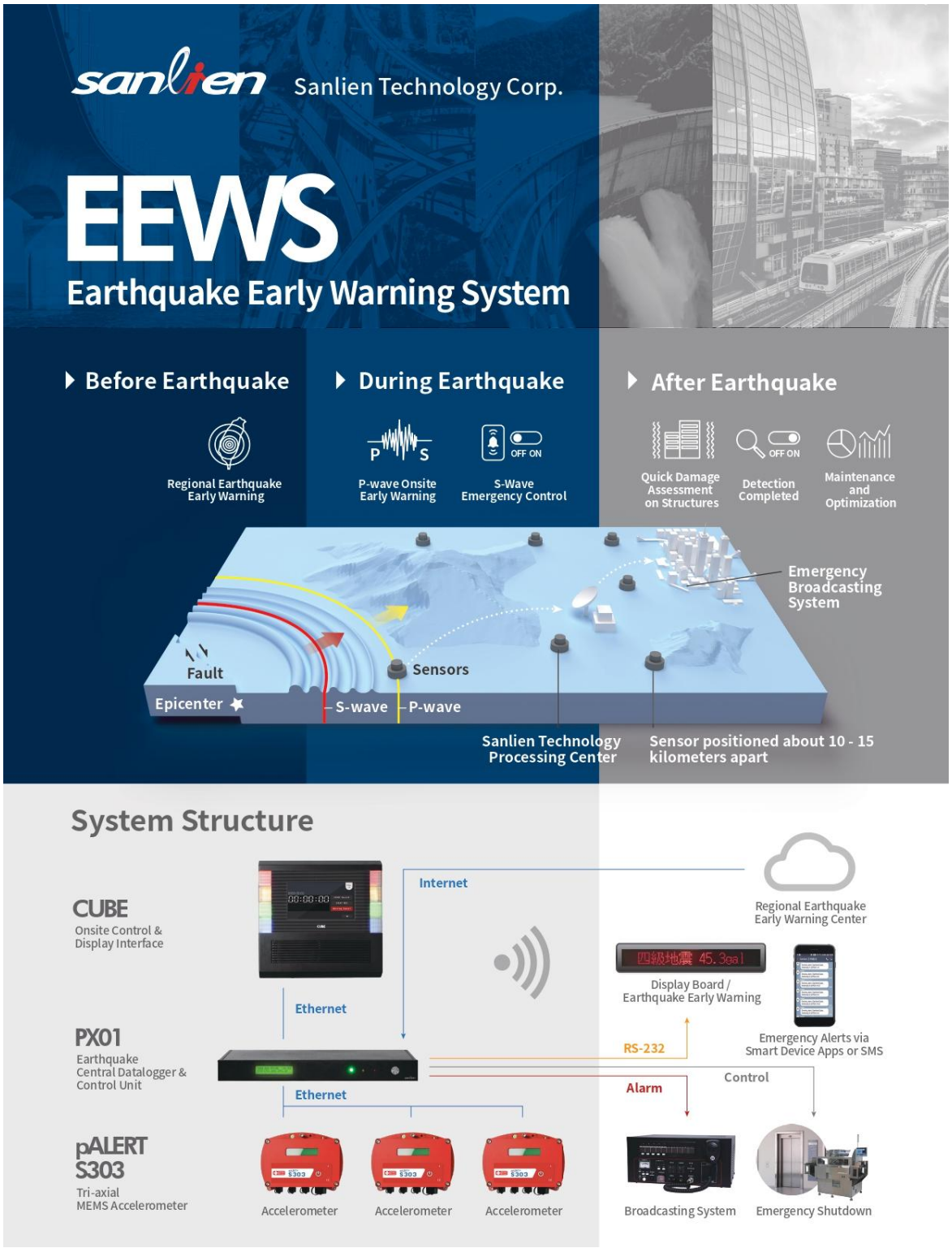
Control of alarm voice and relay outputs based on event trigger logic, PGA, PGV, and seismic intensity.

Provides the option for event recording or continuous recording, with customizable file lengths.

Supports MMI, KMA, JMA, GB/T, and CWB seismic intensity scales.

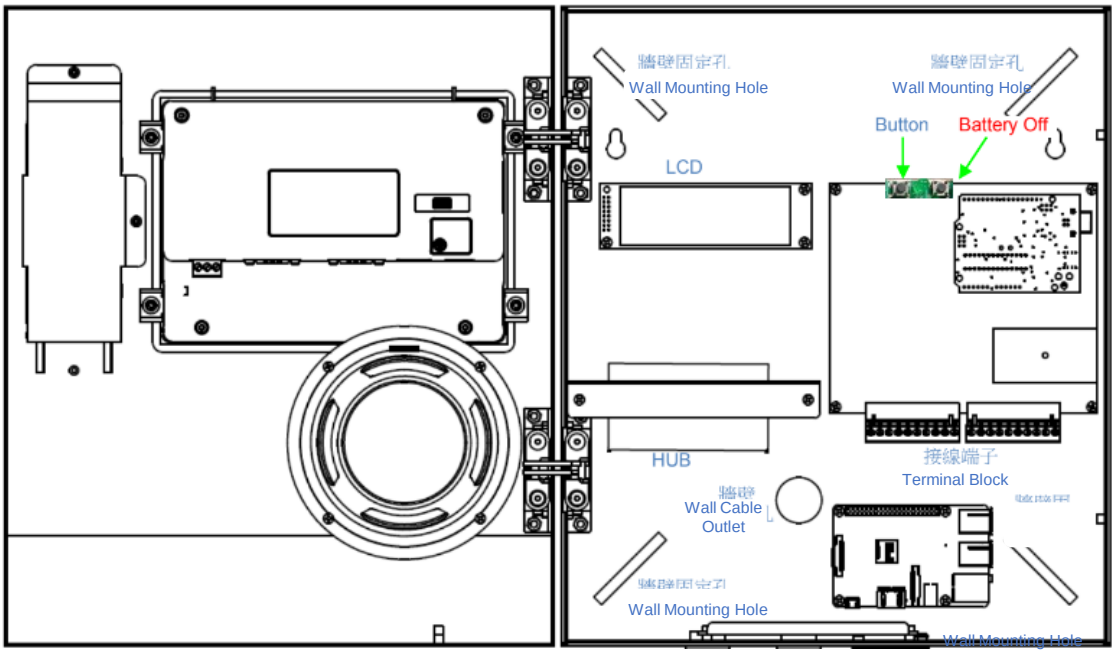
Offers real-time waveform forwarding to allow system integration and reduce communication traffic.

2. System Service Architecture



3. Hardware

Internal Diagram



Internal Terminal Block

Item	Description
Battery Off	When there is no external power supply, it is possible to forcibly disconnect the internal battery from the system
Button	Function buttons, please refer to the explanation below
LCD	20 characters, 2-line LCD display, please refer to the explanation below
24 VDC	24 VDC power input, current requirement is 2 A
GND	0 V, ground
Audio Switch	Analog volume output control switch that synchronously activates this contact when voice output is active
Audio Out+, -	Voice Signal Output
Rain Gauge IN+, -	Rain Gauge Contact Signal Input
Rain Gauge Out	Rain Gauge Contact Signal Output
RL1	Relay1 Contact Output, Contact Rating 120 VAC, 0.5 A
RL2	Relay2 Contact Output, Contact Rating 120 VAC, 0.5 A
RL3	Relay3 Contact Output, Contact Rating 120 VAC, 0.5 A
+12 VDC	12 VDC Power Output, Maximum 1A
GND	0 V, ground

3-1 Powering On and Off

3-1-1 Powering On

When 24 VDC power is supplied, CUBE will automatically power on and enter the booting state. If the external power is removed at this time, the internal battery will continue to supply power, ensuring that the device continues to operate until the program starts normally.

3-1-2 Powering Off

Turn off the power switch. At this point, the system is powered by the internal battery, and the LCD screen will display a countdown timer. After 12 seconds, it will initiate the shutdown procedure and automatically disconnect the battery power upon completion.

3-1-3 Automatic Power-On

If the system is operating while powered on and loses external power for more than 12 seconds, it will automatically shut down. If the power is restored afterward, the system will automatically restart.

3-2 Touch Screen

The touch screen not only displays the status of the device but also allows for button operations and volume adjustment. To access the button interface, press and hold the screen's top left corner for two seconds. The button screen will automatically appear. To return to the main screen, simply tap once on the button screen.

3-3 LCD Display Screen

A 20-character, 2-line screen that provides users with real-time status information about the device.

3-3-1 Backlight

To conserve power, the backlight is normally off during operation. However, it will automatically turn on in the following two cases:

When the user presses a button.

When the system detects an event or a connection error.

Once the above events are resolved, the backlight will automatically turn off according to the user-set duration.

3-3-2 Display Content

The first line typically displays "CUBE Vx.xx" every 10 seconds, where Vx.xx represents the software version.

The second line is the message display area. In the event of an event or anomaly, messages will appear in this line.

The total number of characters displayed on the LCD, which is 40 bytes, will also be updated in synchronization with Modbus points. Please refer to the following section for details on Modbus points.

3-4 Buttons

In addition to remote control using the Modbus communication protocol, this device can also be controlled locally using buttons. If you wish to prevent unauthorized access and operation of the buttons, please refer to the section on button password protection in the configuration file provided later.

Please note that to prevent accidental button presses and to ensure the safety of the device, do not press the buttons within 10 seconds after a successful startup.

3-4-1 Button Duration Explanation

When you press a button, the LCD will display a duration in seconds, and when you release the button, it corresponds to the button duration.

Button Duration	Description
1	Display IP Address
2	Restart NTP Service
3	Cancel Alarms
4	Restart Network, NTP Service, and Software
5	Display Program Version Date
6	Restart Software
7	Update Software via FTP
8	Manually Start Logging
9	Test Mode
12	Shutdown
Compound	To Restore Factory Settings, please refer to 3-3-11

3-4-2 Press for 2 seconds - Voice Test and Restart NTP Service

The system will emit a test voice saying "PX01 voice test, PX01 vocal testing."

If there is a persistent issue with obtaining the correct time from the NTP server due to NTP server or network adjustments, you can press for 2 seconds to force the system to restart the NTP service. For details on how to configure NTP, please refer to the instructions in the following section.

3-4-3 Press for 3 seconds - Cancel Alarms

The system will emit a voice saying "Cancel alarms."

When the system detects events, it will determine whether to record or activate the relay based on the user's settings. You can press for three seconds to cancel events.

3-4-4 Press for 4 seconds - Restart Network, NTP Service, and Software

CUBE's configuration file is only read when the program is started. Therefore, if there are any changes, the system must be restarted for them to take effect. This function also restarts the network and NTP service.

3-4-5 Press for 5 seconds - Display Program Version Date

CUBE provides control not only for software versions but also for version dates.

3-4-6 Press for 6 seconds - Restart Software

Similar to pressing for four seconds but only restarting the software.

3-4-7 Press for 7 seconds - Update Software via FTP

CUBE periodically adds new features. If the instrument's network settings allow internet access, you can use this function to automatically update the software. After releasing the button after seven seconds, the LCD display will show "FTP updating..." and attempt to obtain the latest software in the background. If the update is successful, the system will automatically restart.

3-4-8 Press for 8 seconds - Manually Start Logging

If you wish to manually initiate the device's logging function, release the button after eight seconds. When the LCD displays "RecStandby, press 2," press for two seconds to start logging. The LCD will display "Manual Rec...". To stop recording, press for three seconds.

3-4-9 Press for 9 seconds - Test Mode

When CUBE's Relay is connected to external devices, you can use this function to test if it can drive external devices correctly.

After pressing for nine seconds, the LCD will display "Test Mode: xx." Pressing for an additional 10 seconds will enter self-test mode, where Relay1 to Relay3 will cycle act at a two-second rate.

To exit the test mode, you can press for nine seconds again, or simply do not press any buttons for 60 seconds to allow the system to automatically exit the test mode.

3-4-10 Press for 12 seconds - Shutdown

After pressing for 12 seconds, the shutdown procedure will initiate, and the system will turn off. Because the device has an internal battery for backup power, it is necessary to turn off the external power to perform a complete shutdown.

3-4-11 Factory Reset

If a user forgets the device's IP and password, they can use the factory reset function to restore it. Once successful, the network IP will be restored to 192.168.255.1, and the username and password will be reset to "pi" and p@ssw0rd.

Button Sequence:

The unlock code is 15162612, consisting of eight digits. This means the user must press the buttons in the following sequence: 1 second press, pause for 5 seconds, 1-second press, pause for 6 seconds, 2-second press, pause for 6 seconds, 1-second press, pause for 2 seconds, and then pause. (A pause of at least one second is required between button presses.)

4. Device Configuration

The CUBE system is built on the Linux operating system, so it can be divided into two main parts: Linux system services and CUBE application layer functionality.

PX01 Software
Linux Operating System
Hardware

4-1 Linux System Services

This chapter will provide an explanation of the Linux system services used by CUBE. Users are encouraged to refer to information related to the Linux system.

4-1-1 SSH Service

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

4-1-2 TCP/IP Service

TCP/IP Services	
Edit Configuration File	sudo nano /etc/network/interfaces Use this command to edit the configuration file for setting the IP address or using DHCP to obtain an IP.
Start Service	sudo /etc/init.d/networking start
Stop Service	sudo /etc/init.d/networking stop
Restart Service	sudo /etc/init.d/networking restart

Update: Due to adjustments in the way Raspbian configures networking, starting from 2021, the following method is adopted:

TCP/IP Services	
Edit Configuration File	sudo nano /etc/dhcpcd.conf Use this command to edit the configuration file for setting the IP address or using DHCP to obtain an IP.
Start Service	sudo systemctl enable dhcpcd.service
Stop Service	sudo systemctl disable dhcpcd.service
Restart Service	sudo systemctl start dhcpcd.service

Note: When using this method, you need to modify /etc/network/interfaces, keeping only source-directory /etc/network/interfaces.d, and you can delete or comment out the rest of the settings. If you are not using this method for network configuration and are certain that you want to use a static IP, it is recommended to disable the dhcpcd service.

dhcpcd.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: Enabling DHCP

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

Your provided configuration in dhcpcd.conf sets a fallback static profile for the eth0 interface in case DHCP fails to obtain an IP address.

```
profile static_eth0
static ip_address=192.168.255.1/24
static routers=192.168.255.254
static domain_name_servers=192.168.255.254
# fallback to static profile on eth0
interface eth0
fallback static_eth0
```

4-1-3 DHCP Service

DHCP Service	
Edit Configuration File	sudo nano /etc/dhcp/dhclient.conf Use this command to edit the configuration file for setting DHCP-related information, such as renewal intervals and the default IP to be used when unable to obtain an IP from the DHCP server.
Restart DHCP Client	sudo dhclient -r

4-1-4 DNS Service

DNS Service	
Edit Configuration File	sudo nano /etc/resolv.conf Use this command to edit the /etc/resolv.conf configuration file, where you can specify settings related to Domain Name Service (DNS). This file is typically used to define DNS server addresses for domain name resolution.
Restart DHCP Client	sudo /etc/init.d/dns-clean restart".

4-1-5 NTP Service

NTP Services	
Edit Configuration File	sudo nano /etc/ntp.conf Use this command to edit the /etc/ntp.conf configuration file, where you can specify information related to network time synchronization servers.
Start Service	sudo /etc/init.d/ntp start
Stop Service	sudo /etc/init.d/ntp stop
Restart Service	sudo /etc/init.d/ntp restart

4-2 CUBE Software Services

4-2-1 Instrument Configuration Architecture

There are four files related to configuration, stored in the /home/pi/Desktop/vAlert/bin directory. The relationships between these files are as follows:

vAlert8.cfg, vAlert8Common.cfg, and hardware.cfg are of the same attribute and serve as functional configuration files. However, they follow a priority order, with hardware.cfg having the highest priority, followed by vAlert8Common.cfg, and finally vAlert8.cfg.

Users can utilize this feature to place instrument-specific settings in vAlert8.cfg. If CUBE is used to form a monitoring network system, common network-specific settings can be placed in vAlert8Common.cfg. As for hardware.cfg, it is reserved for manufacturing-specific settings, and users should generally avoid making changes to this file.

initSetup.cfg stores initial settings for individual instrument operations, which are not typically needed for normal usage.

<table>
<tr><td>vAlert8.cfg</td><td rowspan="3">initSetup.cfg</td></tr>
<tr><td>vAlert8Common.cfg</td></tr>
<tr><td>hardware.cfg</td></tr>
<tr><td colspan="2">CUBE software</td></tr>
</table>

4-2-2 Configuration Syntax

In the configuration files, there are two main types of settings: single-item settings and multi-item settings. Regardless of the type of setting, each setting must start with "[" and end with "]." The system determines the end of an item based on an empty line or the absence of a sub-item. You can also use "#" or "!" at the beginning of a line to indicate a comment (using "#" won't be displayed in the web interface, while "!" will be displayed). Please refer to the example vAlert8.cfg configuration file below.

Please note:

- All settings are case-sensitive.
- For compatibility with the instrument, 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
```

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
```

Here is a 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
FTPPORT 22
USER palertPlus
PASSWORD 1977
FTPDIR /home/data
```

Empty line, ending the configuration section [MQTT_CONFIG]

Empty line, ending the configuration section [MQTT_CONFIG]

The system will only read the following configuration items from the settings mentioned above:

```
[MQTT_CONFIG]
IP 127.0.0.1
PORT 1883

[VWHUB_CONFIG]
FTPIP 192.168.255.100
FTPPORT 22
USER palertPlus
PASSWORD 1977
FTPDIR /home/data
```

4-2-3 Functional Configuration File Item Descriptions (vAlert8.cfg, vAlert8Common.cfg, and hardware.cfg)

4-2-3-1 [AC200GW]

In addition to connecting to the Palert series (16-bit streaming packet mode 1, 2), CUBE can also connect to network acceleration accelerometers AC217 and AC220 (24-bit streaming packet mode 16) and, together with the built-in seismic monitoring algorithm, turns these AC200 series network accelerometers into virtual Palert seismographs.

CUBE can support a total of 30 seismographs, meaning that the combined total of Palert series [PALERT_IP] and AC200 series [AC200GW] devices should not exceed 30. If you have parameters set up with [PALERT_IP] or [AC200GW] only, the first device's IP represents the 0th device, and subsequent devices are numbered sequentially. If both [PALERT_IP] and [AC200GW] are used, the numbering starts with [PALERT_IP] and continues to [AC200GW] in order.

Syntax:

[AC200GW]
Configuration Details Configuration Contents

[AC200GW] Configuration Details Explanation		
Configuration Details	**Configuration Contents**	**Description**
IP	IP:Port:Mode Example 1 (AC200GW): 10.0.0.10:1968:-16 Example 2 (Palert+): 10.0.0.11:502:16	IP: The IP address of AC200GW Port: The port of AC200GW Mode: 16 or -16. 16 indicates that the network accelerometer will return Modbus response packets, while -16 indicates that it will not return Modbus response packets. Set to 16 when connecting to Palert+ and to -16 when connecting to AC217, AC220, or AC222.
GAIN0 GAIN1 GAIN2	-99999 ~ 99999	Set the gain for each axis. If the network accelerometer has already been calibrated for output, set it to 1.
OFFSET0 OFFSET1 OFFSET2	-99999 ~ 99999	Set the zero offset values for each axis. If the network accelerometer has already been calibrated for output, set it to 0.
SENSOR_ALIGNMENT	ZNE ZEN NZE NEZ EZN ENZ	Set the output direction for each axis. The default is ZNE.
FIR_MODE	YES NO	Use FIR or IIR filtering, the default value is NO.

[AC200GW] Configuration Details Explanation		
Configuration Details	**Configuration Contents**	**Description**
LPF	10, 20, 40, 50, 80, 100 (Hz)	Set the frequency for the low-pass filter in Hz. If not used, set it to 0. The system can choose to use IIR or FIR filters, and the characteristics of each are explained below. IIR Butterworth Frequency Degree 10 4 20 4 40 4 50 4 80 4 100 4 FIR Raised Cos Frequency Degree 10 32 20 32 40 32 50 32 80 32 100 32
HPF	0.1, 0.3, 0.5, 1, 2, 3 (Hz)	Set the frequency for the high-pass filter, unit in Hz. If not in use, set to 0. This machine uses a 2nd-order Butterworth filter.
AUTO_OFFSET	TRTC YES NO	Choose the automatic zeroing method. YES means always enable automatic zeroing, TRTC means automatic zeroing under normal conditions but not during events, and NO means no automatic zeroing.

[AC200GW] Configuration Details Explanation		
Configuration Details	**Configuration Contents**	**Description**
PD_TRIG_ENABLE	YES NO	Enable Pd trigger monitoring of earthquake events (P-wave displacement). The default value is NO.
PD_WATCH_THRESHOLD	>= 0.01 (cm)	Set the alert threshold for P-wave displacement in centimeters. The default value is 0.2.
PD_WARNING_THRESHOLD	>= 0.01 (cm)	Set the warning threshold for P-wave displacement in centimeters. The default value is 0.3.
PGA_TRIG_ENABLE	YES NO	Enable the PGA trigger for monitoring seismic events. The default value is NO.
PGA_WATCH_THRESHOLD	>= 0 (gal)	Set the PGA trigger threshold in gals (galileos). The default value is 9999.
PGA_WARNING_THRESHOLD	>= 0 (gal)	Set the PGA warning threshold in gals (galileos). The default value is 9999.
PGA_ACTION_THRESHOLD	>= 0 (gal)	Set the PGA trigger action threshold in gals (galileos). The default value is 9999.
STA_LTA_TRIG_ENABLE	YES NO	Set the detection mode to use STA/LTA for triggering.
STA_WIDTH	> 0 (second)	Set the duration for STA in seconds. The recommended value is 2 seconds.
LTA_WIDTH	> 0 (second)	Set the duration for LTA in seconds. The recommended value is 40 seconds.

[AC200GW] Configuration Details Explanation		
Configuration Details	**Configuration Contents**	**Description**
STA_LTA_THRESHOLD	> 0.05	Set the trigger threshold for STA/LTA (positive edge). The recommended value is 3.5.
STA_LTA_EVENT_TIME	3 ~ 200	Set the duration of the event after STA/LTA triggering in seconds. The recommended value is 30 seconds.
WATCH_TIME	5 ~ 255	Set the warning time duration after Pd and PGA event triggers.
WARNING_TIME	5 ~ 255	Set the duration of the warning time after Pd and PGA event triggers.
EVENT_MAX_SECONDS	>= 60	Set the maximum duration for event triggers in seconds, with a default value of 180 seconds.
STREAM_CLIENT	YES NO	Configure whether to forward the data as Mode 1 packets to port 501 + n + m, where n is the number of Palerts and m is the AC200GW's number.

4-2-3-2 [ADMIN_SERVER_IP]

This setting allows the local machine to actively connect to the outside. When the local machine's IP address is private and cannot be connected to from the internet, you can set the remote server's IP in this setting. After the connection is established, the local machine becomes a Modbus TCP server and can receive Modbus commands. The local machine can connect to a maximum of 5 Administration servers.

Syntax:

```
[ADMIN_SERVER_IP]
serverIP1:portNumber1
...
serverIP5:portNumber5
```

For example:

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

Explanation: Connect to the first server with an IP of 192.168.255.1 on port 1502, and connect to the second server with the domain name test.modbusserver.com on port 502.

4-2-3-3 [API_CONFIG]

When an event is triggered, this setting allows you to call a user-defined application. An event is defined as when PGA, STA/LTA, or Pd triggers, and its intensity exceeds the voice alarm threshold. The voice alarm threshold is determined based on whether it is daytime or nighttime and is influenced by the settings in [DAY_VOICEALARM_INTENSITY] and [NIGHT_VOICEALARM_INTENSITY].

Daytime or nighttime is defined based on [DAY_BEGIN_MINUTE] and [DAY_END_MINUTE]. These settings help determine when the daytime and nighttime periods start and end, which, in turn, influence the voice alarm threshold.

Syntax:

```
[API_CONFIG]
EEWS_API eewsApi
EARTHQUAKE_API userApiOnEventRising
PD_API_PARAMETER YES/NO
EARTHQUAKE_FALLING_API userApiOnEventFalling
RAIN_ALARM_API rainAlarmApi
RAIN_API (Solomon-specific)
EARTHQUAKE_API_BY_EVENT (Solomon-specific)
```

- EEWS_API: When there's a regional earthquake warning message, the eewsApi program is called.
- EARTHQUAKE_API: When the event's rising edge occurs, the system calls the userApiOnEventRising program.
- PD_API_PARAMETER: Used in conjunction with EARTHQUAKE_API, if set to YES, when the Palert message triggers and the PGA or PGV increases, the userApiOnEventRising API is called with the Pd value.
- EARTHQUAKE_FALLING_API: When the event's falling edge occurs, the system calls the userApiOnEventFalling program.
- When the MQTT service is enabled, the rainAlarmApi program is called whenever there's a rainfall warning.

For example:

[API_CONFIG]

EARTHQUAKE_API /home/pi/Desktop/vAlert/bin/eqAlert.sh

PD_API_PARAMETER YES

EARTHQUAKE_FALLING_API /home/pi/Desktop/vAlert/bin/uploadFile.sh

4-2-3-4 [AUTO_RECORD]

This setting allows for automatic recording on startup or scheduled start and stop recording functions.

Syntax:

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

Example 1:

```
[AUTO_RECORD]
AUTO_START YES
```

Explanation 1: Automatically start recording after program startup

Example 2:

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

Explanation 2:

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

4-2-3-5 [BACKUP_CONFIG]

Syntax: [BACKUP_CONFIG] A single line is sufficient.

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

4-2-3-6 [BACKUP_PROGRAM]

Syntax: [BACKUP_PROGRAM] A single line is sufficient.

Explanation: When this function is enabled, the program will back up the main program paInt.exe to paIntBak.exe every time it is executed.

4-2-3-7 [BA_DOOR_ADDRESS], [BA_DOOR_INTENSITY], [BA_HOST_IP]

CUBE can send Modbus TCP commands to open Modbus DO devices on the network when seismic events exceed a certain threshold. This function must be used in conjunction with the three settings: [BA_HOST_IP], [BA_DOOR_INTENSITY], and [BA_DOOR_ADDRESS].

Syntax and example:

```
[BA_HOST_IP]
192.168.255.100

[BA_DOOR_INTENSITY]
4

[BA_DOOR_ADDRESS]
150
```

This setting allows the automatic activation of the Modbus TCP device with an IP of 192.168.255.100 when the earthquake event exceeds magnitude 4. The relay address will be set to 150.

4-2-3-8 [BBOARD_FUNCTION_CONFIG], [BULLETIN_BOARD_IP], [BULLETIN_BOARD_ID]

This setting allows the configuration of bulletin board information, such as the IP address and ID of supported bulletin boards. The system can support up to 5 bulletin boards. The bBoardMsg.txt file can be used to display messages on the bulletin boards, which can be randomized during normal operation and automatically show real-time event information during earthquake events.

bBoardMsg.txt Syntax:

```
0, message 0
...
254, message 254
```

Note that the bulletin board IDs must not exceed 254.

[BBOARD_FUNCTION_CONFIG] Function Menu: Previous Function		
Function	**Description**	**Function Code**
MOVE_IN_LEFT	Move In From Left	0
MOVE_IN_RIGHT	Move In From Right	1
SCROLL_IN_INNER	Scroll Inward	2
OVERLAY_LEFT	Cover From Left	3
OVERLAY_RIGHT	Cover From Right	4
OVERLAY_UP	Cover From Top	5
OVERLAY_DOWN	Cover From Bottom	6

[BBOARD_FUNCTION_CONFIG] Function Menu: Previous Function		
Function	**Description**	**Function Code**
OVERLAY_INNER	Cover From Inside	7
OVERLAY_OUTER	Cover From Outside	8
OVERLAY_UP_DOWN	Cover ↑↓	9
OVERLAY_DOWN_UP	Cover ↓↑	10
SCROLL_IN_UP	Scroll In From Top	15
SCROLL_IN_DOWN	Scroll In From Bottom	16
DISPLAY_IMMEDIATELY	Appear Immediately	17
DISPLAY_TOGETHER	Appear At Once	18
SHOT_IN	Fly In	19
JUMP_IN	Bounce In	20
RAIN_IN	Rain	21
SNOW_IN	Snow	22
ANIMATION_IN	Animation In	23
TIME_IN	Time	29
DATE_IN	Date	30
RANDOM_IN	Random	31
SCROLL_IN_OUTER	Scroll Out From Bottom	32

[BBOARD_FUNCTION_CONFIG] Function Menu: Subsequent Functions		
Function	**Description**	**Function Code**
CONTINUE_OUT	Continue out	255
MOVE_OUT_LEFT	Move out to the left	0
MOVE_OUT_RIGHT	Move out to the right	1
SCROLL_OUT_INNER	Scroll inside	2
OVERLAY_LEFT	Overlay from the left	3
OVERLAY_RIGHT	Overlay from the right	4
OVERLAY_UP	Overlay from the top	5
OVERLAY_DOWN	Cover Down	6
OVERLAY_INNER	Cover Inward	7
OVERLAY_OUTER	Cover Outward	8
OVERLAY_UP_DOWN	Cover ↑↓	9
OVERLAY_DOWN_UP	Cover ↓↑	10
SCROLL_OUT_UP	Scroll Upward	15
SCROLL_OUT_DOWN	Scroll Downward	16
DISAPPEAR_IMMEDIATELY	Disappear Immediately	17
DISAPPEAR_TOGETHER	Disappear Together	18
SHOT_OUT	Shot Out	19
JUMP_OUT	Jump Out	20

[BBOARD_FUNCTION_CONFIG] Function Menu: Subsequent Functions		
Function	**Description**	**Function Code**
EVAPORATE_OUT	Evaporate	21
ROT_OUT	Corrode	22
ANIMATION_OUT	Animate Out	23
STOP_OUT	Stop	24
BLINK_OUT	Blink	25
BLINK_INVERSE_OUT	Inverse Blink	26
PAUSE_OUT	Pause	27
TIME_OUT	Time	29
DATE_OUT	Date	30
RANDOM_OUT	Random Transformation	31
SCROLL_OUT_OUTER	Scroll Outward	32

Syntax and Example:

```
[BULLETIN_BOARD_IP]
192.168.10.11:10002

[BULLETIN_BOARD_ID]
0

[BBOARD_FUNCTION_CONFIG]
WIDTH 20
MESSAGE_START_NO 160
MESSAGE_END_NO 196
MESSAGE_SKIP_TIMER 160
PRE_FUNCTION 29
POST_FUNCTION 30
HOLD_SECOND0 0
HOLD_SECOND1 1
ON_TIME 510
OFF_TIME 1080
```

Explanation:

- [BULLETIN_BOARD_IP] sets the IP of the bulletin board to 192.168.10.11, with a port of 10002.
- [BULLETIN_BOARD_ID] represents the ID as 0.
- WIDTH indicates that the bulletin board is 20 characters wide.
- Every 160 seconds (MESSAGE_SKIP_TIMER), a random message is selected for display from message number 160 (MESSAGE_START_NO) to 196 (MESSAGE_END_NO) in bBoardMsg.txt.
- The pre-function (PRE_FUNCTION) displays the time (29), and the post-function (POST_FUNCTION) displays the date (30).
- HOLD_SECOND0 and HOLD_SECOND1 represent the duration of the pre-function and post-function.
- The bulletin board opens at the 510th minute of the day (ON_TIME) and closes at the 1080th minute (OFF_TIME).

4-2-3-9 [BROADCAST_PORT]

In order to provide more efficient transmission of emergency messages, this setting allows the device to send broadcast packets to the specified UDP port during earthquake events. The device also sends time packets to this UDP port every minute. When using this feature, it can be paired with LF-01 (desktop seismic warning and CO2 display screen).

Syntax and Example:

```
[BROADCAST_PORT]
502
```

Explanation:

- Broadcast packets are sent to UDP port 502 on this domain. To disable this function, set it to 0.
- Time packet format:

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

- 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

4-2-3-10 [BROADCAST_CANCEL_TIMER]

Works in conjunction with [BROADCAST_PORT]. After the event ends, a UDP cancellation packet will be sent out when the specified number of seconds in this setting elapses. The default value is 5 seconds.

Syntax and Example:

```
[BROADCAST_CANCEL_TIMER]
10
```

Explanation:

UDP cancellation packet is sent 10 seconds after the event ends.

End packet format

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

4-2-3-11 [CEB_ALARM_MODE]

Set whether to use the four alarm sounds required by the China Earthquake Administration's early requirements to replace human voice alerts, with a default value of NO.

Syntax and Example:

```
[CEB_ALARM_MODE]
YES
```

Explanation: Use the four-alarm sounds required by the China Earthquake Administration's early requirements as alert sounds.

4-2-3-12 [CEB_BUZZER]

Configure the use of RS232 to control the alert relay output. In earlier versions, when the intensity exceeds a certain threshold, it sends "@%d\r" via RS232, where %d represents values from 1 to 4, and \r represents the carriage return character (0x0d).

Syntax:

```
[CEB_BUZZER]
BUZZER1_INTENSITY bz1Intensity
BUZZER2_INTENSITY bz2Intensity
BUZZER3_INTENSITY bz3Intensity
BUZZER4_INTENSITY bz4Intensity
```

Example:

```
[CEB_BUZZER]
BUZZER1_INTENSITY 1
BUZZER2_INTENSITY 3
BUZZER3_INTENSITY 4
BUZZER4_INTENSITY 5
```

4-2-3-13 [CEB_EEWS]

Set up the use of the China Earthquake Administration's regional early warning service. You can configure up to three service servers, each with a pair of information that includes SERVER_IP, USER, and PASSWORD.

Syntax:

```
[CEB_EEWS]
SERVER_IP cebServerIp1
USER user1
PASSWORD password1
CLIENT_ID clientId
MQTT_VERSION1 31
MQTT_VERSION2 311
MQTT_VERSION3 31
INTENSITY_CUSTOMIZE YES/NO
INTENSITY_COEF_A1 A1
INTENSITY_COEF_A2 A2
INTENSITY_COEF_A3 A3
INTENSITY_COEF_A4 A4
INTENSITY_COEF_B1 B1
INTENSITY_COEF_B2 B2
INTENSITY_COEF_B3 B3
INTENSITY_COEF_B4 B4
INTENSITY_0_AS_1 YES/NO
```

Example 1:

```
[CEB_EEWS]
SERVER_IP 190.168.255.100:26000
USER sanlien
PASSWORD 1234
MQTT_VERSION1 31
SERVER_IP 190.168.255.101:26001
USER trisco
PASSWORD 4321
MQTT_VERSION2 311
```

Explanation 1: Set up two China Earthquake Administration regional early warning service servers.

- The first server is located at IP address 192.168.100.100, port 26000, with MQTT version 3.1. It uses the USER "sanlien" and the password "1234".
- The second server is located at IP address 192.168.100.101, port 26001, with MQTT version 3.11. It uses the USER "trisco" and the password "4321".

Example 2:

```
[CEB_EEWS]
SERVER_IP 190.168.255.100:26000
USER sanlien
PASSWORD 1234
MQTT_VERSION1 31
SERVER_IP 190.168.255.101:26001
USER trisco
PASSWORD 4321
MQTT_VERSION2 311
INTENSITY_CUSTOMIZE YES
INTENSITY_COEF_A1 1
INTENSITY_COEF_A2 1
INTENSITY_COEF_A3 1
INTENSITY_COEF_A4 1
INTENSITY_COEF_B1 1
INTENSITY_COEF_B2 1
INTENSITY_COEF_B3 1
INTENSITY_COEF_B4 1
INTENSITY_0_AS_1 YES
```

Explanation 2:

- INTENSITY_CUSTOMIZE set to YES means that the user will use an elliptical attenuation relationship to calculate earthquake warning intensity. When calculating earthquake warning intensity using the elliptical attenuation relationship, you can define the coefficients of the polynomial.

- Elliptical attenuation relationship:
  - Ia = A1 + A2 × M - A3 × log10(R + A4)
  - Ib = B1 + B2 × M - B3 × log10(R + B4)
  - I = (Ia + Ib) / 2
  - Where M is the earthquake magnitude, and R is the epicentral distance.

4-2-3-14 [CHINA_PALERT_VERSION]

Set the connected Palert's Mode 1 packet to the mainland China version (with compression). The default setting is NO.

Syntax and Example:

```
[CHINA_PALERT_VERSION]
YES
```

Explanation: Set to use the mainland China version (with compression) of Palert.

4-2-3-15 [CHK_VERSION], [VOICE_ENGLISH]

Set the voice alerts to be in English. This setting must be used in conjunction with replacing all voice files in the /home/pi/Desktop/vAlert/bin directory with English voice files. The default value is NO.

Syntax and Example:

```
[CHK_VERSION]
YES
```

OR

```
[VOICE_ENGLISH]
YES
```

4-2-3-16 [CONFIG_TO_FILE]

When this feature is enabled, it will create a configRead.txt file in the /home/pi/Desktop/vAlert/bin directory based on the three configuration files vAlert8.cfg, vAlert8Common.cfg, and hardware.cfg that are read. Users can check this file to ensure that the configured functions have been correctly read by the system.

Syntax: [CONFIG_TO_FILE] is a single-line entry that should be placed at the beginning of the configuration file.

4-2-3-17 [CWB2019INTENSITY]

The Central Weather Bureau (CWB) revised its seismic intensity scale in 2019, and it was implemented starting in 2020. The main difference is that for earthquakes with a magnitude of four or lower, the Peak Ground Acceleration (PGA) determines the intensity, while for magnitude five and higher (inclusive), the Peak Ground Velocity (PGV) is used to calculate the intensity. If the instrument does not have any settings related to intensity calculation standards, it defaults to CWB's earlier intensity scale (using PGA as the calculation standard). This setting configures the instrument to use CWB's 2020 seismic intensity scale.

Syntax:

```
[CWB2019INTENSITY]
YES
```

- Earthquake intensity classification standards before 2020 by the Central Weather Bureau (CWB)

Intensity	Human Sensation	**PGA (gal)**
0	No Sensation	Below 0.8
1	Microquake	0.8 – 2.5
2	Light Tremor	2.5 – 8.0
3	Weak Tremor	8.0 – 25
4	Moderate Tremor	25 – 80
5	Strong Tremor	80 – 250
6	Severe Tremor	250 – 400
7	Violent Tremor	Above 400

- Earthquake intensity classification standards before 2020 by the Central Weather Bureau (CWB)

Intensity	Human Sensation	PGA (gal)	PGV (cm/s)
0	No Sensation	Below 0.8	
1	Microquake	0.8 – 2.5	
2	Light Tremor	2.5 – 8.0	
3	Weak Tremor	8.0 – 25	
4	Moderate Tremor	25 – 80	
5 weak	Strong Tremor		15 – 30
5 strong	Strong Tremor		30 – 50
6 weak	Severe Tremor		50 – 80
6 strong	Severe Tremor		80 – 140
7	Violent Tremor		Above 140

In order to correspond to the CWB 2020 Intensity Standard, the following values are used by this device:

CUBE Intensity Values	CUBE 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

4-2-3-18 [CWB_FILE]

This feature allows you to convert the generated event files into a special format used by the Central Weather Bureau Seismic Reporting Center, including both event information and waveform files in two separate files. These files are then uploaded to a designated SFTP server location using the SFTP protocol. To enable this functionality, you need to include the cwbUpload.exe program.

Syntax and Example:

```
[CWB_FILE]
ID ABCD
LONGITUDE 121.212
LATITUDE 23.456
SFTP_IP 192.168.1.20
SFTP_PORT 22
SFTP_USER user
SFTP_PASSWORD pswd
SFTP_FOLDER /home/user
```

Explanation:

- ID: Necessary information for event information and filenames.
- LONGITUDE and LATITUDE: Essential information for event details. Use negative values if your location is east longitude or south latitude.
- SFTP_IP, SFTP_PORT, SFTP_USER, SFTP_PASSWORD, and SFTP_FOLDER: Necessary information for uploading files.

4-2-3-19 [DAY_BEGIN_MINUTE], [DAY_END_MINUTE]

In practical applications, it's desirable to have different levels of voice alerts, control, and message notifications after an event trigger during the day or night. Users can define the daytime and nighttime periods for the device in minutes using these two settings. The unit is in minutes, with midnight (00:00) being 0 minutes, and 23:59 being 1439 minutes.

Syntax and Example:

```
[DAY_BEGIN_MINUTE]
480
[DAY_END_MINUTE]
1020
```

Explanation:

- [DAY_BEGIN_MINUTE] is set to 480, which is equivalent to 8:00 since 480 divided by 60 is 8, indicating that the daytime starts at 8:00.
- [DAY_END_MINUTE] is set to 1020, which is equivalent to 17:00 since 1020 divided by 60 is 17, indicating that the daytime ends at 17:00.
- This setting defines the daytime range as 8:00 to 17:00.
- The system's default daytime range is 7:00 to 18:00.

4-2-3-20 [DAY_VOICEALARM_INTENSITY]

Sets the threshold for the earthquake's intensity that triggers the alarm voice and message sending during the daytime period defined by [DAY_BEGIN_MINUTE] and [DAY_END_MINUTE]. This parameter allows you to specify the intensity level at which alerts are issued during the daytime.
Syntax and Example:

```
[DAY_VOICEALARM_INTENSITY]
1
```

The system will generate an alarm voice and send messages when an earthquake event occurs during the daytime, and the intensity is equal to or greater than level one.

4-2-3-21 [DISK_MIN_SPACE]

This setting allows the system to automatically delete log files in the /home/pi/Desktop/vAlert/rec directory to ensure that there is enough storage space . The unit is 4 kB, and when the available storage space falls below this value, the system will delete the 20 oldest files at a time. The default value is 262144, which is approximately 1048 MB.

Syntax and Example:

```
[DISK_MIN_SPACE]
384000
```

Explanation: The minimum storage space for the system is set to 384000 * 4 = 1,536,000 kB, which is approximately 1.5 GB.

4-2-3-22 [DL-100_IP], [DL-100_PULLING_INTERVAL], [DL-100_AVRG_NO]

These settings are used to connect the DL-100 temperature and humidity sensor from ICPDAS. The temperature and humidity data will be synchronized and stored in the Modbus register table. If a rain gauge is connected, the temperature and humidity data will also be written into the log file.

Syntax and Example:

```
[DL-100_IP]
192.168.255.10:10002


[DL-100_PULLING_INTERVAL]
30


[DL-100_AVRG_NO]
5
```

The DL-100 sensor is connected via IP address 192.168.255.10 and port 10002. The system reads data from the DL-100 every 30 seconds, and the data is averaged over five readings.

4-2-3-23 [EEWS_DAY_VOICE_INTENSITY]

This setting configures the earthquake early warning system's alert voice intensity threshold during the daytime. The definition of daytime and nighttime is based on the values set in [DAY_BEGIN_MINUTE] and [DAY_END_MINUTE].

Syntax and Example:

```
[EEWS_DAY_VOICE_INTENSITY]
1
```

Explanation: The earthquake early warning system's alert voice intensity threshold for daytime is set to level 1.

4-2-3-24 [EEWS_FORWARD]

The function allows this machine to forward earthquake early warning messages to other devices connected to it (such as CUBE devices) when it receives earthquake early warning messages. This is useful for scenarios where multiple CUBE devices need to connect to a single CWB (Central Weather Bureau) regional warning account. By enabling this function on the CUBE devices connected to the CWB and connecting other CUBE devices to this machine, the earthquake early warning messages can be distributed to multiple devices.

Syntax and Example:

```
[EEWS_FORWARD]
LISTEN_PORT 26000
```

Explanation: Enable the function to forward earthquake early warning messages from this machine using port 26000.

4-2-3-25 [EEWS_HOLD_SECONDS]

Set the duration for which the regional earthquake early warning continues to sound after the countdown is completed. The default value is 20 seconds.

Syntax and Example : This example sets the duration to 30 seconds.

```
[EEWS_HOLD_SECONDS]
30
```

Explanation: The earthquake early warning system's alert voice continues to sound 30 seconds.

4-2-3-26 [EEWS_NIGHT_VOICE_INTENSITY]

Set the earthquake early warning alert threshold for nighttime conditions. Please refer to [DAY_BEGIN_MINUTE] and [DAY_END_MINUTE] for the definition of daytime and nighttime.

Syntax and Example:

```
[EEWS_NIGHT_VOICE_INTENSITY]
5
```

Explanation: The threshold for nighttime earthquake early warning alert is set to level 5 .

4-2-3-27 [EEWS_RELAY1_INTENSITY]

Set the activation threshold for Relay 1 during regional earthquake early warning. The threshold is defined in levels.

Syntax and Example:

```
[EEWS_RELAY1_INTENSITY]
1
```

Explanation: The activation threshold for Relay 1 during regional earthquake early warning is set to 1 level.

4-2-3-28 [EEWS_RELAY2_INTENSITY]

Set the activation threshold for Relay 2 during regional earthquake early warning. The threshold is defined in levels.

[EEWS_RELAY2_INTENSITY]

3

Explanation: The activation threshold for Relay 2 during regional earthquake early warning is set to 3 levels.

4-2-3-29 [EEWS_RELAY3_INTENSITY]

Set the activation threshold for Relay 3 during regional earthquake early warning. The threshold is defined in levels.

Syntax and Example:

[EEWS_RELAY3_INTENSITY]

5.1

Explanation: The activation threshold for Relay 3 during regional earthquake early warning is set to 5.1 levels, which corresponds to a moderately strong earthquake (assuming the earthquake intensity standard is set to CWB 2020 intensity scale).

4-2-3-30 [EEWS_SERVERS_IP]

This setting allows you to configure up to five servers for connecting to Central Weather Bureau (CWB) or Sanlien Technology regional earthquake early warning servers to receive regional earthquake early warning services.

Syntax:

[EEWS_SERVERS_IP]

ip1:port1

ip2:port2

...

ip5:port5

Example :

```
[EEWS_SERVERS_IP]
192.168.1.100:80
192.168.255.100:26000
```

two regional earthquake early warning servers are configured. The first server is the Central Weather Bureau (CWB) server at IP address 192.168.1.100, and it uses port 80 for connection (indicating the connection to the CWB server). The second server is the Sanlien Technology server at IP address 192.168.255.100, and it uses port 26000 for connection.

4-2-3-31 [EEWS_TIMEOUT_ALARM]

This setting controls whether the system will send regional earthquake early warning alerts when the warning time is less than -10 seconds (indicating that the seismic waves have already arrived for more than 10 seconds). By default, this feature is disabled (set to NO), and the system will not send alerts in such cases. However, if you want to trigger alerts for all regional earthquake early warnings, you can set this option to YES.

Syntax and Example:

```
[EEWS_TIMEOUT_ALARM]
NO
```

In this example, the system is configured to not send earthquake early warning alerts when the warning time is less than -10 seconds.

4-2-3-33 [EVENT_FILE_OPTION]

This setting allows you to define the maximum length of event log files. When the recording duration exceeds this number of seconds, the system will automatically close the current file and create a new one. The default value is 60 seconds.

Syntax and Example:

```
[EVENT_FILE_MAX_LENGTH_IN_SECOND]
100
```

4-2-3-32 [EVENT_FILE_MAX_LENGTH_IN_SECOND]

This setting allows you to define the maximum length of event log files. When the recording duration exceeds this number of seconds, the system will automatically close the current file and create a new one. The default value is 60 seconds.

Syntax and Example:

```
[EVENT_FILE_MAX_LENGTH_IN_SECOND]
100
```

In this example, the system is configured to create a new log file when the recording duration exceeds 100 seconds.

4-2-3-33 [EVENT_FILE_OPTION]

This setting defines detailed options related to 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:

- PACKETNO_CHECK: When set to YES, this option enables packet sequence number checks. If the device detects discontinuous packet sequence numbers, it will display "PacketErr[%d]" on the LCD. If there are recorded event files, it will include "#PacketLoseCnt: %d" at the beginning of the file. This check is important for accurate calculations in applications like HAZUS RSHD. Set it to YES if you are using HAZUS RSHD.

- DATA_FLOATING_POINT: When set to YES (the default), the recorded data format is fixed-point with a precision of 3 decimal places (4F10.3). If you want the data to be displayed with more decimal places, you can set this option to NO, which will use a floating-point data format.

4-2-3-34 [EXIT_SIGN_ON_RIGHT]

This setting configures the direction in which the emergency exit sign is displayed on the marquee. The default value is NO, which corresponds to the left direction. Please note that this setting is applicable for marquee displays from Wirop SPRING INDUSTRIAL CO., LTD.

Syntax and Example:

```
[EXIT_SIGN_ON_RIGHT]
YES
```

Explanation: Setting the direction of the emergency exit sign to the right.

4-2-3-35 [FORWARD_SERVER_IP]

This setting enables the functionality to forward Mode 1 packets to other server hosts, with a maximum of three hosts.

Syntax:

```
[FORWARD_SERVER_IP]
TCP_SIZE bytes
serverIp:port
```

Example:

```
[FORWARD_SERVER_IP]
TCP_SIZE 32768
192.168.255.100:1502
192.168.255.101:2502
```

Explanation:

- Set the TCP transmission buffer size to 32768 bytes. The system's minimum value is 16384 bytes.
- Configure forwarding to two servers, specifically 192.168.255.100 with port 1502 and 192.168.255.101 with port 2502.

4-2-3-36 [FTP_CONFIG]

This setting provides the functionality for software updates over the network. It defines the information of the remote software update FTP server. When the button is held for seven seconds, the system will attempt to update the software based on these settings.

Example:

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

Explanation:

By default, when PX01 is updated, it connects to Sanlien Technology's server. If a customer's environment lacks external network access, they can set up their own FTP server.

If there is a need to set up a custom FTP server, please contact Sanlien Technology's sales department.

4-2-3-37 [FTE-D04_IP], [FTE-D04_HEART_BEAT_INTERVAL]

FTE-D04 is an earthquake message display unit.

Syntax and Example:

```
[FTE-D04_IP]
192.168.0.77


[FTE-D04_HEART_BEAT_INTERVAL]
5
```

Explanation:

[FTE-D04_IP] defines the IP address of the FTE-D04 earthquake message display unit.

[FTE-D04_HEART_BEAT_INTERVAL] is used to configure the heartbeat interval for FTE-D04 to confirm its operational status. It specifies the period for sending heartbeats.

4-2-3-38 [GLOBAL_EVENT_ENABLE]

This setting determines whether, during an earthquake event, waveforms from all connected seismometers will be simultaneously recorded.

Syntax:

```
[GLOBAL_EVENT_ENABLE]
YES/NO
```

Example 1:

```
[GLOBAL_EVENT_ENABLE]
NO
```

Explanation 1:

Setting it to "NO" means that during an earthquake event, only the waveforms from the triggered seismometers will be recorded.

Example 2:

```
[GLOBAL_EVENT_ENABLE]
YES
```

Explanation 2:

Setting it to "YES" means that during an earthquake event, waveforms from all seismometers will be recorded.

4-2-3-39 [GRID_EEWS]

This setting allows you to configure connections to a grid-based earthquake early warning (EEWS) server. You can connect to up to three different servers using the MQTT protocol.

Syntax:

```
[GRID_EEWS]
SERVER_IP serverIp:port
USER userId
PASSWORD password
HEARTBEAT YES/NO
CWB_AREA_CODE cwbAreaCode
CWB_EQ_TIMER cwbEqTimer
NCREE_AREA_CODE ncreeAreaCode
NCREE_EQ_TIMER ncreeEqTimer
INTENSITY_LATCH YES/NO
MQTT_VERSION 31/311
```

Example:

```
[GRID_EEWS]
MQTT_VERSION 31
SERVER_IP 192.168.255.100:1883
USER user1
PASSWORD 1234
HEARTBEAT YES
SERVER_IP 192.168.255.101:1883
USER user2
PASSWORD 4321
HEARTBEAT NO
NCREE_AREA_CODE 10002030
NCREE_EQ_TIMER 15
CWB_AREA_CODE 341
CWB_EQ_TIMER 2
```

Explanation:

- You are connecting to two earthquake early warning (EEWS) servers using the MQTT 3.1 protocol. The IP addresses for the first and second servers are 192.168.255.100 and 192.168.255.101, and both use port 1883.
- The first server uses the login information "user1" with the password "1234," while the second server uses "user2" with the password "4321."
- The first server employs HEARTBEAT as a disconnection detection mechanism, while the second server does not.
- The NCREE regional code is set to 10002030, with a warning time of 15 seconds.
- The CWB (Central Weather Bureau) regional code is 341, and the warning time is 2 seconds.

4-2-3-40 [GPS]

CUBE can optionally use a GPS module, and this setting defines the GPS configuration. This configuration falls under hardware-related settings and is typically preconfigured before shipment. If any modifications are needed, it should be done with the assistance of Sanlien Technology's Field Application Engineer (FAE).

Example:

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

Explanation:

- Specifies the GPS signal source from USB port number.
- Sets the Baud rate for GPS signal transmission.
- Specifies the 1 PPS (Pulse Per Second) signal source from GPIO pin number 40.

4-2-3-41 [GPIO_CONFIG]

This setting defines the hardware connection information. It is considered a hardware-related configuration, and any modifications that may be needed should be done with the assistance of Sanlien Technology's Field Application Engineer (FAE).

Syntax and Example:

[GPIO_CONFIG]

AUDIO_RELAY_PIN 21

BATTERY_RELAY_PIN 22

LCD_BACK_LIGHT 23

PX01_SIGNAL_PIN 13

POWER_OFF_SIGNAL_PIN 7

RELAY1_PIN 4

RELAY2_PIN 5

RELAY3_PIN 6

RELAY4_PIN 28

RG_CLEAR_PIN 13

RG_HOLD_PIN 12

4-2-3-42 [HAZUS_RSHD]

This function is for HAZUS Rapid Structural Health Diagnostics (RSHD). Rapid structural health diagnostics require at least two seismic accelerometers, and the accelerometers must be installed at appropriate locations. This function includes calculations for inter-story displacement and inter-story drift ratio. Note that this method is for estimation purposes and is an optional feature.

Syntax:

[HAZUS_RSHD]

Configuration Details Configuration Content

[HAZUS_RSHD] Configuration Details Explanation		
Configuration Details	**Configuration Content**	**Description**
API	./hazus.exe	The filename of the executable file usually does not to be modified, the hazus.cfg configuration file needs to be set up, with detailed configuration instructions provided later in the document. The program calculates results from 0 to 4, which correspond to different levels of damage. These results are stored in Modbus register 0x02c2 with the following meanings: 0: No damage 1: Slight damage 2: Moderate damage 3: Severe damage 4: Total destruction
FILE_LENGTH	120	Set the length of the log file in seconds, with a minimum value of 120.
RELAY1_STRING	SAFE	When the calculation result is 0, Relay 1 will be activated. This setting allows the user to define a representing string, with the default value being "SAFE."
RELAY2_STRING	SLIGHT	When the calculation result is 1, Relay 2 will be activated. This setting allows the user to define a representing string, with the default value being "SLIGHT."
RELAY3_STRING	MODERATE	When the calculation result is 2, Relay 3 will be activated. This setting allows the user to define a representing string, with the default value being "MODERATE."

[HAZUS_RSHD] Configuration Details Explanation		
Configuration Details	**Configuration Content**	**Description**
RELAY4_STRING	EXTENSIVE	When the calculation result is 3 or 4, Relay 4 will be activated. This setting allows the user to define a representing string, with the default value being "EXTENSIVE."
TITLE_STRING	Damage Status	This setting provides the user with a customizable header string. The default value is "Damage Status."
MAXIMUM_LATCH	YES	YES/NO, once Relay is triggered, it needs to be manually canceled. If this feature is enabled, the message displayed on the HMI will automatically show the event information with the highest damage level in the event history. To cancel this display, please contact the Sanlien window to confirm the deletion of that information.

- Here's the translation of the configuration settings in hazus.cfg

```
# Number of installed instruments

[NUM_PALERT]

num = 3


# Palert installation heights

# h0 represents the installation height of the first Palert specified in [PALERT_IP], in centimeters.

# h1 represents the installation height of the second Palert specified in [PALERT_IP], in centimeters.

# h2 represents the installation height of the third Palert specified in [PALERT_IP], in centimeters.

[HEIGHT]

h0 = 0

h1 = 150

h2 = 300


# Drift ratio threshold settings

# Drift ratio <= t0, Relay1 ON, result is 0.

# t0 < Drift ratio <= t1, Relay2 ON, result is 1.

# t1 < Drift ratio <= t2, Relay3 ON, result is 2.

# t2 < Drift ratio <= t3, Relay4 ON, result is 3.

# t3 < Drift ratio, Relay4 ON, result is 4.

# Thresholds should be set based on HAZUS building types and average inter-story drift values for HAZUS structural damage states.

[THRESHOLD]

t0 = 0.006

t1 = 0.012

t2 = 0.03

t3 = 0.08
```

```
# Pairs of Palerts to be calculated
# p2 represents the second pair, 0_1 means calculating the result between Palert 0 and Palert 1.
# This example is for three Palerts.
# With 5 installations, you can calculate up to 10 pairs (C(5, 2) = 10).
# With 3 installations, you can calculate up to 3 pairs (C(3, 2) = 3).
# Setting more pairs will increase the calculation time.
[PAIR]
p0 = 0_1
p1 = 0_2
p2 = 1_2
```

This configuration file defines the number of installed instruments, their installation heights, drift ratio thresholds for relay activation, and pairs of Palerts to be used for calculations. The thresholds should be set based on building types and structural damage states for HAZUS.

- HAZUS model building types

No.	Label	Description	Height			
			Range		Typical	
			Name	Stories	Stories	Feet
1 2	W1 W2	Wood, Light Frame (5,000 sq. ft.) Wood, Greater than 5,000 sq. ft.		All All	1 2	14 24
3 4 5	S1L S1M S1H	Steel Moment Frame	Low-Rise Mid-Rise High-Rise	1 - 3 4 - 7 8+	2 5 13	24 60 156
6 7 8	S2L S2M S2H	Steel Braced Frame	Low-Rise Mid-Rise High-Rise	1 - 3 4 - 7 8+	2 5 13	24 60 156
9	S3	Steel Light Frame		All	1	15
10 11 12	S4L S4M S4H	Steel Frame with Cast-in-Place Concrete Shear Walls	Low-Rise Mid-Rise High-Rise	1 - 3 4 - 7 8+	2 5 13	24 60 156
13 14 15	S5L S5M S5H	Steel Frame with Unreinforced Masonry Infill Walls	Low-Rise Mid-Rise High-Rise	1 - 3 4 - 7 8+	2 5 13	24 60 156

No.	Label	Description	Height			
			Range		Typical	
			Name	Stories	Stories	Feet
16 17 18	C1L C1M C1H	Concrete Moment Frame	Low-Rise Mid-Rise High-Rise	1 - 3 4 - 7 8+	2 5 12	20 50 120
19 20 21	C2L C2M C2H	Concrete Shear Walls	Low-Rise Mid-Rise High-Rise	1 - 3 4 - 7 8+	2 5 12	20 50 120
22 23 24	C3L C3M C3H	Concrete Frame with Unreinforced Masonry Infill Walls	Low-Rise Mid-Rise High-Rise	1 - 3 4 - 7 8+	2 5 12	20 50 120
25	PC1	Precast Concrete Tilt-Up Walls		All		
26 27 28	PC2L PC2M PC2H	Precast Concrete Frames with Concrete Shear Walls	Low-Rise Mid-Rise High-Rise	1 - 3 4 - 7 8+	2 5 12	20 50 120
29 30	RM1L RM1M	Reinforced Masonry Bearing Walls with Wood or Metal Deck Diaphragms	Low-Rise Mid-Rise	1 - 3 4+	2 5	20 50

No.	Label	Description	Height			
			Range		Typical	
			Name	Stories	Stories	Feet
31 32 33	RM2L RM2M RM2H	Reinforced Masonry Bearing Walls with Precast Concrete Diaphragms	Low-Rise Mid-Rise High-Rise	1 - 3 4 - 7 8+	2 5 12	20 50 120
34 35	URML URMM	Unreinforced Masonry Bearing Walls	Low-Rise Mid-Rise	1 - 2 3+	1 3	15 35
36	MH	Mobile Homes		All	1	10

The information provided in the previous response is based on the "HAZUS-MH Advanced Engineering Building Module (AEBM)" developed by the Federal Emergency Management Agency (FEMA) in Washington, D.C. in the year 2001.

- HAZUS structure damage state average inter-story drift ratio

Model Building Type	Structural Damage States			
	Slight	Moderate	Extensive	Complete
Low-Rise Buildings – High-Code Design Level				
W1, W2	0.004	0.012	0.040	0.100
S1	0.006	0.012	0.030	0.080
C1, S2	0.005	0.010	0.030	0.080
C2	0.004	0.010	0.030	0.080
S3, S4, PC1, PC2, RM1, RM2	0.004	0.008	0.024	0.070
Low-Rise Buildings – Moderate-Code Design Leve				
W1, W2	0.004	0.010	0.031	0.075
S1	0.006	0.010	0.024	0.060
C1, S2	0.005	0.009	0.023	0.060
C2	0.004	0.008	0.023	0.060
S3, S4, PC1, PC2, RM1, RM2	0.004	0.007	0.019	0.053
Low-Rise (LR) Buildings – Low-Code Design Level				
W1, W2	0.004	0.010	0.031	0.75
S1	0.006	0.010	0.02	0.050
C1, S2	0.005	0.008	0.020	0.050
C2	0.004	0.008	0.020	0.050
S3, S4, PC1, PC2, RM1, RM2	0.004	0.006	0.16	0.044
S5, C3, URM	0.003	0.006	0.15	0.035

Model Building Type		Structural Damage States			
		Slight	Moderate	Extensive	Complete
Low-Rise (LR) Buildings – Pre-Code Design Level					
W1, W2		0.003	0.008	0.025	0.060
S1		0.005	0.008	0.016	0.040
C1, S2		0.004	0.006	0.016	0.040
C2		0.003	0.006	0.016	0.040
S3, S4, PC1, PC2, RM1, RM2		0.003	0.005	0.013	0.035
S5, C3, URM		0.002	0.005	0.012	0.028
Mid-Rise Buildings[1]					
All	Mid-Rise Building Types	2/3 * LR	2/3 * LR	2/3 * LR	2/3 * LR
High-Rise Buildings[1]					
All	High-Rise Building Types	1/2 * LR	1/2 * LR	1/2 * LR	1/2 * LR

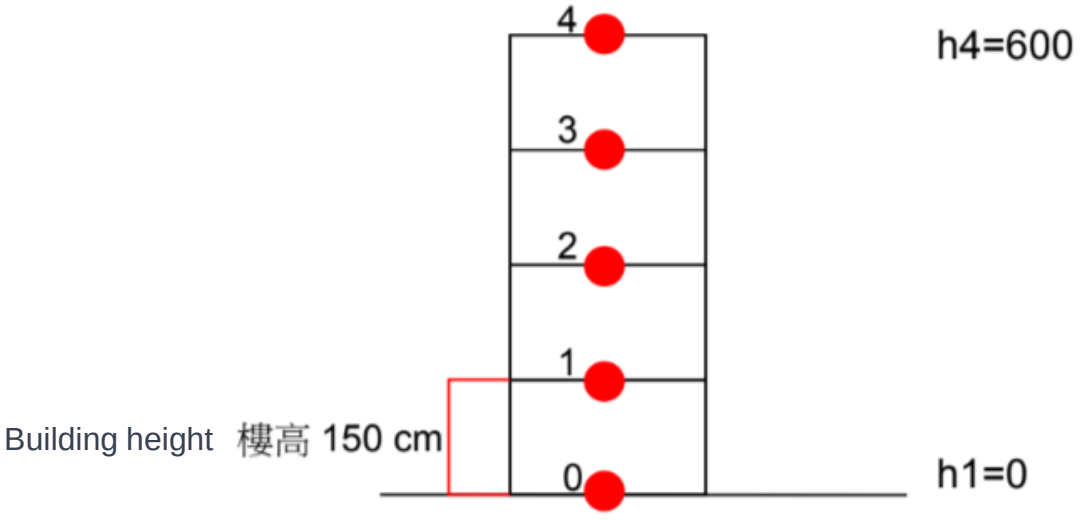
1. Mid-rise and high-rise buildings have damage-state drift values based on low-rise (LR) drift criteria reduced by factors of 2/3 and 1/2, respectively, to account for higher-mode effects and differences between average inter-story drift and individual inter-story drift

The information provided in the previous response is based on the "HAZUS-MH Advanced Engineering Building Module (AEBM)" developed by the Federal Emergency Management Agency (FEMA) in Washington, D.C. in the year 2001.

Example:

```
[NUM_PALERT]
num = 5
[HEIGHT]
h0 = 0
h1 = 150
h2 = 300
h3 = 450
h4 = 600
[THRESHOLD]
t0 = 0.006
t1 = 0.012
t2 = 0.03
t3 = 0.08
[PAIR]
p0 = 0_1
p1 = 0_2
p2 = 1_2
```

The above parameters are as shown in the diagram below:



4-2-3-43 [HEIGHT]:

Instrument installation altitude, in meters, stored in the Modbus address for user reference.

Syntax and Example:

```
[HEIGHT]
35
```

Explanation: The installation altitude is 35 meters

4-2-3-44 [ITK]

Configure the use of ITK for RSHD calculations. This section requires the purchase of the hardware and software required for this algorithm separately.

Syntax and Example:

```
[ITK]
ITK_PROJECT 1
ITK_USER sanlien
ITK_PASSWORD sanlien
ITK_PORT 22
ITK_IP 192.168.5.20
SFTP_MODE YES
LOCAL_PATH /home/ia/Palert
CONTROL_RELAY NO
DISPLAY_ON_HMI YES
TECHNICAL_SUPPORT NO
```

Explanation:

- To use this feature, you need to create building information before use and upload it to the algorithm server (Aries server). Building information includes project numbers, which should match ITK_PROJECT.
- ITK_USER, ITK_PASSWORD, ITK_PORT, and ITK_IP are the details of the Aries server.
- Aries server supports file exchange via network neighborhood or SFTP protocol. Currently, only the SFTP protocol is available, so SFTP_MODE is set to YES by default.
- If the Aries server uses network neighborhood functionality, LOCAL_PATH specifies the file exchange location.
- Customers can choose to set CONTROL_RELAY to NO, indicating that the calculation results will not control relays and lights. Set it to YES if control is needed.
- If customers have an HMI (Human-Machine Interface) that can display Aries server calculation results, set DISPLAY_ON_HMI to YES. In this case, PX-01 will store the calculation results in the corresponding Modbus registers.
- TECHNICAL_SUPPORT works in conjunction with the network function. Enabling this feature will cause the firmware to execute itkSupport.sh, passing the file name as a parameter to the script.
- The content of itkSupport.sh can be modified to specify the upload location. It's used for FTP file uploads and removal.

4-2-3-45 [JMA]

Adopt the Japan Meteorological Agency (JMA) seismic intensity scale standard.

Syntax:

```
[JMA]
RING_SECOND ringSeconds
```

Explanation:

- ringSeconds specifies the time domain duration in seconds required for calculating seismic intensity levels in the frequency domain. It is recommended to set the ringSeconds value to 10 seconds.
- Since the JMA seismic intensity scale uses frequency domain-weighted calculations, there must be sufficient time domain data available for the calculation.

4-2-3-46 [KMA_INTENSITY]

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

Syntax:

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

4-2-3-47 [LINE]

This feature supports two modes: "LINE Official Account" and "Line Notify." Currently, the latter can be used for free. If you have any requirements, please contact Sanlien Technology's business window. For configuration steps, refer to the "Line Notify Setup" instructions.

Starting April 18, 2019, LINE Corporation has fully implemented the LINE Official Account 2.0 project. The previous feature that allowed sending messages for free to up to 50 friends has been discontinued. To use the LINE Official Account, you need to apply for this service on your own and provide the necessary information to Sanlien Technology.

For information about LINE Official Account, please contact the LINE Official website. When using LINE Notify message notifications, the system will send messages according to the settings in this section when events occur.

Syntax:

```
[LINE]
IP lineServerIp
FOLDER_NAME lineServiceFolder
STATION_NAME stationName
EARTHQUAKE_LANGUAGE CHINESE/ENGLISH
EEWS_DAY_INTENSITY dayThreshold
EEWS_NIGHT_INTENSITY nightThreshold
```

Example:

```
[LINE]
IP linegw.iot.sanlien.com
STATION_NAME PX-01
EARTHQUAKE_LANGUAGE CHINESE
EEWS_DAY_INTENSITY 1
EEWS_NIGHT_INTENSITY 4
```

Explanation:

- The IP address of the LINE server is linegw.iot.sanlien.com.
- If you set the FOLDER_NAME for the LINE Official Account, you can specify the displayed customer name. Please confirm this with the business window. Line Notify does not require this setting.
- STATION_NAME is the name of the device, and this information will appear in LINE messages.
- For Chinese messages, the message posting thresholds are set to Level 1 during the day and Level 4 at night.

4-2-3-48 [LCD]

This section configures the hardware operation settings for the LCD.

Syntax:

```
[LCD]
COLUMN columnNumber
ROW rowNumber
RW_PIN_ENABLE YES/NO
DISPLAY_CONFIG YES/NO
DISPLAY_ON_ERR YES/NO
```

Example:

```
[LCD]
COLUMN 20
ROW 2
RW_PIN_ENABLE YES
DISPLAY_CONFIG NO
DISPLAY_ON_ERR YES
```

Explanation:

- The LCD on this device is fixed at 20 columns by 2 rows, and this configuration should remain unchanged.
- The R/W pin is used to control the LCD module, and this setting is related to hardware. Please consult with FAE for confirmation.
- DISPLAY_CONFIG allows you to choose whether to display the configuration content. In this example, it's set to not display (the default value is NO).
- DISPLAY_ON_ERR allows you to decide whether to turn on the LCD backlight when there is an error message. In this example, it's set to turn on the backlight (the default value is YES).

4-2-3-49 [LCD_TITLE]

This setting allows users to customize the instrument name displayed on the first line of the LCD. The default name is "SANLIEN CUBE," and it can be up to 14 characters long.

Syntax and Example:

```
[LCD_TITLE]
CUBE
```

4-2-3-50 [LF-01_IP]

LF-01 is a carbon dioxide (CO2) concentration and temperature-humidity detector. CUBE can directly send event messages to our company's desktop seismic display LF-01. The message is transmitted through UDP broadcast packets. This setting provides the capability to capture CO2 and temperature-humidity information from LF-01 and store it in the Modbus point table. Additionally, if [BA_HOST_IP] is configured, when the CO2 concentration exceeds 2000 ppm, it will trigger the [BA_DOOR_ADDRESS] DO (Digital Output). When the CO2 concentration falls below 1000 ppm, it will turn off the DO.

Syntax and Example:

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

4-2-3-51 [LISTEN_PORT]

The default listening port for the Modbus TCP server on this device is 502. However, users can modify it to a different port using this setting.

Syntax and Example:

```
[LISTEN_PORT]
503
```

Explanation: The Modbus TCP server will use port 503 for connections.

4-2-3-52 [LOCAL_LATITUDE], [LOCAL_LONGITUDE]

These settings define the latitude and longitude of the device's installation location. They are used in conjunction with the regional earthquake early warning system to calculate earthquake intensity and the time it takes for seismic waves to arrive. The results are then stored in Modbus registers for user access.

Syntax and Example:

```
[LOCAL_LATITUDE]
24.973065
[LOCAL_LONGITUDE]
121.548529
```

4-2-3-53 [MAIN_PORT_INTERFACE]

This setting defines the main network interface used by the device for communication. By default, it uses the Linux network device. However, users can modify this setting to use a different network device. It's essential to note that changing this setting should be performed by an FAE to avoid potential issues, as incorrect configurations may cause the system to malfunction.

Syntax and Example:

```
[MAIN_PORT_INTERFACE]
Eth0
```

Explanation: In this example, "eth0" is specified as the network communication device.

4-2-3-54 [MESSAGE_PALERT]

This setting determines which Palert seismometer is used to calculate and display the earthquake intensity (shindo) as well as PGA (Peak Ground Acceleration) and PGV (Peak Ground Velocity) when multiple Palert seismometers series are connected.

Syntax and Example:

```
[MESSAGE_PALERT]
0
```

Explanation:

In this example, the 0th Palert in the configuration is set to determine and display earthquake intensity, PGA, and PGV. The actual seismometer referred to as the 0th Palert is specified in the [Palert_IP] or [AC200GW] configuration settins.

4-2-3-55 [MODBUS_TCP_DO]

This setting allows you to transmit the current relay status of the local device to remote network Modbus devices' Digital Outputs (DO). You can control up to 5 devices using this feature.

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 setting will transmit the current relay status of the local device in real time to the following Modbus TCP devices:

- 192.168.255.100, port 502, with Relay address 100.
- 192.168.255.101, port 1502, with Relay address 200.
- 192.168.255.102, port 502, with Relay address 300.

4-2-3-56 [MQTT_CONFIG]

Allows you to configure the MQTT settings for the local device. When an event is triggered and exceeds the defined threshold, the device will use MQTT to propagate messages.

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:

- This configuration sets up the local device as an MQTT broker, using port 1883.
- The LOCATION is set to BUILDING1, and the topics published for message transmission correspond to different types of earthquake alerts and warnings. Messages will be sent for earthquakes with alert thresholds at level 1 during the day and level 4 at night.

- The topics include various types of alerts and reports related to earthquake early warning systems, such as ONSITE alerts, REGIONAL warnings, TEST alerts, REPORTs, EXERCISE alerts, CWB alerts, and NCREE alerts, all specific to BUILDING1.

4-2-3-57 [MMI_INTENSITY]

Adopt MMI seismic intensity scale.

Syntax:

[MMI_INTENSITY]
YES/NO

4-2-3-58 [M_WHERE_N_OUT_OF_M]

To avoid triggering events caused by human-induced vibrations, the device provides a pick two from three earthquake event judgment mechanism. This means that if CUBE is connected to more than one seismometer, you can set how many seismometers must trigger simultaneously for an event to be considered a seismic event.

Syntax:

[M_WHERE_N_OUT_OF_M] setting detail
Setting Content

Earthquake Three Out of Two Decision Mechanism		
Setting Detail	**Setting Content**	**Description**
[M_WHERE_N_OUT_OF_M]	>= N	Setting the number of connected seismometers, where N represents [N_WHERE_N_OUT_OF_M].
[N_WHERE_N_OUT_OF_M]	<= M	Setting the number of seismometers that need to trigger simultaneously to be considered an earthquake event, where M represents [M_WHERE_N_OUT_OF_M].
[N_OUT_OF_M_IN_SECOND]	>= 1	Set the "simultaneous" seconds, meaning that within this period, the number of seismometers with positive-edge triggers must be greater than or equal to N to be considered a seismic event.
[N_OUT_OF_M_BY_MIDDLE]	YES/NO	Set to view it as a seismic event as long as the number of triggered seismometers is greater than or equal to N within the "simultaneous" seconds, without using "positive-edge trigger." The default value is NO.
[N_OUT_OF_M_INTENSITY_BY_ALL]	YES/NO	Set to use the minimum intensity among all triggered seismometers as the seismic intensity for this system when an event occurs. The default value is NO. When not set, the system uses [MESSAGE_PALERT] as the seismic intensity for this system.

Example:

[M_WHERE_N_OUT_OF_M]

5

[N_WHERE_N_OUT_OF_M]

3

[N_OUT_OF_M_IN_SECOND]

2

[N_OUT_OF_M_BY_MIDDLE]

NO

[N_OUT_OF_M_INTENSITY_BY_ALL]

YES

Explanation:

- There are a total of five seismometers using the pick three from two seismic event detection mechanism.
- If at least two of the seismometers detect a positive edge trigger within two seconds, it is considered a seismic event.
- After an event occurs, the system sets the seismic intensity as the minimum intensity among all triggered seismometers.

4-2-3-59 [MSEED_SENSOR]

If the customer has sensors that support a SeedLink server, CUBE can use the SeedLink protocol as a source for sensors, but it supports only one sensor in this mode. In addition to the configuration settings, you'll need to run the "slclient" executable and configure the station parameter file "streamlist.conf." If you have any specific requirements or questions, please contact Sanlien Technology's sales department. This setting can be used in conjunction with [PALERT_LOCAL_MODE] for filtering and controlling relays.

Syntax and Example:

```
[MSEED_SENSOR]
IP 192.168.9.11:18000
FACTOR_Z 0.002
FACTOR_N 0.002
FACTOR_E 0.002
```

Explanation:

• IP: The IP address and port of the SeedLink server.

• FACTOR_Z, FACTOR_N, FACTOR_E: These are the conversion factors for the three axes. For example, if 1 count equals 0.002 gals, then you would enter 0.002.

•streamlist.conf: This file contains station information, including SCNL (Station, Channel, Network, and Location), which is important in the miniseed format. Here's a brief explanation of the components:

- S: Station name (up to 5 alphanumeric characters).
- C: Channel name (up to 3 alphanumeric characters), with the last character indicating direction (e.g., HLZ, HLN, HLE).
- N: Network name.
- L: Location name, typically used to differentiate between sensors at the same monitoring site. For example, "00" for surface and "10" for 10 meters underground.
- For more detailed information, please refer to http://www.fdsn.org/pdf/SEEDManual_V2.4.pdf.

The example of the streamlist.conf file is as follows

```
DG TEST  CN?.D
```

- DG: Net
- TEST: Station
- CN?.D: Channel, where "?" represents the wildcard character indicating that the first two characters are the same for eligible channels.

It is recommended to modify the first two characters of Net, Station, and Channel to suit your needs.

4-2-3-60 [NTP_RESET], [NTP]

This setting allows you to control the Linux NTP service and hardware-related time settings.

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:

- CUBE checks whether the time is synchronized with NTP approximately every 10 seconds. If it fails to sync with the NTP server for more than ten times, the system considers it as a synchronization failure. This setting RESET_TH is set to 3, which means that if it's not synchronized for about 300 seconds, the Linux NTP service will be restarted.
- RTC_TO_SYSTEM_TIME is set to YES, which means that if the system is not synchronized with the NTP server and the reset counter increases by one, the time from the RTC will be written into the Linux system time.
- If some applications cannot synchronize with the NTP server, setting it to YES will considers it as an error and display it on the LCD. If set to NO, it won't be considered as an error.
- RTC_TYPE is set to use the RX8900 RTC. Please note that this setting must be configured by an FAE, as incorrect settings can cause the RTC to malfunction.
- FAKE_PPS is set to YES, which means that the firmware will write the system time to shared memory clock and label it as PPS. Enabling this setting is most likely for systems without a network time server. When enabling this setting, the /etc/ntp.conf file must have the following settings:

```
# GPS PPS reference
server 127.127.28.0 prefer maxpoll 3
fudge 127.127.28.0 refid GPS


# get time from SHM from gpsd; this seems working
server 127.127.28.2 maxpoll 3
fudge 127.127.28.2 refid PPS
```

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

4-2-3-61 [NET_DEVICE]

This device supports the COAP protocol, allowing it to broadcast messages over the network when triggered by events.

Syntax:

```
[NET_DEVICE]
YES/NO
```

The COAP protocol of this device:

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

4-2-3-62 [NIGHT_VOICEALARM_INTENSITY]

During the nighttime period, when an earthquake event is triggered, the seismic intensity threshold for playing a voice alarm and sending messages is set. For definitions of daytime and nighttime, please refer to [DAY_BEGIN_MINUTE] and [DAY_END_MINUTE].

Syntax and Example:

```
[NIGHT_VOICEALARM_INTENSITY]
5.1
```

Explanation: When the seismic intensity of nighttime earthquake events is greater than or equal to "five weak" on the scale (assuming the intensity scale is set to CWB 2020), the system will execute the playback of a voice alarm and message transmission.

4-2-3-63 [PALERT_IP]

Configure the connected Palert series seismometers. CUBE can support a total of 30 seismometers, which means the combined total of Palert series and AC200 series seismometers must be less than or equal to 30 units.

Syntax:

```
[PALERT_IP]
palertIp0:port0
```

Example:

```
[PALERT_IP]
192.168.255.100:1502
192.168.255.101
192.168.255.102:2502
```

Explanation:

- A total of three Palert devices are connected, with the following configurations:
    1. 192.168.255.100, port 1502
    2. 192.168.255.101, port 502
    3. 192.168.255.102, port 2502

4-2-3-64 [PALERT_LOCAL_MODE]

The local device can connect to seismic sensors that output in CWB RTD format (optional). For settings related to sampling, filtering, and triggering, as the configuration rules are the same as described earlier, they will be presented in a table format to simplify the explanation.

Syntax:

[PALERT_LOCAL_MODE]

RTD_TRA_SENSOR_SPS 50/100

RTD_READY_SECOND 1~30

Configuration Detail Configuration Content

[PALERT_LOCAL_MODE] Configuration Details Explanation

Configuration Detail	Configuration Content	Description
RTD_READY_SECOND	1 – 30	Set the stability time for RTD data in seconds. (Mandatory setting)
RTD_TRA_SENSOR_SPS	50, 100	Select the sampling rate for RTD data, either 50 or 100. (Mandatory setting)
AUTO_OFFSET	TRTC YES NO	Choose the auto-zeroing mode: YES for continuous auto-zeroing, TRTC for auto-zeroing under normal conditions but not during event detection, and NO for no auto-zeroing.
DOWN_SAMPLING_BY_A VRG	YES NO	Set the local device to down-sample mode. The default value is YES, which means it uses high-speed sampling, applies low-pass filtering, and then takes the average.

[PALERT_LOCAL_MODE] Configuration Details Explanation		
Configuration Detail	**Configuration Content**	**Description**
EVENT_MAX_SECONDS	>= 60 (second)	Event maximum time duration: When exceeded, the system will attempt to re-zero and clear all seismic event flags. The default value is 180 seconds.
EVENT_MIN_SECONDS	> 0 (second)	Minimum time duration for seismic events: After an event trigger, the seismic flag will be retained for at least this duration. The default value is 10 seconds.
FIR_MODE	YES NO	Select FIR or IIR filtering. The default value is NO.
HPF	0.1, 0.3, 0.5, 1, 2, 3 (Hz)	Set the frequency for the high-pass filter in Hz. If not used, set it to 0. The local device employs a Butterworth 2nd-order filter.
INSTALLATION_ANGLE	0 ~ 360 (degree)	Instrument installation angle: If the instrument cannot be aligned with the north due to on-site constraints, you can set this value. The calculation is done in a clockwise angle. The default value is 0 degrees.
LCD_BACK_LIGHT_SECOND	> 0 (second)	Set the display duration in seconds when the LCD backlight is triggered. The default value is 15 seconds.

[PALERT_LOCAL_MODE] Configuration Details Explanation		
Configuration Detail	**Configuration Content**	**Description**
LPF	10, 20, 40, 50, 80, 100 (Hz)	Set the frequency for using a low-pass filter, with the unit in Hz. If not in use, set it to 0. You can choose to use either an IIR or FIR filter on this device, and the following provides an explanation of their characteristics. IIR Butterworth Frequencies Order High-order 10 4 8 20 4 14 40 4 14 50 4 12 80 4 12 100 4 12 FIR Raised Cos Frequencies Order 10 32 20 32 40 32 50 32 80 32 100 32
LPF_HI_ORDER	YES NO	When using an LPF, you can choose a higher filter order, as indicated in the table above with HI_ORDER. The default is set to YES.
MINIMUM_OFFSET_GAL	>= 0.1 (gal)	Set the minimum value for the successful self-correction of the zero point at startup. If it is higher than this value, the system will continue to perform zero point correction until successful. The unit is in gallons, with a default value of 5.

[PALERT_LOCAL_MODE] Configuration Details Explanation		
Configuration Detail	**Configuration Content**	**Description**
MODE	CHINA INTERNATIONAL	Whether to use the China Earthquake Administration version, with the default setting being INTERNATIONAL.
PD_TRIG_ENABLE	YES NO	Enable Pd trigger monitoring for earthquake events (P-wave displacement) with the default value set to NO.
PD_WATCH_THRESHOLD	>= 0.01 (cm)	Set the warning threshold for P-wave displacement, with the unit in centimeters, and the default value is 0.2.
PD_WARNING_THRESHO LD	>= 0.01 (cm)	Set the warning threshold for P-wave displacement, with the unit in centimeters, and the default value is 0.3.
PGA_TRIG_ENABLE	YES NO	Enable PGA trigger monitoring for earthquake events, with the default value set to NO.
PGA_WATCH_THRESHOL D	>= 0 (gal)	Set the alert threshold for PGA triggering, with the unit in gal (galileos), and the default value is 9999.
PGA_WARNING_THRESH OLD	>= 0 (gal)	Set the warning threshold for PGA triggering, with the unit in gal (galileos), and the default value is 9999.
PGA_ACTION_THRESHOL D	>= 0 (gal)	Set the action threshold for PGA triggering, with the unit in gal (galileos), and the default value is 9999.
RTD_READY_SECOND	1 ~ 30	Set the stabilization time for RTD data, with the unit in seconds.

[PALERT_LOCAL_MODE] Configuration 1Details Explanation		
Configuration Detail	**Configuration Content**	**Description**
RTD_TRA_SENSOR_SPS	1 ~ 30	Set the stabilization time for RTD data, with the unit in seconds.
SAMPLING_RATE	50, 100, 200, 400, 500, 1000	Choose the data sampling rate for the system, with the default value set to 100 samples per second.
SERIAL_NO	0 ~ 65535	Set the device's serial number, which must be in numeric format. It is recommended to choose a value within the range of 0 to 65535. Please note that the device comes with a factory-set serial number for validation purposes. If users change it, they should keep the original serial number for future reference during recalibration.
SERVER_IP	IP1:PORT1 IP2:PORT2 IP3:PORT3	"Configure the server and port information for outbound connections for this device, with support for up to three sets.
SERVER_PASSWORD	PASSWORD1 PASSWORD2 PASSWORD3	"If this device is set to the China Earthquake Administration mode, it will provide the corresponding connection password for the server in this configuration.
SERVER_STREAM_MODE_TAIWAW	1, 2, 4, 8, 16	Set the default streaming output packet format after connecting to the server. For details about the streaming packet format, please refer to the explanation in the following section.
STA_LTA_TRIG_ENABLE	YES NO	Set the STA/LTA trigger detection mode.

[PALERT_LOCAL_MODE] Configuration Details Explanation		
Configuration Detail	**Configuration Content**	**Description**
STA_WIDTH	> 0 (second)	Set the STA (Short-Term Average) time duration, with the unit in seconds. The recommended value is 2.
LTA_WIDTH	> 0 (second)	Set the LTA (Long-Term Average) time duration, with the unit in seconds. The recommended value is 40.
STA_LTA_THRESHOLD	> 0.05	Set the trigger threshold for STA/LTA (positive edge), with the recommended value of 3.
STA_LTA_STOP_THRESH OLD	> 0	Set the ending threshold for STA/LTA-triggered events (negative edge), with the recommended value of 1.
STA_LTA_EVENT_TIME	> 3	Set the duration of events following STA/LTA triggering, with the unit in seconds, and the recommended value is 30.
STA_LTA_RELAY1	> 0	Set the activation threshold for local DO1 following STA/LTA event triggering, with the unit in gal (galileos).
STA_LTA_RELAY2	> 0	Set the activation threshold for local DO2 following STA/LTA event triggering, with the unit in gal (galileos).
STA_LTA_RELAY3	> 0	Set the activation threshold for local DO3 following STA/LTA event triggering, with the unit in gal (galileos). These three sets of DOs are independently controlled.

[PALERT_LOCAL_MODE] Configuration Details Explanation		
Configuration Detail	**Configuration Content**	**Description**
STREAM_TRIG_PACKET	YES NO	If you select YES and set the Pd trigger mode, when choosing Mode 1 or 2 for streaming packet output, a Mode 2 packet will be sent upon triggering, and another Mode 2 packet will be sent 3 seconds later. This can be used by the user for remote P-wave early warning purposes. The default value is NO. Note: Mode 2 packet contains the header part of Mode 1.
VECTOR_INTENSITY	YES NO	When using the old CWB earthquake intensity standard (before 2020), you can choose to calculate earthquake intensity using either horizontal or three axes. The default value is NO.
WATCH_TIME	5 ~ 255	Set the alert time duration following Pd and PGA event triggers.
WARNING_TIME	5 ~ 255	Set the warning time duration following Pd and PGA event triggers.
ZEROING_PERIOD_IN_MI NUTE	> 1	Set whether to enable scheduled zero calculation, with the unit in minutes. If you do not use this function, you can delete this line. If the AUTO_OFFSET function is not enabled, it is recommended to activate this function with a recommended value of 60 minutes.
ZEROING_DATA_LENGTH	> 400	Set the number of data points required for automatic zeroing.

4-2-3-65 [PATLITE_PNS_IP]

CUBE provides the capability to connect with Patlite network tower lights' relays, supporting up to 15 units. Please note that this feature is optional, and you can inquire about it with your Sanlien Technology sales department.

Syntax:

```
[PATLITE_PNS_IP]
PATLITE_CU
ip0:port0
ip1:port1
```

Example 1:

```
[PATLITE_PNS_IP]
192.168.255.100:26000
192.168.255.101:26000
```

Explanation 1:

Configure two Patlite PNS network tower light relays, with the following settings: 192.168.255.100, port 26000, and 192.168.255.101, port 26000.

Example 2:

```
[PATLITE_PNS_IP]
PATLITE_CU
192.168.255.100:26000
192.168.255.101:26000
```

Explanation 2:

Configure two Patlite CU network tower light relays, with the following settings: 192.168.255.100, port 26000, and 192.168.255.101, port 26000.

4-2-3-66 [PRE_EVENT_SECOND]

Set the number of seconds for the earthquake record's before event recording, with a maximum value of 200 and a default value of 20.

Syntax and Example:

```
[PRE_EVENT_SECOND]
10
```

Explanation: Set the number of seconds for the earthquake record's pre-event recording to 10 seconds.

4-2-3-67 [POST_EVENT_SECOND]

Set the number of seconds for the earthquake record's after event recording, with a maximum value of 600 and a default value of 20.

Syntax and Example:

```
[POST_EVENT_SECOND]
10
```

Explanation: Set the number of seconds for the earthquake record's post-event recording to 10 seconds

4-2-3-68 [POWER_OFF_SWITCH_EXIST]

Set whether the system has a button switch. Please note that this function is hardware-related and must be configured by an FAE. An improper setting can lead to the system not functioning correctly. The default value is YES.

Syntax:

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

4-2-3-69 [RAIN_GAUGE_UNIT_IN_MM]

CUBE can be connected to a tipping bucket rain gauge, which not only provides recording but can also transmit information to a scrolling marquee for activating relays for disaster warning control.

Syntax:

[RAIN_GAUGE_UNIT_IN_MM] and other detailed settings

Set the configuration

Tipping Bucket Rain Gauge Configuration Details		
Configuration Detail	**Configuration Content**	**Description**
[RAIN_GAUGE_UNIT_IN_MM]	> 0	Set the amount of rainfall represented by a single signal from the rain gauge, with the unit in millimeters (mm).
[RAIN_INFORMATION_DISPLAY_ON_LCD]	YES/NO	Set whether to display the accumulated rainfall information on the LCD.
[RELAY2_MM_IN_1_HOUR]	> 0	Set the activation threshold for Relay2 for 1-hour rainfall.
[RELAY2_MM_IN_12_HOUR]	> 0	Set the activation threshold for Relay2 for 12-hour rainfall.
[RELAY2_MM_IN_24_HOUR]	> 0	Set the activation threshold for Relay2 for 24-hour rainfall.
[RELAY3_MM_IN_1_HOUR]	> 0	Set the activation threshold for Relay3 for 1-hour rainfall.
[RELAY3_MM_IN_12_HOUR]	> 0	Set the activation threshold for Relay3 for 12-hour rainfall.
[RELAY3_MM_IN_24_HOUR]	> 0	"Set the activation threshold for Relay3 for 24-hour rainfall.

Tipping Bucket Rain Gauge Configuration Details		
Configuration Detail	**Configuration Content**	**Description**
[RAIN_GAUGE_LOG_BY_DAY]	YES/NO	Set whether to generate a rainfall record file daily, with the default value of NO.
[RAIN_GAUGE_FLUSH_BY_HOUR]	YES/NO	Set whether to forcibly write the memory's rainfall data to a file every hour, with the default value of NO.
[RAIN_GAUGE_SIGNAL_BELL]	YES/NO	Set whether to play the COWBELL1.wav audio file upon receiving a signal from the rain gauge, with the default value of NO.

Note: To control the Relay, [RELAY_CONTROL_BY_RAIN_GAUGE] must be configured.

Example:

```
[RAIN_GAUGE_UNIT_IN_MM]
0.5

[RAIN_INFORMATION_DISPLAY_ON_LCD]
YES

[RELAY2_MM_IN_1_HOUR]
15

[RELAY2_MM_IN_12_HOUR]
50

[RELAY2_MM_IN_24_HOUR]
80

[RELAY3_MM_IN_1_HOUR]
30

[RELAY3_MM_IN_12_HOUR]
75

[RELAY3_MM_IN_24_HOUR]
120

[RAIN_GAUGE_LOG_BY_DAY]
YES

[RAIN_GAUGE_FLUSH_BY_HOUR]
YES

[RAIN_GAUGE_SIGNAL_BELL]
YES
```

Explanation:

- Set the rain gauge to represent 0.5 mm of rainfall for each signal.
- Display rainfall information on the LCD.
- Set the activation thresholds for Relay2 as 15 mm/hr, 50 mm/hr, and 80 mm/hr, respectively.
- Set the activation thresholds for Relay3 as 30 mm/hr, 75 mm/hr, and 120 mm/hr, respectively.
- Generate a daily rainfall record file. Force the memory's rainfall data to be written to a file every hour.
- Play the COWBELL1.wav audio upon receiving a signal from the rain gauge.

4-2-3-70 [RELAY_CONTROL_BY_RAIN_GAUGE]

Configure whether rain gauge information can control the Relay.

Syntax and Example:

```
[RELAY_CONTROL_BY_RAIN_GAUGE]
YES
```

Explanation: Use rain gauge information to control the Relay.

4-2-3-71 [RELAY_INTENSITY]

Set the seismic intensity thresholds for Relay operation during earthquake events.

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 Relay1 to Relay3 as 1, 3, and 5.1 (CWB 2020 intensity scale, 5.1 is considered as a weak shaking) for earthquakes.

4-2-3-72 [RELAY_PD]

Set the Pd thresholds for Relay operation during earthquake events, with the unit in centimeters (cm).

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 Relay1 to Relay3 as 0.2, 0.3, and 0.35 cm, respectively.

4-2-3-73 [RELAY_PGV]

Set the velocity thresholds for Relay operation during earthquake events, with the unit in millimeters per second (mm/second).

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 Relay1 to Relay3 as 1.5, 15, and 30 mm/second, respectively.

4-2-3-74 [RELAY_RESET_BY_MANUAL]

reset mode (press the button for three seconds or remote control via the Modbus protocol), with the default value of NO.

Syntax and Example:

```
[RELAY_RESET_BY_MANUAL]
YES
```

Explanation: Set Relay and voice to require manual reset.

4-2-3-75 [REMOTE_CONTROL]

Set whether the device allows controlling the output status of digital outputs (DO) via Modbus (REMOTE_RELAY, 0x031E). Please note that even if allowed, the DO output will be the logical OR result with the Modbus points.

Syntax and Example:

```
[REMOTE_CONTROL]
RELAY NO
```

Explanation:

Configure the device not to allow control of DO via Modbus. The default setting on the device is YES.

4-2-3-76 [RECORD_INTENSITY]

Set the intensity threshold value to trigger earthquake event recording, which can be used in conjunction with [PRE_EVENT_SECOND] and [POST_EVENT_SECOND] settings.

Syntax and Example:

```
[RECORD_INTENSITY]
5.1
```

Explanation:

Configure the threshold for triggering earthquake event recording as a weak shaking of 5.1 (CWB 2020 earthquake scale).

4-2-3-77 [RECORD_PGA]

Set the PGA (Peak Ground Acceleration) threshold value to trigger earthquake event recording. This can be used in conjunction with [PRE_EVENT_SECOND] and [POST_EVENT_SECOND] settings. This setting has the same effect as [RECORD_INTENSITY], and both are combined using an OR logic operation, where either condition being met triggers the recording.

Syntax and Example:

```
[RECORD_PGA]
8.5
```

Explanation:

Configure that when an earthquake event occurs, recording will be triggered as long as the PGA is greater than or equal to 8.5 gal.

4-2-3-78 [RELAY1_GAL]

Set the PGA (Peak Ground Acceleration) threshold for Relay1 during an earthquake event.

Syntax and Example:

```
[RELAY1_GAL]
8.5
```

Explanation:

Configure the PGA threshold for Relay1 during an earthquake event as 8.5 gal.

4-2-3-79 [RELAY2_GAL]

Set the PGA (Peak Ground Acceleration) threshold for Relay2 during an earthquake event.

Syntax and Example:

```
[RELAY2_GAL]
80
```

Explanation:

Configure the PGA threshold for Relay2 during an earthquake event as 80 gal.

4-2-3-80 [RELAY3_GAL]

Set the PGA (Peak Ground Acceleration) threshold for Relay3 during an earthquake event.

Syntax and Example:

```
[RELAY3_GAL]
250
```

Explanation:

Configure the PGA threshold for Relay3 during an earthquake event as 250 gal.

4-2-3-81 [RELAY_CONTROL_BY_ERR]

When the system detects any errors, such as low external voltage, NTP abnormality, and other conditions, Relay1 will turn off, and Relay2 will activate. If everything is normal, Relay1 will activate, and Relay2 will turn off. The default value is NO.

Syntax and Example:

```
[RELAY_CONTROL_BY_ERR]
YES
```

Explanation: Use Relay1 and Relay2 as indicators of system abnormalities.

4-2-3-82 [RELAY_BLINK_MODE]

Set whether the Relay operates continuously or blinks at a one-second frequency during activation. The default value is NO.

Syntax and Example:

```
[RELAY_BLINK_MODE]
YES
```

Explanation: Configure the Relay to blink during operation.

4-2-3-83 [REDUNDANT]

Configure the use of two CUBE devices for redundancy. When setting up this system, the two CUBE devices monitor each other's heartbeat over the network. If the primary system does not respond, the backup system will take over. When the primary system returns to normal, the backup system will resume monitoring in the background. When using this mechanism, the settings for the primary and backup CUBE devices must be identical (except the backup CUBE has this setting).

Syntax:

```
[REDUNDANT]
MASTER_IP masterIp:port
HEART_BEAT_SECOND heartbeatSecond
```

Example:

```
[REDUNDANT]
MASTER_IP 192.168.255.100:502
HEART_BEAT_SECOND 5
```

Explanation:

- Set the IP of the master CUBE to 192.168.255.100 with port 502.
- Check the status of the master CUBE every 5 seconds. If it's functioning normally, the LCD will display 'Guarding'.

4-2-3-84 [RESTORE_IP_WHILE_IP_ERROR]

When setting up dynamic IP acquisition, the system can automatically copy /home/Desktop/vAlert/bin/interfacesBackup to /etc/network/interfaces and restart the network service when an incorrect IP is obtained.

Syntax: [RESTORE_IP_WHILE_IP_ERROR] - This setting can be placed on a single line.

Explanation:

- Enable the function to restore network settings from a backup file and restart the network.
- If you do not wish to use this function, you can delete this line.

4-2-3-85 [RSHD_NCHU] and [RSHD]

This function is for rapid structural health diagnostics (RSHD) of buildings. Rapid structural health diagnostics require at least three seismometers, and these three seismometers must be installed in appropriate locations. This function includes inter-story displacement and stiffness calculation. An initial estimate of stiffness is required for this method to assess the building's health.

The formula for estimating the initial stiffness value is Stiffness = (2 * π * f)2, where f is 10/N, and N is the number of floors.

Please note that this method is for estimation purposes only, and this function is an optional feature.

Syntax:

[RSHD_NCHU]
Set the details Set the content

[RSHD_NCHU] Configuration Detail		
Configuration Detail	**Configuration Content**	**Description**
API	./rshd.exe	The file name for execution is typically not necessary to modify. If you wish to run a program you've developed yourself, please contact the Sanlien Technology business department.
BUILDING_HEIGHT	25.2	Building height, unit is meter
DISPLACEMENT_RATIO	0.0025	Building regulations standard, such as 2.5 ‰
X_STIFFNESS_SET0	157.9, when the building has 5 floors in height	If the X-direction stiffness reference value (top floor-1F) is set to 0, it means that Relay is not controlled by changes in this simulated stiffness.
Y_STIFFNESS_SET0	157.9, when the building has 5 floors in height	If the Y-direction stiffness reference value (top floor-1F) is set to 0, it means that Relay is not controlled by changes in this simulated stiffness.
X_STIFFNESS_WARNING_TH0	Generally recommended to set it at or above 30%	Top floor-1F X direction WARNING threshold (percentage)
X_STIFFNESS_DANGER_TH0	Generally recommended to set it at or above 40%	Top floor-1F X direction DANGER threshold (percentage)
Y_STIFFNESS_WARNING_TH0	Generally recommended to set it at or above 30%	Top floor-1F Y direction WARNING threshold (percentage)

[RSHD_NCHU] Configuration Detail		
Configuration Detail	**Configuration Content**	**Description**
Y_STIFFNESS_DANGER_TH0	Generally recommended to set it at or above 40%	Top floor-1F Y direction DANGER threshold (percentage)
X_STIFFNESS_SET1	157.9, when the building has 5 floors in height	If the X-direction simulated stiffness reference value (2F-1F) is set to 0, it means that Relay is not controlled by changes in this simulated stiffness.
Y_STIFFNESS_SET1	157.9, when the building has 5 floors in height	If the Y-direction simulated stiffness reference value (2F-1F) is set to 0, it means that Relay is not controlled by changes in this simulated stiffness.
X_STIFFNESS_WARNING_TH1	Generally recommended to set it at or above 30%	2nd floor to 1st floor X direction WARNING threshold (percentage)
X_STIFFNESS_DANGER_TH1	Generally recommended to set it at or above 40%	2nd floor to 1st floor X direction DANGER threshold (percentage)
Y_STIFFNESS_WARNING_TH1	Generally recommended to set it at or above 30%	2nd floor to 1st floor Y direction WARNING threshold (percentage)
Y_STIFFNESS_DANGER_TH1	Generally recommended to set it at or above 40%	2nd floor to 1st floor Y direction DANGER threshold (percentage)

[RSHD_NCHU] Configuration Detail		
Configuration Detail	**Configuration Content**	**Description**
GREEN_STRING	SAFE	Default Display: SAFE, up to 20 characters maximum. Will be displayed in Line messages and MQTT messages.
YELLOW_STRING	WARNING	Default Display: WARNING, up to 20 characters maximum. Will be displayed in Line messages and MQTT messages.
RED_STRING	DANGER	Default Display: DANGER, up to 20 characters maximum. Will be displayed in Line messages and MQTT messages.
TITLE_STRING	Building Health	"Default Display: Building Health, up to 20 characters maximum.
MAXIMUM_LATCH	YES	YES/NO, Relay once triggered, requires manual cancellation.

4-2-3-86 [SERVICE]

Configure the device to proactively contact the service server every 60 seconds to check for updates or service requests. Prioritize user-defined server connections. If the connection fails or there are no service requirements, then use palertService.sanlien.com. The checking process is as follows:

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

B. Check the response message for "service_code:no:“

- If "no" is 1:

78print(buf, “./serviceApi \”%s\” \”%s\” –c %d –v %d –d %d %s”, serviceIp, “/palertService”, serviceCode, mbusAi[PX_VERSION], revDate, px01SerialNo);

- If "no" is 0:

78print(buf, “./serviceApi \”%s\” \”%s\” –c %d –v %d –d %d %s”, serviceIp, serviceDir, serviceCode, mbusAi[PX_VERSION], revDate, px01SerialNo);

C. Execute the system command: system(buf)

- Syntax and Example:

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

4-2-3-87 [SIAP]

Configure the use of the SIAP+MICROS meteorological station.

Syntax:

[SIAP]

Setting details Setting value

[SIAP] Setting Details		
Setting Details	**Setting Content**	**Description**
IP	IP:PORT	Set the IP address and port for the connected SIAP weather station.
T035TVTD_ID	>= 0	Set the Modbus RTU ID for T035TVTD. Ensure that it is different from the ID of T026TTEPRH.
T026TTEPRH_ID	>= 0	Set the Modbus RTU ID for T026TTEPRH. Ensure that it is different from the ID of T035TVTD.
RECORD_MINUTE	>= 1	The recording interval.
FTP_IP	IP	Set the IP address of the FTP server for recording file uploads.
FTP_PORT	> 0	Set the port for connecting to the FTP server for recording file uploads.
FTP_USER	userId	Set the user ID for connecting to the FTP server for recording file uploads.
FTP_PASSWORD	password	Set the password for the user ID used to connect to the FTP server for recording file uploads.

[SIAP] Setting Details		
Setting details	**Setting content**	**Description**
FTP_DIR	FTP server dir	Set the directory on the FTP server where the recording files will be uploaded.
FTP_FILENAME	fileName	Set the filename for the recording files to be uploaded to the FTP server.
SIAP_TO_RG_FTP	YES/NO	Set whether to upload the recording files to the FTP server specified in [VWHUB_CONFIG].
RG_TO_SIAP_FTP	YES/NO	Set whether to upload the recording files of the general rain gauge to the FTP server specified in this setting.

Example:

```
[SIAP]
IP 192.168.255.100:10002
T035TVTD_ID 11
T026TTEPRH_ID 12
RECORD_MINUTE 5
FTP_IP 192.168.0.100
FTP_PORT 21
FTP_USER siap
FTP_PASSWORD 1234
FTP_DIR /siap
FTP_FILENAME meteorFile
SIAP_TO_RG_FTP NO
RG_TO_SIAP_FTP YES
```

Explanation:

- Set the IP of the connected SIAP+MICROS weather station to 192.168.255.100 on port 10002.
- The Modbus RTU ID for T035TVTD is 11, and the Modbus ID for T026TTEPRH is 12.
- Record data every five minutes.
- Upload to the FTP server with IP 192.168.0.100 on port 21.
- Use the username "siap" and password "1234" for FTP login.
- Upload recording files to the "/siap" directory on the FTP server with the filename "meteorFile."
- Do not upload recording files to the FTP server specified in [VWHUB_CONFIG].
- Upload the recording files of the rain gauge to the FTP server specified in this setting.

4-2-3-88 [SINGLE_RELAY_MODE]

Set whether the Relay outputs are consolidated into a single output or remain separate. The default system value is NO, which means each RELAY is controlled individually without interfering with each other. If set to YES, when Relay3 is activated, Relay2 and Relay1 will be forcibly turned off. When Relay2 is activated, Relay1 will be forcibly turned off.

Syntax and Example:

```
[SINGLE_RELAY_MODE]
YES
```

Explanation: Set Relay to consolidated single output mode.

4-2-3-89 [SITE_EFFECT]

Set the site effect for regional earthquake early warning. Different locations have different geological conditions, which can have varying effects on the vibrations generated by earthquakes. In some areas, the effects may be reduced, while in others, they may be amplified. For more information, please contact the Sanlien Technology sales department.

Syntax and Example:

```
[SITE_EFFECT]
1.9
```

4-2-3-90 [SOCKT_OPTION]

Configure the size of the TCP transmission buffer. The default value is 5120 bytes, and the configured value must be greater than 2048 bytes.

Syntax and Example:

```
[SOCKT_OPTION]
SEND_BUF_SIZE 10240
```

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

4-2-3-91 [STORAGE_CONFIG]

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

Syntax and Example:

```
[STORAGE_CONFIG]
USB_DIR /media/usb/
EARTHQUAKE eqEvent/
MINISEED mSeed/
LOG log/
```

Explanation:

- Store earthquake data in /media/usb/eqEvent/
- Store miniSeed data ring in /media/usb/mSeed/
- Store system logs in /media/usb/log/

4-2-3-92 [SWITCH_UNLOCK_CODE]

Users can set an unlock code to prevent unauthorized access to the buttons.

Syntax and Example:

```
[SWITCH_UNLOCK_CODE]
123321
```

Explanation: Set the unlock code for the buttons as 123321, which means users must unlock by pressing the buttons in the sequence of 1 second pause, 2 seconds pause, 3 seconds pause, 3 seconds pause, 2 seconds pause, and 1 second pause.

4-2-3-93 [TILTVIEW]

CUBE can connect to TiltView inclinometers produced by Sanlien Technology, with a maximum of 31 units.

Syntax:

```
[TILTVIEW]
Setting Details Setting Value
```

[TILTVIEW] Configuration Details		
Setting Detail	**Setting Content**	**Description**
IP	IP	Set the IP address for connecting to the TiltView device.
PORT	>= 0	Specify the port number for connecting to the TiltView device.
FTPIP	IP address	Set the IP address of the FTP server for uploading recorded files
FTPPORT	Port number	Set the port for connecting to the FTP server for uploading recorded files.

[TILTVIEW] Configuration Details		
Setting Detail	**Setting Content**	**Description**
USER	user	Set the port for connecting to the FTP server for uploading recorded files.
PASSWORD	password	Set the user password for uploading the log file to the FTP server.
READ_MINUTES	>= 1	Set the polling interval for reading TiltView data in minutes.
FILEMAXSIZE	>= 5120	Set the size of the recorded file tiltviewData.dat, in bytes.
FTPFILENAME	filename	Set the filename for uploading FTP log files.
FTPMAXSIZE	>= 5120	Set the size of the FTP log file for uploading, in bytes.
FTPDIR	dir	Set the directory for the user on the FTP server for uploading log files.
ID	>= 0	Set the Modbus RTU ID for the TiltView. If there are multiple TiltView devices, enter one ID per line in sequential order
INSTRUMENT_NO	name	Instrument name, maximum 20 bytes. If you have multiple TiltView devices, enter one INSTRUMENT_NO per line in sequential order.
VOLTAGE_LOW	> 0	Low voltage warning value in volts. If you have multiple TiltView devices, enter one VOLTAGE_LOW value per line in sequential order.

[TILTVIEW] Configuration Details		
Setting Detail	**Setting Content**	**Description**
WRITE_ZERO	YES/NO	If the connection fails, force write to 0.
RETRY_NO	>= 0	The number of retries if the connection fails.
MQTT_ON_ERROR	YES/NO	In case of an abnormality, send an MQTT message with the Topic 'sanLien/%s/VWHUB', where %s is the LOCATION setting in [MQTT_CONFIG]
MATH	formula	Customize mathematical formulas as described below.
	MATH R0=tiltview[0].angle[0]-tiltview[0].offset[0] MATH R1=tiltview[0].angle[1]-tiltview[0].offset[1] MATH R2=R0*R0 MATH R3=R1^2 MATH R4=R2+R3 MATH tiltview[0].physics[0]=R4^0.5	

Example:

```
[TILTVIEW]
IP 192.168.255.100
PORT 10002
FTPIP 192.168.0.100
FTPPORT 21
USER px01
PASSWORD 1234
READ_MINUTES 5
FILEMAXSIZE 10240
FTPFILENAME tiltViewDat
FTPMAXSIZE 1024
FTPDIR /tiltView
ID 1
ID 10
ID 21
INSTRUMENT_NO TiltView1F
INSTRUMENT_NO TiltView5F
INSTRUMENT_NO TiltView10F
VOLTAGE_LOW 10
VOLTAGE_LOW 10.5
VOLTAGE_LOW 11.5
WRITE_ZERO YES
RETRY_NO 2
MQTT_ON_ERROR YES
MATH tiltview[0].angle[0]=tiltview[0].angle[0]-tiltview[0].offset[0]
MATH tiltview[1].angle[0]=tiltview[1].angle[0]-tiltview[1].offset[0]
MATH tiltview[2].angle[1]=tiltview[2].angle[1]-tiltview[2].offset[1]
```

4-2-3-94 [TEST_MODE_CONFIG]

This setting allows users to customize their own self-test mode (enter this mode by pressing the button for 9 seconds, exit it by pressing the button for 9 seconds again, or automatically exit the mode after 60 seconds without pressing the button). Users can use this setting to test the Relay.

Syntax:

[TEST_MODE_CONFIG]

Setting details Setting value

[TEST_MODE_CONFIG] Setting Details		
Setting Details	**Setting Content**	**Description**
STAGE	0 ~ 3	You can set up to four groups, and each group's configuration must start with STAGE, for example: TAGE 0 SWITCH_SECOND 6 RELAY_HOLD_SECOND 6 PLAY_FILE 3.wav RELAY2 ON You can customize the parameters for each group as needed.
SWITCH_SECOND	1 ~ 10	Defines the number of seconds required to enter this STAGE when pressing the button.
RELAY1 RELAY2 RELAY3	ON OFF	When entering this STAGE, specify whether the corresponding Relay should be activated (ON) or deactivated (OFF).

[TEST_MODE_CONFIG] Setting Details		
Setting Details	**Setting Content**	**Description**
RELAY_HOLD_SECOND	> 0	specifies the duration for which the corresponding Relay will remain active, measured in seconds.
	< 0	This represents a regional earthquake warning where the warning PGA is the high word, and the countdown seconds are the low word. For example, for a warning of 30 gal and a countdown of 20 seconds: 30 =0x001E. 20 =0x0014. When combined, the value is 0x001E0014, which is equivalent to 1966100 in decimal. To represent it as a negative value, it would be -1966100.
PLAY_FILE	The filename of the audio file to be played.	The local device does not support audio file playback, but you can set the keyword "eewsCancel.wav" to execute the cancel function, which is equivalent to pressing the button for three seconds in normal mode.

4-2-3-95 [TSUNAMI_WARNING_ENABLE]

This setting allows you to enable or disable the CWB tsunami warning function.

Syntax and Example:

```
[TSUNAMI_WARNING_ENABLE]
YES/NO
```

4-2-3-96 [VIBRATION_SENSOR]

Configure the connection to a vibration monitoring device, either Palert S3 or VC222 (DIN4150-3 functionality), or Palert+ (with ISO2631-2 and DORTS enabled). Place the monitoring data at Modbus addresses 0X031F to 0x0352. Please refer to the following section for details on the Modbus content.

Syntax and Example:

[VIBRATION_SENSOR]

IP 192.168.255.100:502

Explanation:

- Set the IP address of the connected vibration monitoring device to 192.168.255.100 with port 502.
- If the vibration monitoring device triggers an alarm, the local system will activate the corresponding relay.
- When the local system's button is held for 3 seconds to cancel an alarm, this action will also be transmitted to the vibration monitoring device to deactivate the alarm.

4-2-3-97 [VWHUB_CONFIG]

This configuration item serves two primary purposes: one is to set up the FTP server information for uploading event files, and the other is to configure the connection to Sanlien Technology's string vibration strain gauge reader.

Syntax (For Uploading Event Files):

[VWHUB_CONFIG]

IP ftpServerIP

PORT ftpServerPort

USER userId

PASSWORD password

FTPDIR ftpServerDirder, Vwhub-16.

Example:

```
[VWHUB_CONFIG]
IP 192.168.255.100
PORT 2121
USER admin
PASSWORD adminpw
FTPDIR /
```

Explanation: This configuration sets the FTP server IP to 192.168.255.100, with port 2121. It uses the user ID "admin" and the password "adminpw" for authentication, and uploads files to the root directory ("/") on the FTP server.

Detailed Settings for the Vwhub-16 String Vibration Strain Gauge Reader

Setting Detail	Setting Content	Description
IP	IP	Set the IP of connected Vwhub.
PORT	>= 0	Set the Port of connected Vwhub.
FTPIP	IP address	Set the IP for uploading log files to the FTP server.
FTPPORT	Port number	Set the connection port for uploading log files to the FTP server.
USER	user	Set the user ID for uploading log files to the FTP server
PASSWORD	password	Set the user password for uploading log files to the FTP server.
READ_MINUTES	>= 1	Set the polling interval for reading Vwhub in minutes.
FILEMAXSIZE	>= 5120	Set the size of the log file 'vwhubData.dat' in bytes.
FTPFILENAME	filename	Set the filename for uploading log files to FTP.
FTPMAXSIZE	>= 5120	Set the size of the log file to be uploaded to FTP in bytes.
FTPDIR	dir	Set the user directory for uploading log files to the FTP server.

Detailed Settings for the Vwhub-16 String Vibration Strain Gauge Reader		
Setting Detail	**Setting Content**	**Description**
ID	>= 0	Configure the Modbus RTU ID for Vwhub. If there are multiple tiltView devices, enter one ID per line in sequential order.
INSTRUMENT_NO	name	Instrument name, up to 20 bytes. If there are multiple Vwhub devices, enter one INSTRUMENT_NO per line in sequential order.
VOLTAGE_LOW	> 0	Low voltage warning value in volts. If there are multiple Vwhub devices, enter one VOLTAGE_LOW value per line in sequential order.
WRITE_ZERO	YES/NO	If the connection fails, force write as 0.
RETRY_NO	>= 0	The number of retry attempts if the connection fails.
MQTT_ON_ERROR	YES/NO	When there is an anomaly, send an MQTT message with the Topic as 'sanLien/%s/VWHUB,' where %s is based on the 'LOCATION' setting within [MQTT_CONFIG].
MATH	formula	User-defined mathematical formula, please refer to the following instructions.
	MATH R0=vw[1].freq[16]+vw[5].freq[2]+1001/2 MATH R1=2^10 MATH R0=10000+R0+R1+123 MATH vw[1].freq[16]=333+222+111+R0+99	

Example:

```
[VWHUB_CONFIG]
IP 10.0.0.218
PORT 10002
READ_MINUTES 2
SCAN_WAIT_SECONDS 30
FTPIP 192.168.255.100
FTPPORT 21
USER user
PASSWORD 1234
FILEMAXSIZE 1000000
FTPFILENAME GSI_Vwhub
FTPMAXSIZE 1000000
FTPDIR /home/vwhub
WRITE_ZERO YES
RETRY_NO 5
ID 1
INSTRUMENT_NO 2729-301
FTPIP 211.20.66.150
VOLTAGE_LOW 8.0
CHN 1
FORMULA_STRAIN_a 0.000000123456
FORMULA_STRAIN_b 2.2
FORMULA_STRAIN_c 3.3
FORMULA_PHYSICS_a 4.4
FORMULA_PHYSICS_b 5.5
FORMULA_PHYSICS_c 6.6
CHN 2
CHN 3
CHN 5
ID 5
CHN 2
CHN 4
```

4-2-3-98 [WATCHDOG]

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

Syntax and Example:

```
[WATCHDOG]
5
```

Explanation:

- Set a 5-second delay before executing the watchdog after the system boots up.
- Please note that this item is related to hardware and must be configured by an FAE.

4-2-3-99 [WIND_METER]

The local system can connect to an analog wind speed and wind direction meter using ET-7017 produced by ICP DAS. It can be used for earthquake monitoring, especially in high-rise buildings.

Syntax:

```
[WIND_METER]
ET7017_IP ip:port
DIR_CH windDirAttachedChannel
DIR_COEFFICIENT_A windDirCoefficientA
DIR_COEFFICIENT_B windDirCoefficientB
SPEED_CH windSpeedAttachedChannel
SPEED_COEFFICIENT_A windSpeedCoefficientA
SPEED_COEFFICIENT_B windSpeedCoefficientB
TRIG_SPEED windSpeedTrigThreshold
WRITE_INTERVAL writeInterval
```

Example:

```
[WIND_METER]
ET7017_IP 192.168.255.100:502
DIR_CH 1
DIR_COEFFICIENT_A 0.010986328125
DIR_COEFFICIENT_B 0
SPEED_CH 0
SPEED_COEFFICIENT_A 0.0030517578125
SPEED_COEFFICIENT_B 0
TRIG_SPEED 30
WRITE_INTERVAL 30
```

Explanation:

- The ET-7017 connected to the wind speed and wind direction meter with an IP of 192.168.255.100 and port 502.
- The wind direction meter is connected to CH1 on the ET-7017.
- The wind direction meter's calibration coefficient A is calculated as 360 / 32768 = 0.010986328125.
- The wind direction meter's calibration coefficient B is 0.
- The wind direction angle is calculated as the output from ET-7017 CH1 * A + B.
- The wind speed meter is connected to CH0 on the ET-7017.
- The wind speed meter's calibration coefficient A is calculated as 100 km / 32768 = 0.0030517578125.
- The wind speed meter's calibration coefficient B is 0.
- The wind speed is calculated as the output from ET-7017 CH0 * A + B.
- Data is recorded every 30 seconds (must be >= 10).
- The wind speed meter triggers an earthquake event if the speed threshold is 30 km/h.

4-2-3-100 [WIRELESS_LAN_ENABLE]

This setting configures whether the Wi-Fi IP is displayed on the LCD. The default value is "NO."

Syntax and Example:

```
[WIRELESS_LAN_ENABLE]
NO
```

Explanation: The LCD will not display the WiFi IP in this configuration.

4-2-3-101 [ZT-2000_DO_START_POINT]

The local system can directly control the ZT-2000 DO module produced by ICPDAS. This setting configures 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: The Modbus starting point for the ZT-2000 DO module is set to 0.

4-2-3-102 [ZT-2000_DO_END_POINT]

The local system can directly control the ZT-2000 DO module produced by ICPDAS. This setting configures 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: The Modbus ending point for the ZT-2000 DO module is set to 31.

4-2-3-103 [ZT-2000_DO_ON_GAL]

The local system can directly control the ZT-2000 DO module produced by ICPDAS. This setting configures the PGA activation threshold for the ZT-2000 DO module, measured in gal (acceleration units). The default value is 80 gal.

Syntax and Example:

```
[ZT-2000_DO_ON_GAL]
8
```

Explanation: The activation threshold for the ZT-2000 DO module is set to 8 gal.

4-2-3-104 [ZT-2000_IP]

The local system can directly control the ZT-2000 DO module produced by ICPDAS. This setting configures the IP address of the ZT-2000.

Syntax and Example:

```
[ZT-2000_IP]
192.168.255.100
```

Explanation: The IP address of the ZT-2000 is set to 192.168.255.100.

5. Modbus Point Table

5.1 AO (4xxxx)

Modbus AO Point Table (4xxxx)			
Register	**R/W**	**Label**	**Description**
0x0063	R	SYNC_FLAG	Time Synchronization Flag Bit 0: NTP SYNC. Bit 14: GPS sync. Bit 15: time sync. with CWB EEW server
0x0070	R/W	WRITE_CONFIG	0x0080: Force program to stop running. 0x0180: Restart the program. 0x0181: Initiate FTP software update. 0x0380: Write settings to initSetup.cfg. 0x0480: Read settings from initSetup.cfg. 0x0580: Execute zeroing calculation. 0x10C1: Reload data for the geophone.
0x0076	R	DIO_STATUS	Relay Status: When a relay is activated, the corresponding bit value is set to 1. Bit 0: Relay1 Bit 1: Relay2 Bit 2: Relay3
0x00C0	R/W	STREAM_CONTROL	Stream Packet Forwarding Control: The packet format should follow the section regarding stream packet format. 0: Do not output stream data. 1: Output Mode 1 data packets (16-bit). 2: Output the header for Mode 1.
0x00EC	R/W	GLOBALEVENT	Continuous Recording Control: When the value at this address is 1, the system will continuously record waveform data.

Modbus AO Point Table (4xxxx)			
Register	**R/W**	**Label**	**Description**
0x0102	R/W	POWER_OFF_BUTTON	The number of seconds for the remote control button.
0x0103	R/W	POWER_OFF_CNT	The current cumulative number of seconds for the button presses.
0x0105	R/W	RECORDING_START_TIME	The starting time for scheduled recording in Unix timestamp format.
0x0107	R/W	RECORDING_STOP_TIME	The ending time for scheduled recording in Unix timestamp format.
0x010A	R	ERR_CNT	The number of errors detected by the system.
0x01A3	R	RPI_VOLUME	Voice output volume control.
0x01AD	R	GRID_HEARTBEAT	Heartbeat signal for grid earthquake early warning.
0x01AE	R	GRID_EQ_TIMER	Residual warning time for grid earthquake early warning alerts
0x01AF	R	GRID_EQ_YY	The occurrence time (year) of grid earthquake early warning alert events.
0x01B0	R	GRID_EQ_MM	The occurrence time (month) of grid earthquake early warning alert events.
0x01B1	R	GRID_EQ_DD	The occurrence time (day) of grid earthquake early warning alert events
0x01B2	R	GRID_EQ_hh	The occurrence time (hour) of grid earthquake early warning alert events.

Modbus AO Point Table (4xxxx)			
Register	**R/W**	**Label**	**Description**
0x01B3	R	GRID_EQ_mm	The occurrence time (minute) of grid earthquake early warning alert events.
0x01B4	R	GRID_EQ_ss	The occurrence time (second) of grid earthquake early warning alert events.
0x01B5	R	GRID_EQ_INTENSITY	The intensity of grid earthquake early warning alert events, measured in units of 0.1 level. If set to CWB 2020 intensity scale, it would be equivalent to 1 level.
0x01B6	R	GRID_EQ_ID	The identifier or number for grid earthquake early warning alert events.
0x01B7	R	GRID_EQ_TYPE	The type of grid earthquake early warning alert events, where 0 represents an earthquake, and 1 represents a test.
0x01B8	R	GRID_EQ_ORG	The issuing authority of grid earthquake early warning alert events, where 0 represents CWB (Central Weather Bureau) and 1 represents NCREE (National Center for Research on Earthquake Engineering).
0x0257	R	RSHD_NCHU_YY	The result of structural health rapid diagnosis - year.
0x0258	R	RSHD_NCHU_MM	The result of structural health rapid diagnosis – month.
0x0259	R	RSHD_NCHU_DD	The result of structural health rapid diagnosis – day.
0x025A	R	RSHD_NCHU_hh	The result of structural health rapid diagnosis – hour.

Modbus AO Point Table (4xxxx)			
Register	**R/W**	**Label**	**Description**
0x025B	R	RSHD_NCHU_mm	The result of structural health rapid diagnosis - minute.
0x025C	R	RSHD_NCHU_ss	The result of structural health rapid diagnosis - second.
0x025D	R	RSHD_NCHU_FLAG	Update flag for structural health rapid diagnosis results, for internal use.
0x025E	R	RSHD_NCHU_RESULT	The results of structural health rapid diagnosis, where 1 corresponds to 'OK,' 2 corresponds to 'Warning,' and 3 corresponds to 'NG'.
0x025F	R	RSHD_MAX_DISPLACEMENT	The result of structural health rapid diagnosis, maximum displacement, measured in units of 0.01 cm.
0x0260	R	RSHD_NCHU_STIFFNESS_X	The result of structural health rapid diagnosis, stiffness in the X-axis direction, measured in units of 0.1%.
0x0261	R	RSHD_NCHU_STIFFNESS_Y	The result of structural health rapid diagnosis, stiffness in the Y-axis direction, measured in units of 0.1%.
0x0293	R	ITK_FLAG	The ITK RSHD calculation is completed
0x0294	R	ITK_CNT	Heartbeat of the ITK RSHD program operation
0x0295	R	ITK_ID	Serial number of the ITK RSHD calculation result.
0x0296	R	ITK_RESULT	The ITK RSHD calculation result: 1: 0, 1; 2: 2, 3; 4: 4, 5.
0x0297	R	ITK_INTENSITY	The ITK RSHD intensity.

Modbus AO Point Table (4xxxx)			
Register	**R/W**	**Label**	**Description**
0x0298	R	ITK_PGA	The maximum acceleration value in ITK RSHD.
0x029A	R	ITK_YEAR	Time in ITK RSHD - year.
0x029B	R	ITK_MONTH	Time in ITK RSHD - month.
0x029C	R	ITK_DAY	Time in ITK RSHD - day.
0x029D	R	ITK_HOUR	Time in ITK RSHD – hour.
0x029E	R	ITK_MINUTE	Time in ITK RSHD – minute.
0x029F	R	ITK_SECOND	Time in ITK RSHD – second.
0x02BB	R	HAZUS_ISDR_FLAG	Flag for updating HAZUS calculation results.
0x02BC	R	HAZUS_ISDR_YY	The result of HAZUS rapid diagnosis - year.
0x02BD	R	HAZUS_ISDR_MM	The result of HAZUS rapid diagnosis – month.
0x02BE	R	HAZUS_ISDR_DD	The result of HAZUS rapid diagnosis – day.
0x02BF	R	HAZUS_ISDR_hh	The result of HAZUS rapid diagnosis – hour.
0x02C0	R	HAZUS_ISDR_mm	The result of HAZUS rapid diagnosis – minute.
0x02C1	R	HAZUS_ISDR_ss	The result of HAZUS rapid diagnosis – second.
0x02C2	R	HAZUS_ISDR_RESULT	The result of HAZUS rapid diagnosis, ranging from 0 to 4.
0x02C3 0x02C4	R	HAZUS_ISDR_DRIFT_RATIO	The result of HAZUS rapid diagnosis, maximum displacement drift ratio, in floating-point format.

Modbus AO Point Table (4xxxx)			
Register	**R/W**	**Label**	**Description**
0x02C5 0x02C6	R	HAZUS_ISDR_ABS_DISP	The result of HAZUS rapid diagnosis, maximum displacement drift ratio, in floating-point format.
0x02C7 0x02C8	R	HAZUS_ISDR_RELATIVE_DISP	The result of HAZUS rapid diagnosis, maximum absolute displacement, measured in centimeters, in floating-point format.

5.2 AI (3xxxx)

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x0069	PX_YEAR	The system's time – year
0x006A	PX_MONTH	The system's time – month
0x006B	PX_DAY	The system's time – day
0x006C	PX_WDAY	The system's time – day of the week
0x006D	PX_HOUR	The system's time – hour
0x006E	PX_MINUTE	The system's time – minute
0x006F	PX_SECOND	The system's time – second
0x007B	PX_VERSION	Software version
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.
0x02BB	RSHD_BUILDING_HEIGHT	Structural health rapid diagnosis setting - building height.
0x02BC	RSHD_MAX_DISPLACEMENT_RATIO	Structural health rapid diagnosis setting - displacement ratio, in units of one hundred-thousandth.
0x02BD	RSHD_NCHU_STIFFNESS_SET_X	Structural health rapid diagnosis setting - X-axis stiffness, in units of one-hundredth percent.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x02BE	RSHD_NCHU_STIFFNESS_SET_Y	Structural health rapid diagnosis setting - Y-axis stiffness, in units of one-hundredth percent.
0x02BF	RSHD_NCHU_STIFFNESS_WARN_TH_X	Structural health rapid diagnosis alert setting - X-axis stiffness, in units of one-hundredth percent.
0x02C0	RSHD_NCHU_STIFFNESS_DANGER_TH_X	Structural health rapid diagnosis warning setting - X-axis stiffness, in units of one-hundredth percent.
0x02C1	RSHD_NCHU_STIFFNESS_WARN_TH_Y	Structural health rapid diagnosis alert setting - Y-axis stiffness, in units of one-hundredth percent
0x02C2	RSHD_NCHU_STIFFNESS_DANGER_TH_Y	Structural health rapid diagnosis alert setting - Y-axis stiffness, in units of one-hundredth percent.
The calculation results from 0x031F to 0x0330 are for DIN4150, and they are only useful when [VIBRATION_SENSOR] is enabled to connect to Palert S3 (VC222).		
0x031F	DIN_DATA_COUNTER	Data update counter, incremented each time new data is received.
0x0320	DIN_AXIS0_PEAK	The Peak velocity value for axis 0, measured in units of 0.01 mm/sec.
0x0321	DIN_AXIS1_PEAK	The Peak velocity value for axis 1, measured in units of 0.01 mm/sec.
0x0322	DIN_AXIS2_PEAK	The Peak velocity value for axis 2, measured in units of 0.01 mm/sec.
0x0323	DIN_AXIS3_PEAK	The Peak velocity value for axis 3, measured in units of 0.01 mm/sec.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x0324	DIN_AXIS0_FREQ	The frequency of the Peak velocity value for axis 0, measured in units of 0.01 Hz.
0x0325	DIN_AXIS1_FREQ	The frequency of the Peak velocity value for axis 1, measured in units of 0.01 Hz.
0x0326	DIN_AXIS2_FREQ	The frequency of the Peak velocity value for axis 2, measured in units of 0.01 Hz.
0x0327	DIN_AXIS3_FREQ	The frequency of the Peak velocity value for axis 3, measured in units of 0.01 Hz.
0x0328	DIN_PEAK_LATCH	The Peak velocity hold value, measured in units of 0.01 mm/sec.
0x0329	DIN_FREQ_LATCH	The frequency of the Peak velocity hold value, measured in units of 0.01 Hz.
0x032A	DIN_RELAY	The operating status of the relay.
0x032B	DIN_YEAR	The occurrence time of the event in years.
0x032C	DIN_MONTH	The occurrence time of the event in months.
0x032D	DIN_DAY	The occurrence time of the event in days.
0x032E	DIN_HOUR	The occurrence time of the event in hours.
0x032F	DIN_MINUTE	The occurrence time of the event in minutes.
0x0330	DIN_SECOND	The occurrence time of the event in seconds.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
The calculation results from 0x0333 to 0x033C are for ISO2631 and are only useful when [VIBRATION_SENSOR] is enabled to connect to Palert+ (with ISO2631 functionality enabled).		
0x0333	ISO_DATA_COUNTER	Data update counter, incremented each time new data is received.
0x0334	ISO_XY_GAL	The XY-axis composite vector in gal values, measured in units of 0.1 gal
0x0335	ISO_Z_GAL	The Z-axis gal value, measured in units of 0.1 gal.
0x0336	ISO_XY_DB	The XY-axis composite vector in dB values, measured in units of 0.01.
0x0337	ISO_Z_DB	The Z-axis dB value, measured in units of 0.01.
0x0338	ISO_MAX_DB	The maximum dB value, measured in units of 0.01.
0x0339	ISO_DB_LATCH	The maximum dB hold value, measured in units of 0.01.
0x033A	ISO_MAX_DB_MAX	
0x033B	ISO_MAX_DB_AVRG	
0x033C	ISO_RELAY	The operating status of the relay

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
The calculation results from 0x0347 to 0x0350 are for DORTS and are only useful when [VIBRATION_SENSOR] is enabled to connect to Palert+ (with DORTS functionality enabled).		
0x0347	DORTS_DATA_CONUTER	Data update counter, incremented each time new data is received.
0x0348	DORTS_2HZ_DB	The dB value at 2 Hz, measured in units of 0.01.
0x0349	DORTS_4HZ_DB	The dB value at 4 Hz, measured in units of 0.01.
0x034A	DORTS_8HZ_DB	The dB value at 8 Hz, measured in units of 0.01.
0x034B	DORTS_16HZ_DB	The dB value at 16 Hz, measured in units of 0.01.
0x034C	DORTS_31P5HZ_DB	The dB value at 31.5 Hz, measured in units of 0.01.
0x034D	DORTS_63HZ_DB	The dB value at 63 Hz, measured in units of 0.01.
0x034E	DORTS_MAX_DB	The maximum dB value, measured in units of 0.01.
0x034F	DORTS_DB_LATCH	The maximum dB hold value, measured in units of 0.01.
0x0350	DORTS_RELAY	The operating status of the relay
0x042D	RSHD_ON_HMI_YEAR1	The most recent three RSHD calculation results (1) - year.
0x042E	RSHD_ON_HMI_MONTH1	The most recent three RSHD calculation results (1) – month.
0x042F	RSHD_ON_HMI_DAY1	The most recent three RSHD calculation results (1) – day.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x0430	RSHD_ON_HMI_HOUR1	The most recent three RSHD calculation results (1) – hour.
0x0431	RSHD_ON_HMI_MINUTE1	The most recent three RSHD calculation results (1) – minute.
0x0432	RSHD_ON_HMI_STIFFNESS_X1	The most recent three RSHD calculation results (1) - X-axis pseudo stiffness.
0x0433	RSHD_ON_HMI_STIFFNESS_Y1	The most recent three RSHD calculation results (1) - Y-axis pseudo stiffness.
0x0434	RSHD_ON_HMI_STIFFNESS_X1_P	The most recent three RSHD calculation results (1) - X-axis pseudo stiffness percentage.
0x0435	RSHD_ON_HMI_STIFFNESS_Y1_P	The most recent three RSHD calculation results (1) - Y-axis pseudo stiffness percentage.
0x0436	RSHD_ON_HMI_INTENSITY1	The most recent three RSHD calculation results (1) - event intensity.
0x0437	RSHD_ON_HMI_YEAR2	The most recent three RSHD calculation results (2) - year.
0x0438	RSHD_ON_HMI_MONTH2	The most recent three RSHD calculation results (2) – month.
0x0439	RSHD_ON_HMI_DAY2	The most recent three RSHD calculation results (2) – day.
0x043A	RSHD_ON_HMI_HOUR2	The most recent three RSHD calculation results (2) – hour.
0x043B	RSHD_ON_HMI_MINUTE2	The most recent three RSHD calculation results (2) – minute.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x043C	RSHD_ON_HMI_STIFFNESS_X2	The most recent three RSHD calculation results (2) - X-axis pseudo stiffness.
0x043D	RSHD_ON_HMI_STIFFNESS_Y2	The most recent three RSHD calculation results (2) - Y-axis pseudo stiffness
0x043E	RSHD_ON_HMI_STIFFNESS_X2_P	The most recent three RSHD calculation results (2) - X-axis pseudo stiffness percentage.
0x043F	RSHD_ON_HMI_STIFFNESS_Y2_P	The most recent three RSHD calculation results (2) - Y-axis pseudo stiffness percentage.
0x0440	RSHD_ON_HMI_INTENSITY2	The most recent three RSHD calculation results (2) - event intensity.
0x0441	RSHD_ON_HMI_YEAR3	The most recent three RSHD calculation results (3) – year
0x0442	RSHD_ON_HMI_MONTH3	The most recent three RSHD calculation results (3) – month
0x0443	RSHD_ON_HMI_DAY3	The most recent three RSHD calculation results (3) – day
0x0444	RSHD_ON_HMI_HOUR3	The most recent three RSHD calculation results (3) – hour
0x0445	RSHD_ON_HMI_MINUTE3	The most recent three RSHD calculation results (3) - minute
0x0446	RSHD_ON_HMI_STIFFNESS_X3	The most recent three RSHD calculation results (3) - X-axis pseudo stiffness.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x0447	RSHD_ON_HMI_STIFFNESS_Y3	The most recent three RSHD calculation results (3) - Y-axis pseudo stiffness.
0x0448	RSHD_ON_HMI_STIFFNESS_X3_P	The most recent three RSHD calculation results (3) - X-axis pseudo stiffness percentage
0x0449	RSHD_ON_HMI_STIFFNESS_Y3_P	The most recent three RSHD calculation results (3) - Y-axis pseudo stiffness percentage
0x044A	RSHD_ON_HMI_INTENSITY3	The most recent three RSHD calculation results (3) - event intensity.
0x2773	RELAY1_PGA	The PGA activation value for Relay1, measured in units of 0.1 gal.
0x2774	RELAY2_PGA	The PGA activation value for Rela2, measured in units of 0.1 gal.
0x2775	RELAY3_PGA	The PGA activation value for Relay3, measured in units of 0.1 gal.
0x2776		Reserved
0x2777	RELAY1_PGV	The PGV activation value for Relay1, measured in units of 0.1 mm/sec.
0x2778	RELAY2_PGV	The PGV activation value for Relay2, measured in units of 0.1 mm/sec.
0x2779	RELAY3_PGV	The PGV activation value for Relay3, measured in units of 0.1 mm/sec.
0x277A		Reserved
0x277B	RELAY1_INTENSITY	The seismic intensity trigger threshold for Relay1.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x277C	RELAY2_INTENSITY	The seismic intensity trigger threshold for Relay2.
0x277D	RELAY2_INTENSITY	The seismic intensity trigger threshold for Relay3.
0x277E		Reserved
0x277F	RELAY1_EEWS_INTENSITY	The regional earthquake early warning intensity trigger threshold for Relay1.
0x2780	RELAY2_EEWS_INTENSITY	The regional earthquake early warning intensity trigger threshold for Relay2.
0x2781	RELAY3_EEWS_INTENSITY	The regional earthquake early warning intensity trigger threshold for Relay3.
0x2782		Reserved
0x2783	SINGLE_RELAY_MODE	0: Three sets of Relays controlled individually 1: Relays are consolidated into a single output
0x2784	RELAY_BLINK_MODE	0: Relay output without flashing 1: Relay output flashes for 0.5 seconds when activated.
0x2785	RELAY_CONTROL_BY_ERR	0: System error detection does not affect Relay output 1: Relay control is a composite of whether a system error is detected, please refer to the [RELAY_CONTROL_BY_ERR] setting explanation.
0x2786	RELAY_RESET_BY_MANUAL	0: Relay automatically resets by the system after event output 1: Relay reset requires a three-second button press.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x2787	DAY_BEGIN_MINUTE	The start time of the daytime, measured in minutes.
0x2788	DAY_END_MINUTE	The end time of the daytime, measured in minutes.
0x2789	DAY_VOICEALARM_INTENSITY	The alert threshold for daytime voice and messages.
0x278A	NIGHT_VOICEALARM_INTENSITY	The alert threshold for nighttime voice and messages.
0x278B	LOCAL_LONGITUDE_INT	Longitude, measured in degrees.
0x278C	LOCAL_LONGITUDE_DEC	Longitude, measured in ten-thousandths of degrees.
0x278D	LOCAL_LATITUDE_INT	Latitude, measured in degrees.
0x278E	LOCAL_LATITUDE_DEC	Latitude, measured in ten-thousandths of degrees.
0x278F	HEIGHT	Altitude, measured in meters.
0x2790	SITE_EFFECT	Site effect, measured in units of 0.01.
0x2791	RECORD_INTENSITY	The seismic intensity threshold for triggering recording, measured in units of 0.1 scale.
0x2792	RECORD_PGA	The seismic PGA (Peak Ground Acceleration) threshold for triggering recording, measured in units of 0.1 gal.
0x2793	PRE_EVENT_SECOND	The pre-event recording duration, measured in seconds.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x2794	POST_EVENT_SECOND	The post-event recording duration, measured in seconds.
0x2795	EVENT_FILE_MAX_LENGTH_IN_SECOND	The maximum duration of event recording, measured in seconds.
0x2796	GLOBAL_EVENT_ENABLE	1: During an earthquake event, the waveforms from all connected seismometers will be recorded simultaneously. 0: During an earthquake event, only the triggered seismometer's waveforms will be recorded.
0x2797	MESSAGE_PALERT	Determine the instrument numbers for seismic intensity, PGA, and PGV.
0x2798	N_WHERE_N_OUT_OF_M	Three-out-of-two event detection mechanism: Minimum number of simultaneously triggered seismometers.
0x2799	M_WHERE_N_OUT_OF_M	Three-out-of-two event detection mechanism: Total number of connected seismometers.
0x279A	N_OUT_OF_M_IN_SECOND	Three-out-of-two event detection mechanism: Total number of connected seismometers.
0x279B	N_OUT_OF_M_BY_MIDDLE	Three-out-of-two event detection mechanism: Determine events on the rising edge or not. 0: Determine events on the rising edge. 1: Do not determine events on the rising edge
0x279C	N_OUT_OF_M_INTENSITY_BY_ALL	In the "Three-out-of-two event detection mechanism," the instrument with the lowest intensity is used to determine the intensity, PGA, and PGV values during an event.

Modbus AO Point Table (3xxxx) Read Only		
Register	**Label**	**Description**
0x279D	RELAY1_PD	The "Pd" startup value for Relay 1 is specified in centimeters (cm) with a unit of 0.001 cm.
0x279E	RELAY2_PD	The "Pd" startup value for Relay 2 is specified in centimeters (cm) with a unit of 0.001 cm.
0x279F	RELAY3_PD	The "Pd" startup value for Relay 3 is specified in centimeters (cm) with a unit of 0.001 cm.
0x27A0		Reserved

6. Web User Interface

The device provides a web user interface that can be used by novice users for basic configuration and operation. Please refer to other manuals for more information about the web user interface.

7. Stream Packet Format

7-1 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	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
▲	▲	9	Event flag (111)
▲	▲	10	system time-year (147)
▲	▲	11	system time-month (148)
▲	▲	12	system time-day (149)
▲	▲	13 (high byte)	system time-hour (150)
▲	▲	13 (low byte)	system time-minute (151)
▲	▲	14	system time-second (152)
▲	▲	15	system time-10 msecond
▲	▲	16	PGV within 1 second (125)
▲	▲	17	Reserved
▲	▲	18	PGA within 10 seconds (140)
▲	▲	19	Reserved
▲	▲	20	Pd warning threshold (162)
▲	▲	21	PGA warning threshold (161)
▲	▲	22	Reserved
▲	▲	21	PGV within 1 second (125)
▲	▲	22	Reserved

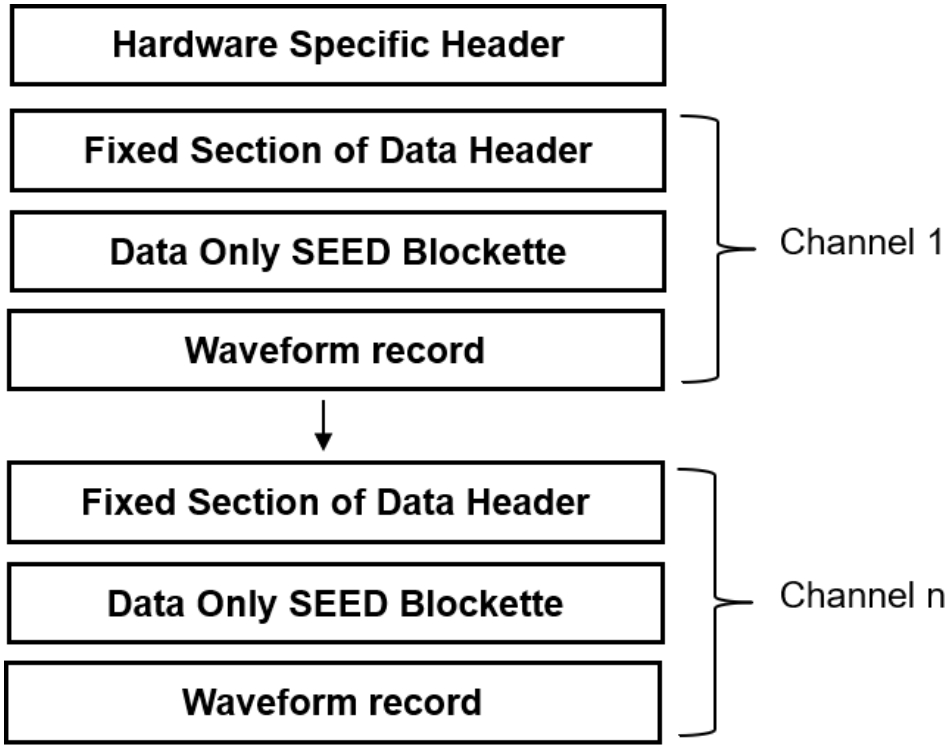
Mode 1	Mode 2	Integer Number	Description (Value in parentheses indicate Palert Modbus registers addresses)
▲	▲	23	Pd flag (139)
▲	▲	24	Pd watch threshold (164)
▲	▲	25	PGA watch threshold (121)
▲	▲	26	Intensity now (109)
▲	▲	27	Intensity maximum (110)
▲	▲	28	PGA within 1 second
▲	▲	29	Reserved
▲	▲	30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

7-2 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:



7-2 mode 4

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.

7-3 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)

7-4 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	

Fixed:

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

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

In the case of Palert+ with a 1000sps sampling rate, 3-axis output data, 200 data points each, let's consider the first packet with a sequence number of 20168. The endianness used for the Linux system is Little Endian.

Byte Position	Value	Remarks
0	0x53	S
1	0x59	Y
2	0x4E	N
3	0x43	C
4	0x00	PacketNo: 0x0000
5	0x00	
6	0x12	HeaderLen: 20➔0x14

Byte Position	Value	Remarks
7	0x 60	DataLen 2400 ➔ 0x0960
8	0x 09	
9	0x7F	PacketLen: (11+20+4*3*200+2) = 2433 ➔ 0x0981
10	0x09	
11	0xB9	UnixTime: 12/19/2019 @ 5:50am (UTC) ➔1576734649 seconds since Jan 01 1970. (UTC) 1576734649 ➔ 0x5DFB0FB9
12	0x0F	
13	0xFB	
14	0x5D	
15	0x00	
16	0xC4	Msec (0～9999) 0.25(s) ➔ 2500(0.1ms) ➔ 0x09C4
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	1000sps ➔ 0x03E8
24	0x03	
25	0x03	Palert+
26	0x03	3-axis output
27	0xC8	S/N 20168 ➔ 0x00004EC8
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		

8. RTD Packet Format

- 16-bit no checksum

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

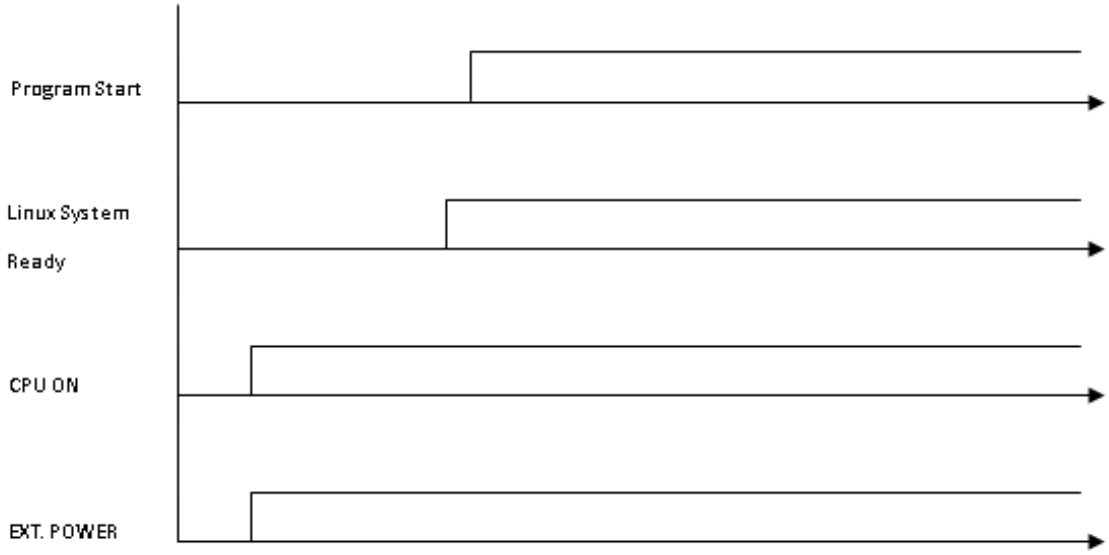
- 16-bit with checksum

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

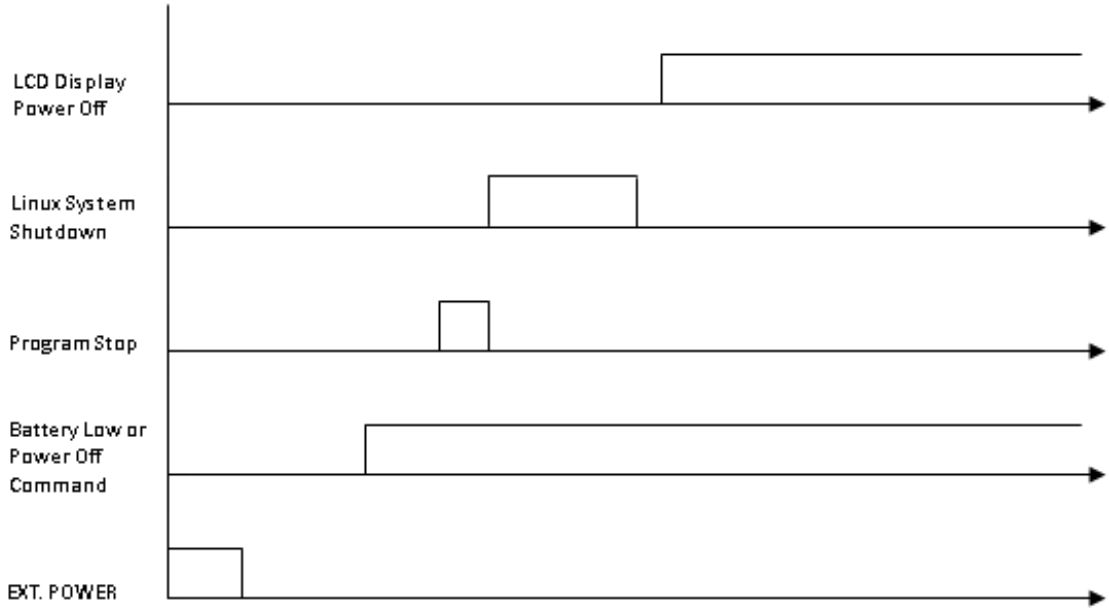
checkSum = 0x0A + 0x0D + XH + XL + YH + YL + ZH + ZL

9. Time Sequence Diagram

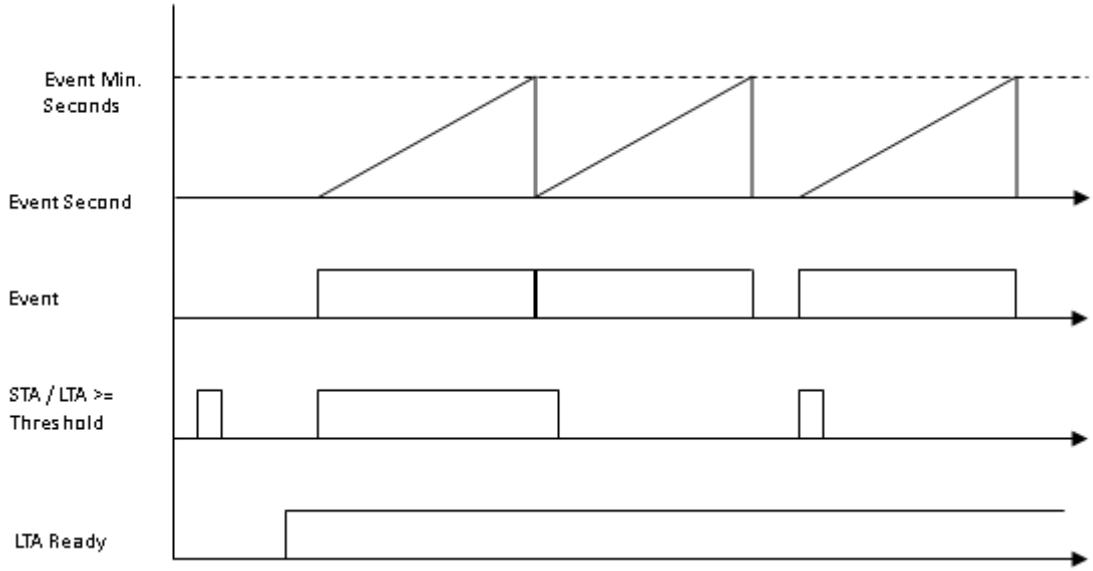
9-1 Power-On Sequence Diagram



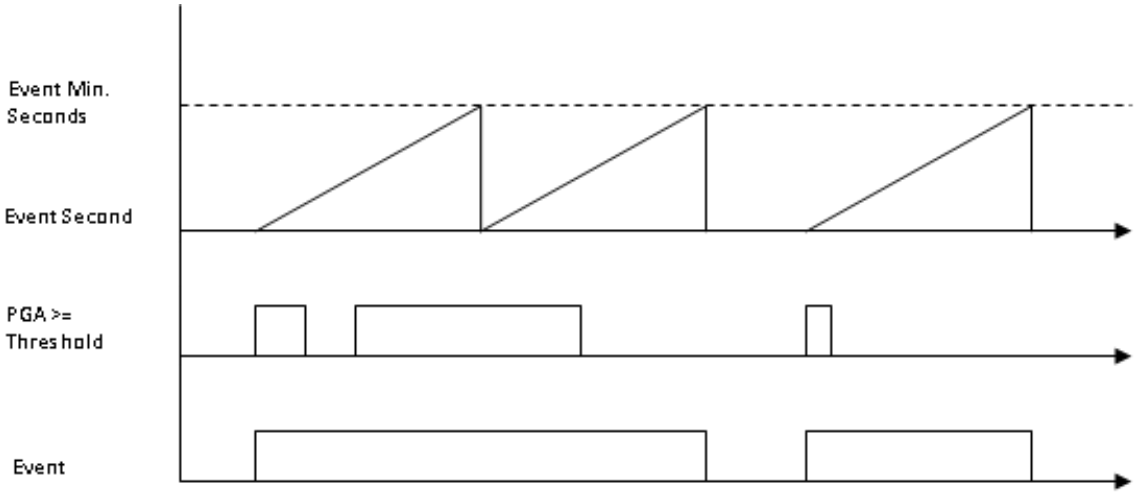
9-1 Power-Off Sequence Diagram



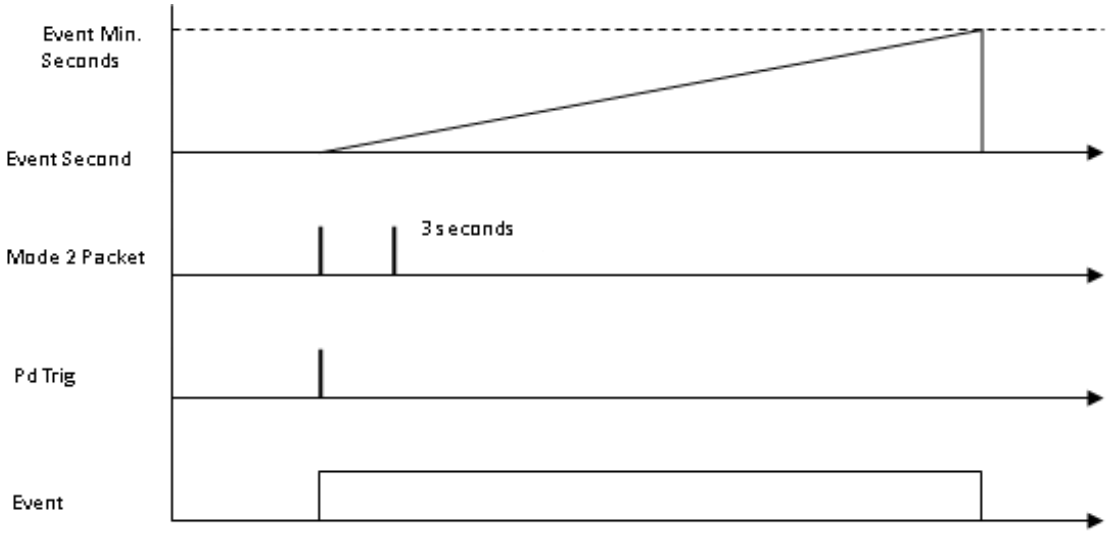
9-3 STA / LTA Earthquake Detection Timing Diagram



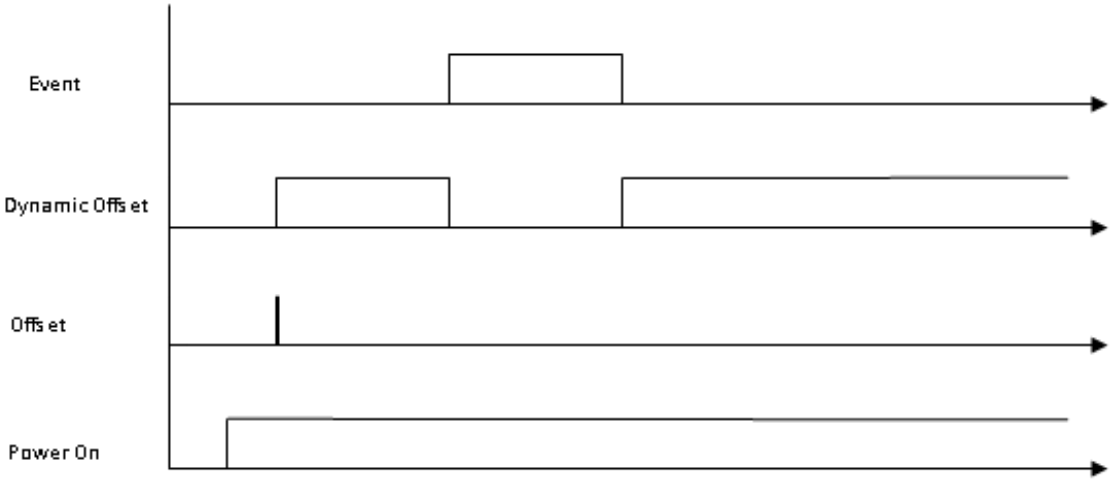
9-4 PGA Earthquake Detection Timing Diagram



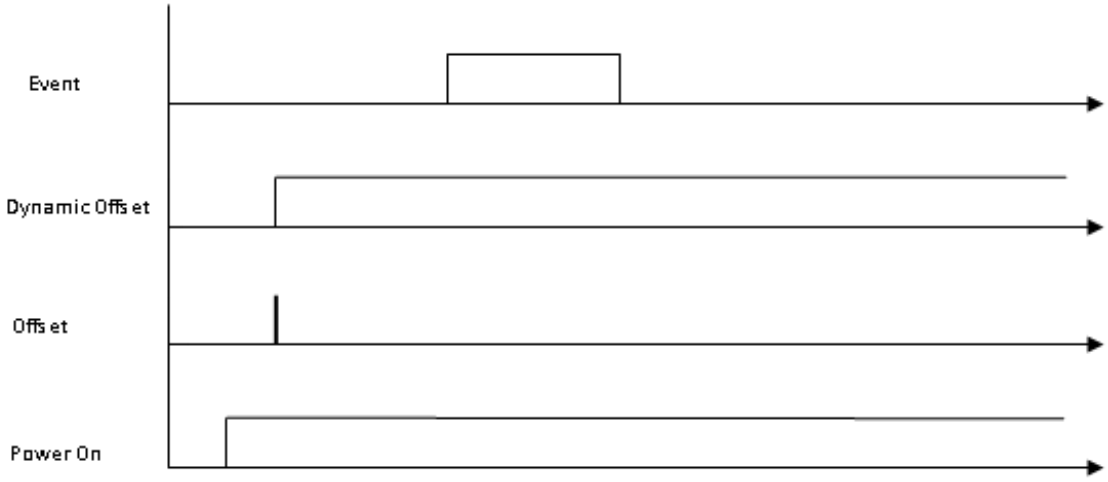
9-5 Pd Earthquake Detection Timing Diagram



9-6 Zeroing Process (AUTO_OFFSET = TRTC)



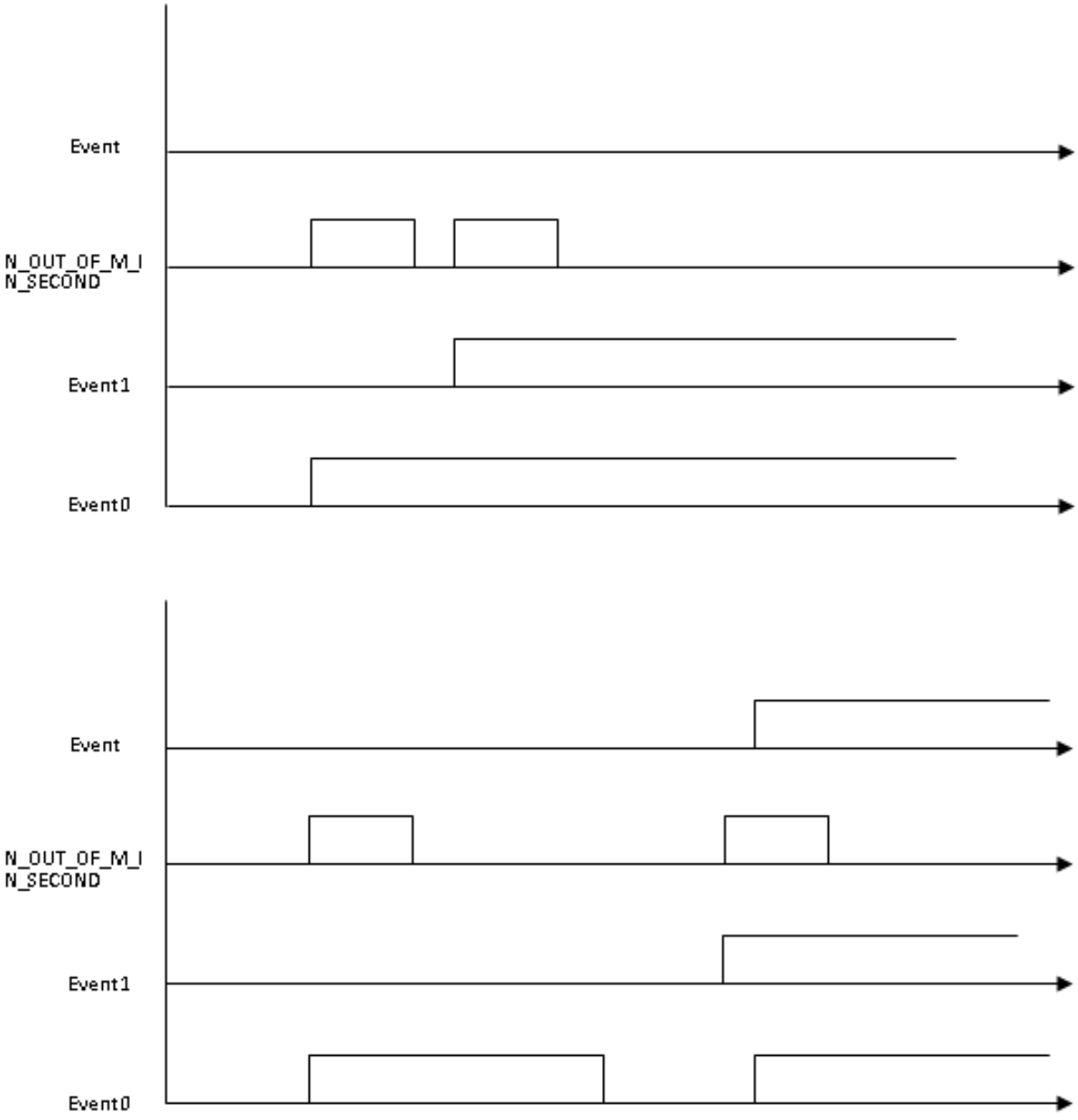
9-7 Zeroing Process (AUTO_OFFSET = YES)



9-8 Three-of-Two Event Detection Logic

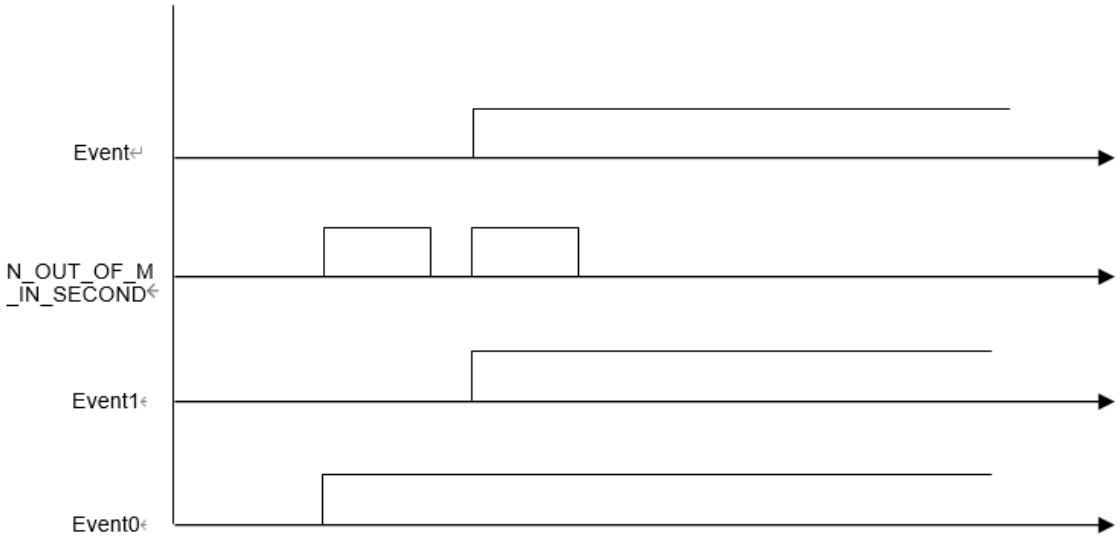
9-8-1 Set [N_OUT_OF_M_BY_MIDDLE] to NO

Condition [N_WHERE_N_OUT_OF_M] is set to 2

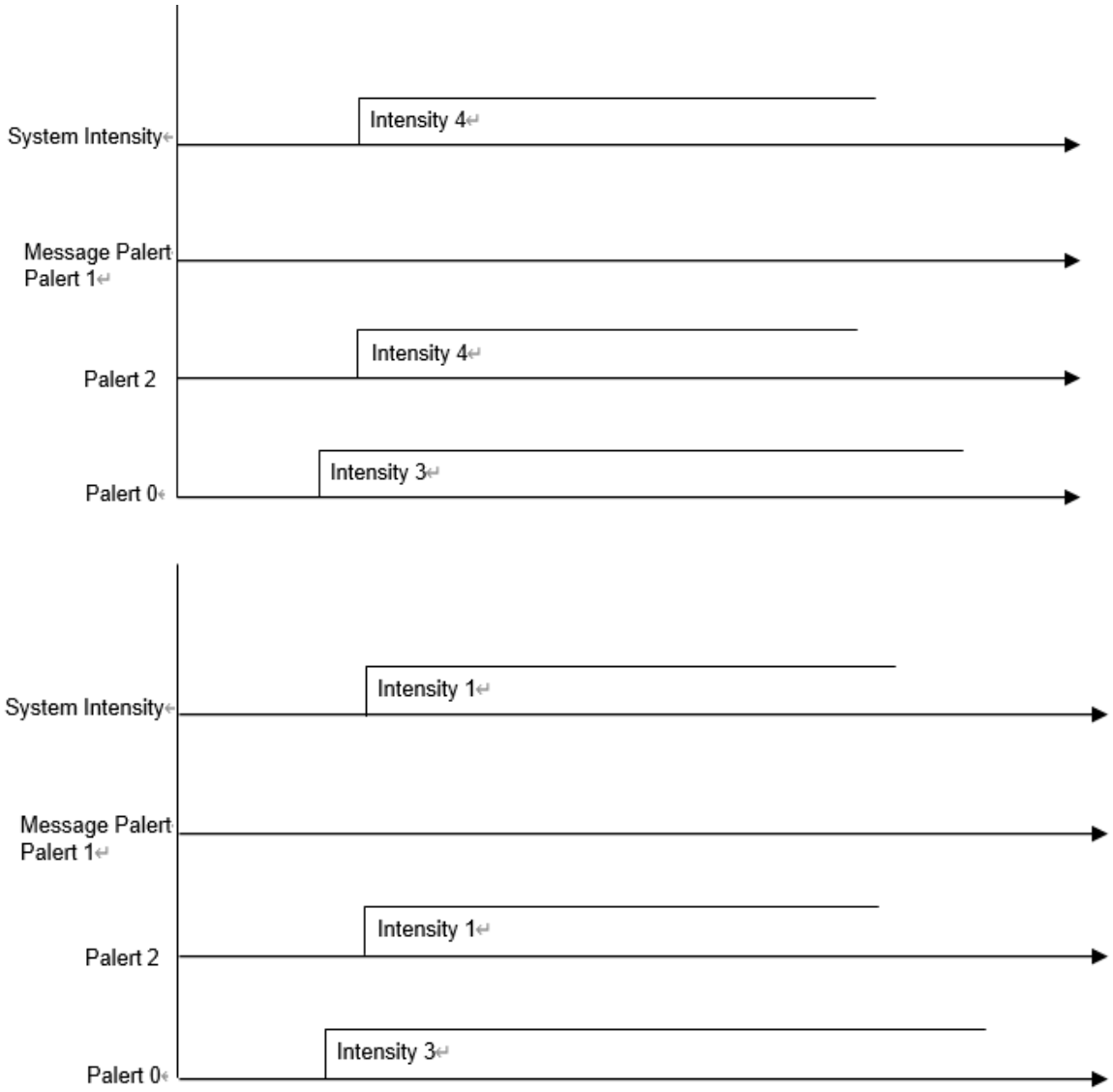


9-8-2 Set [N_OUT_OF_M_BY_MIDDLE] to YES

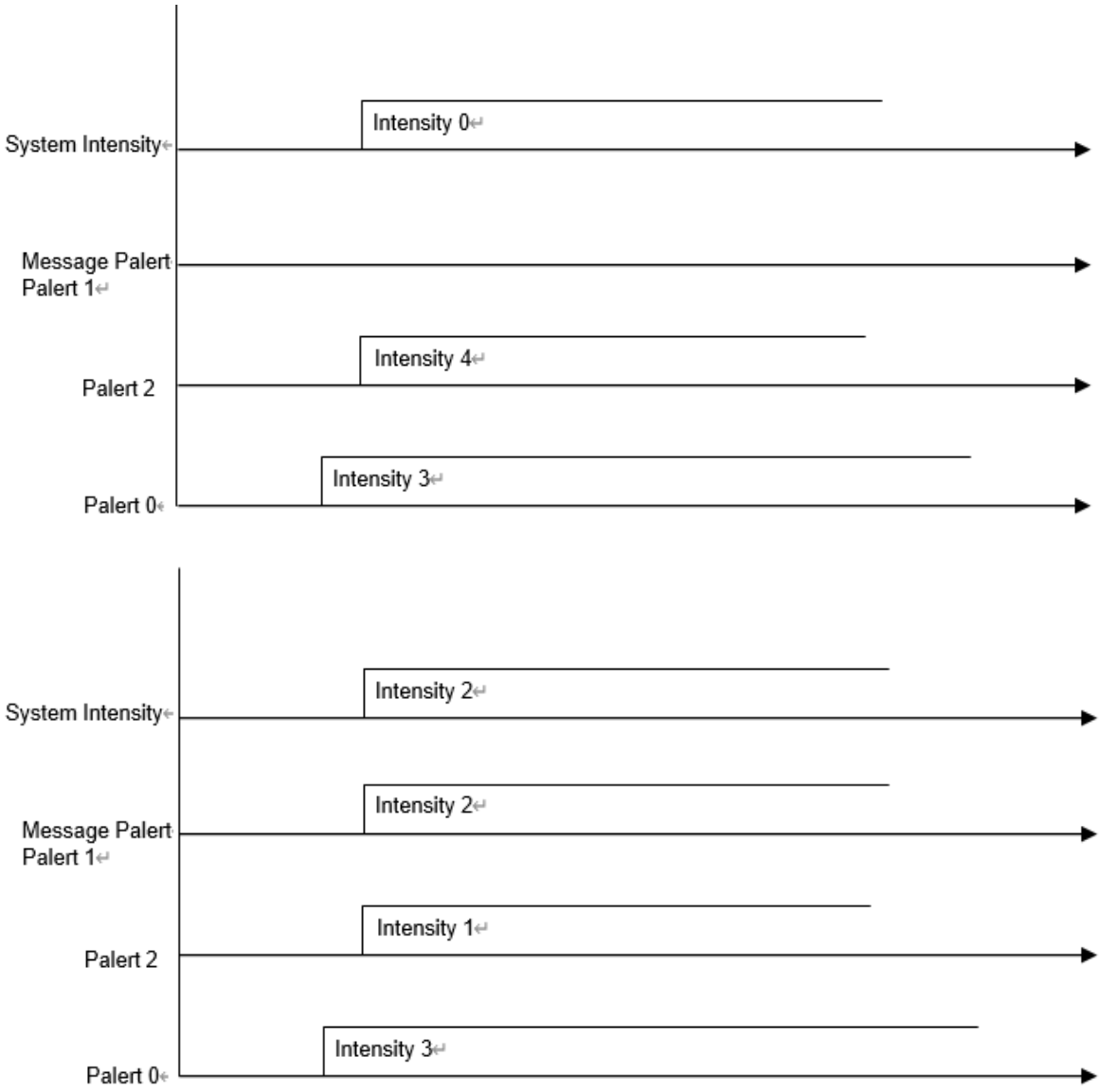
Condition [N_WHERE_N_OUT_OF_M] is set to 2



9-8-3 Message Palert Seismic Event Logic, Message Palert not connected

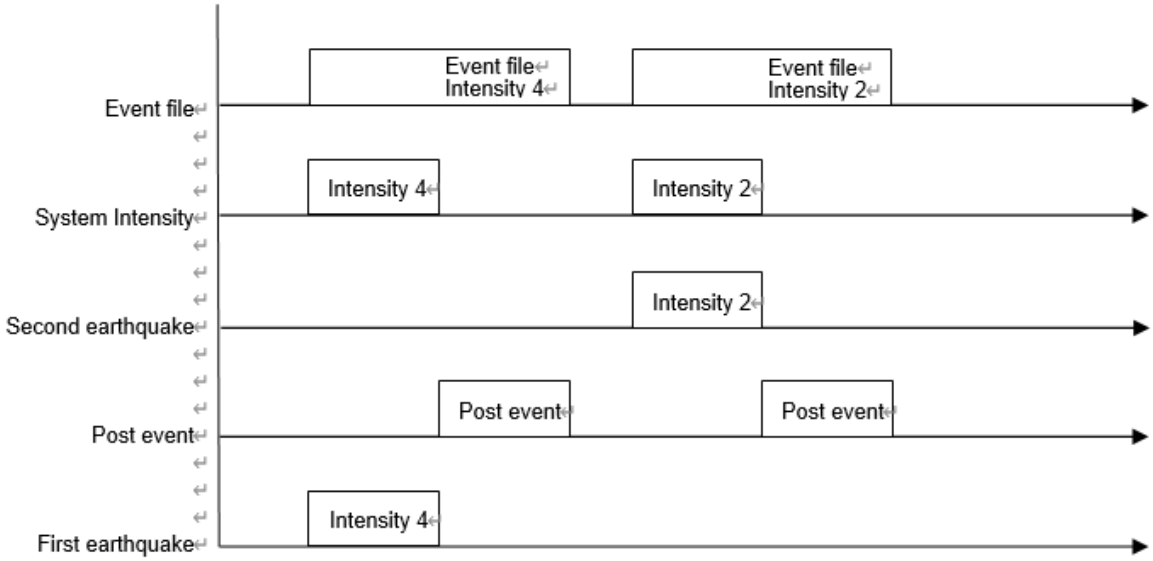


9-8-3 Message Palert Seismic Event Logic, Message Palert connected

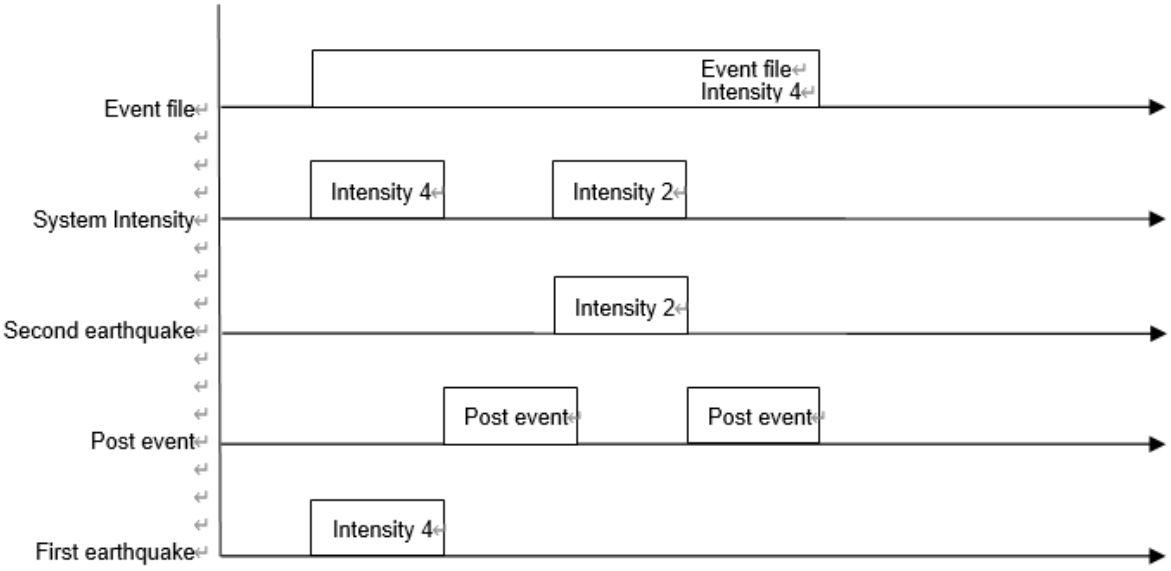


9-9 Continuous Event Logic

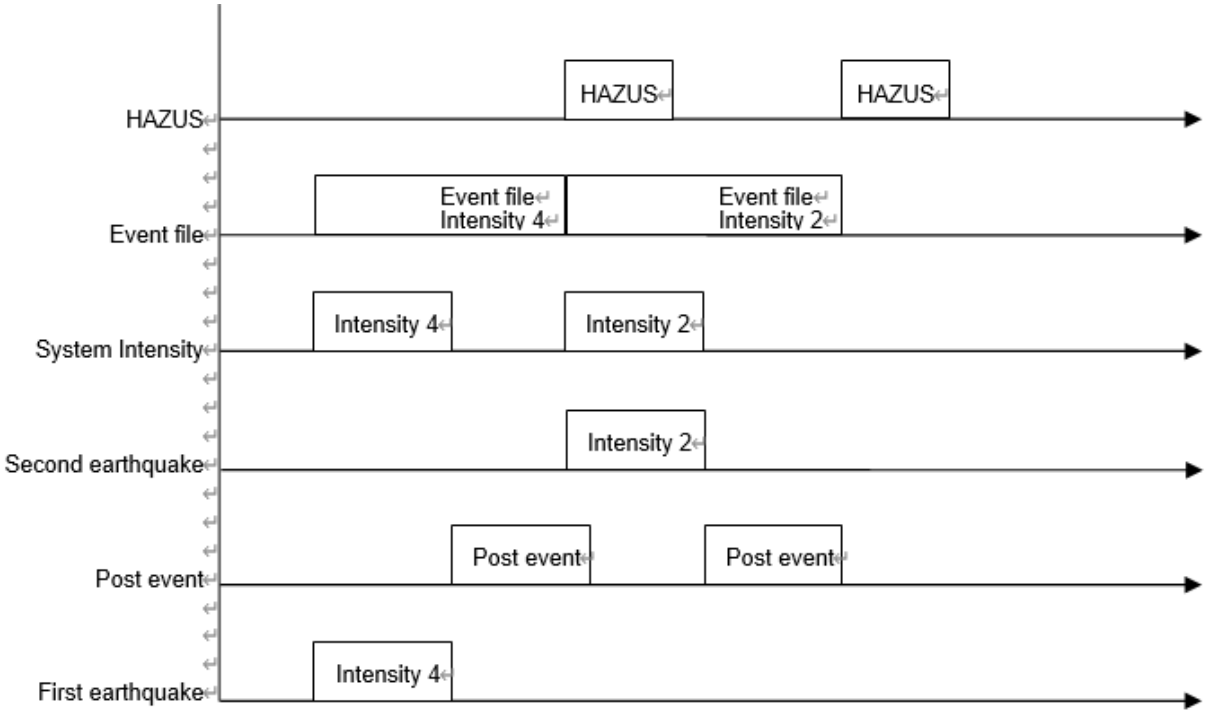
9-9-1 If the second continuous event occurs after the POST EVENT of the previous event



9-9-2 If the second continuous event occurs during the POST EVENT of the previous event



9-10 Sequence diagram for continuous event HAZUS calculations



10. Line Notify Setting

1) Open the Line App on your mobile device and add Line Notify as a friend. Below is the QR code for Line Notify.

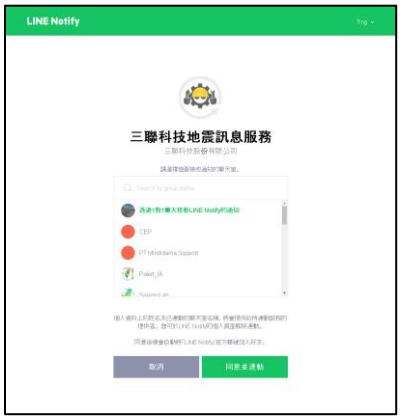
2) Create a group chat and add Line Notify as a member of the group. If you want to use one-on-one chat, you can skip this step.

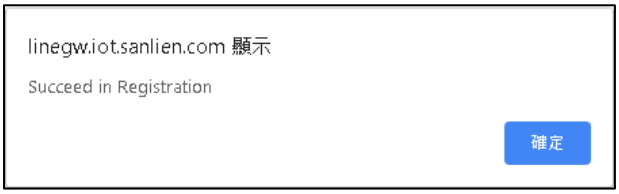
3) To check the PX01 serial number, please refer to the video at https://youtu.be/blwmR33wB7k.

4) Go to http://linegw.iot.sanlien.com/php/linenotify.php to register your PX01 serial number.

5) After registering the serial number, you will be redirected to the Line login page. Please enter your account and password to log in to Line.

6) Once logged into Line, you can choose to receive Line Notify notifications in linked groups, chat rooms, or one-on-one chats.



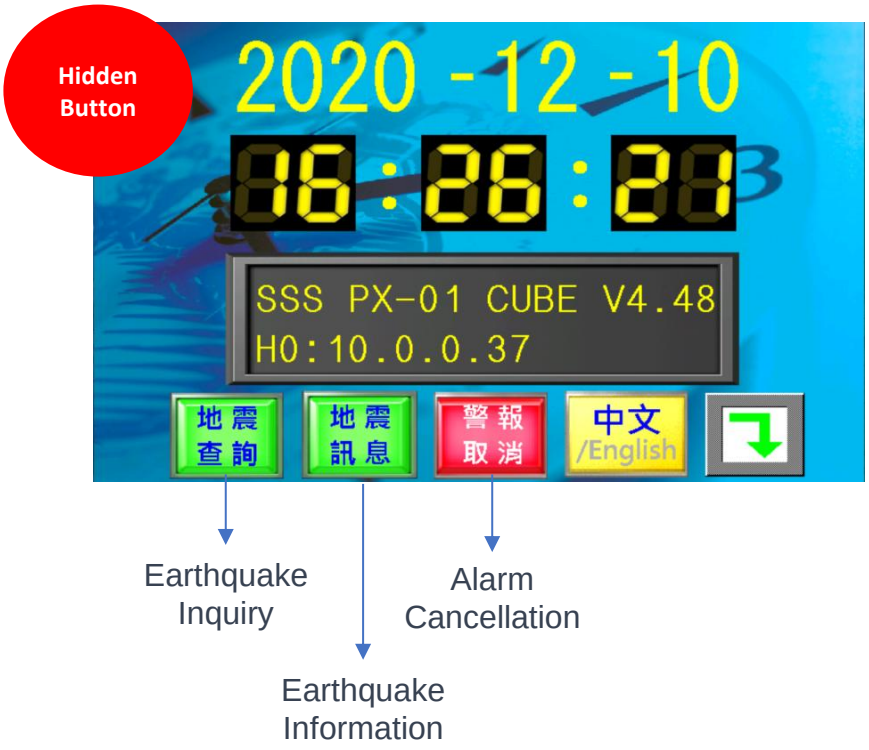


7) The webpage will display a message indicating successful registration.

8) You will receive a message on your mobile phone confirming the successful linking.

11. Human-Machine Interface (HMI)

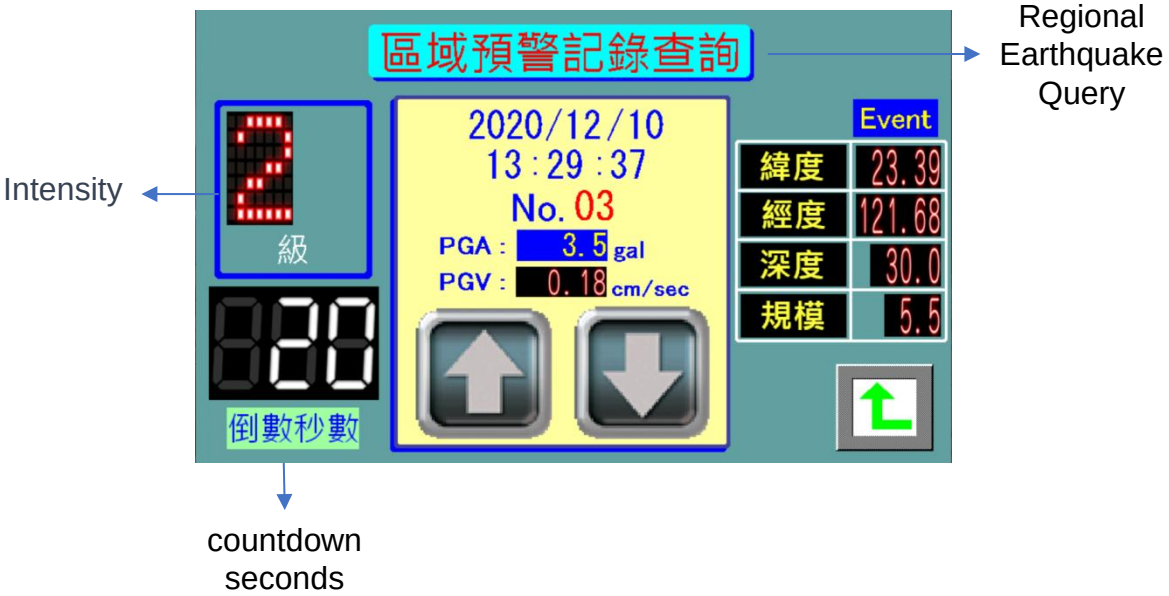
1) Home page: The homepage features five buttons and one hidden button.



2) Earthquake Inquiry: can be divided into On-site earthquake inquiries and regional earthquake inquiries

3) On-site Earthquake Query: displays information on all on-site earthquakes, including trigger time, intensity, and PGA, PGV. Different records of local earthquakes can be queried. Press ↰ to go back to the previous page.

4) Regional Earthquake Query: displays all regional early warning information, including earthquake origin time, epicenter information, and warning messages, including estimated intensity and countdown seconds. Up and down keys can be used to query different records of regional early warnings



5) Earthquake Information: includes local early warnings, regional early warnings, earthquake reports, and RSHD information, displayed in text format here. You can browse different pieces of local earthquake information with the Up and Down buttons. Please note that earthquake reports are in Chinese characters (BIG5), and there might be truncated half-width characters displayed as garbled text along the borders. You can use "中文?" to shift the half-width characters and search for the garbled text. If the message length exceeds one page, you can press ↴ to access the second page of information and ↥ to return to the previous page.

6) Alarm Cancel: When the CUBE is in the triggered state, pressing Alarm Cancel can end the triggered state.

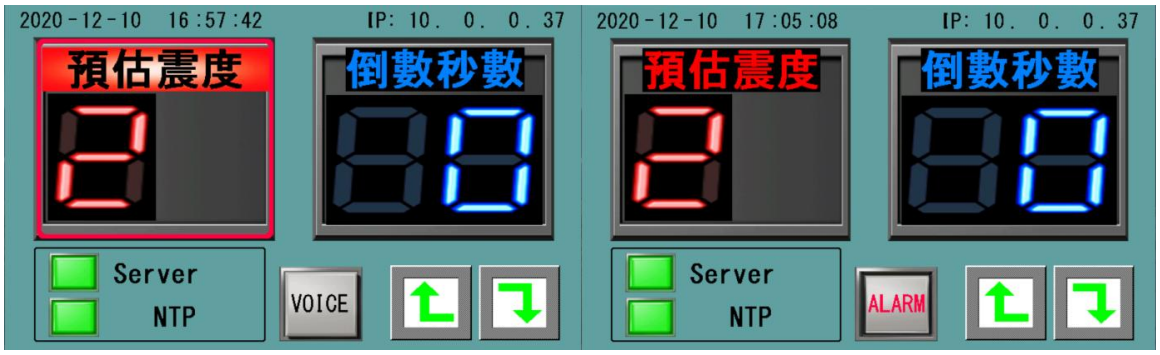
7) Chinese/English: Switch between Chinese and English.

8) Next Page ↴

When a seismic alert message is received, the HMI will automatically switch to this page. This page displays the estimated seismic intensity for regional warnings and the countdown timer. Below, the "Server" and "NTP" status is indicated, with green representing a normal connection. If it shows in red, it means there is a connection issue.

The "VOICE" button indicates the current alarm sound is a voice warning. If it displays "ALARM," it means the current alarm sound is similar to a buzzer. If you require a custom alarm sound, please contact Sanlien Technology's sales department.

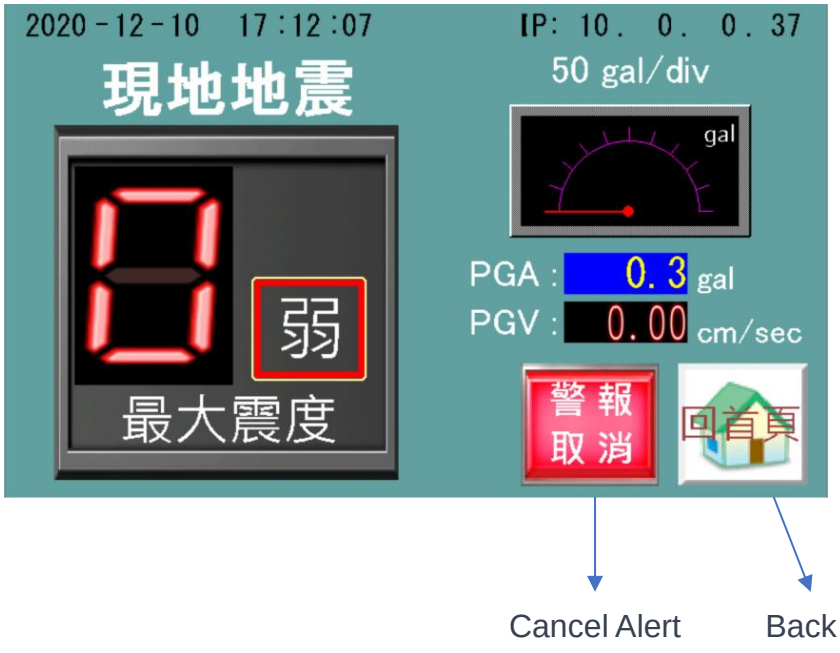
You can switch to the next page using the ↰ and ↴ buttons



The next page from this one provides detailed connection status information.

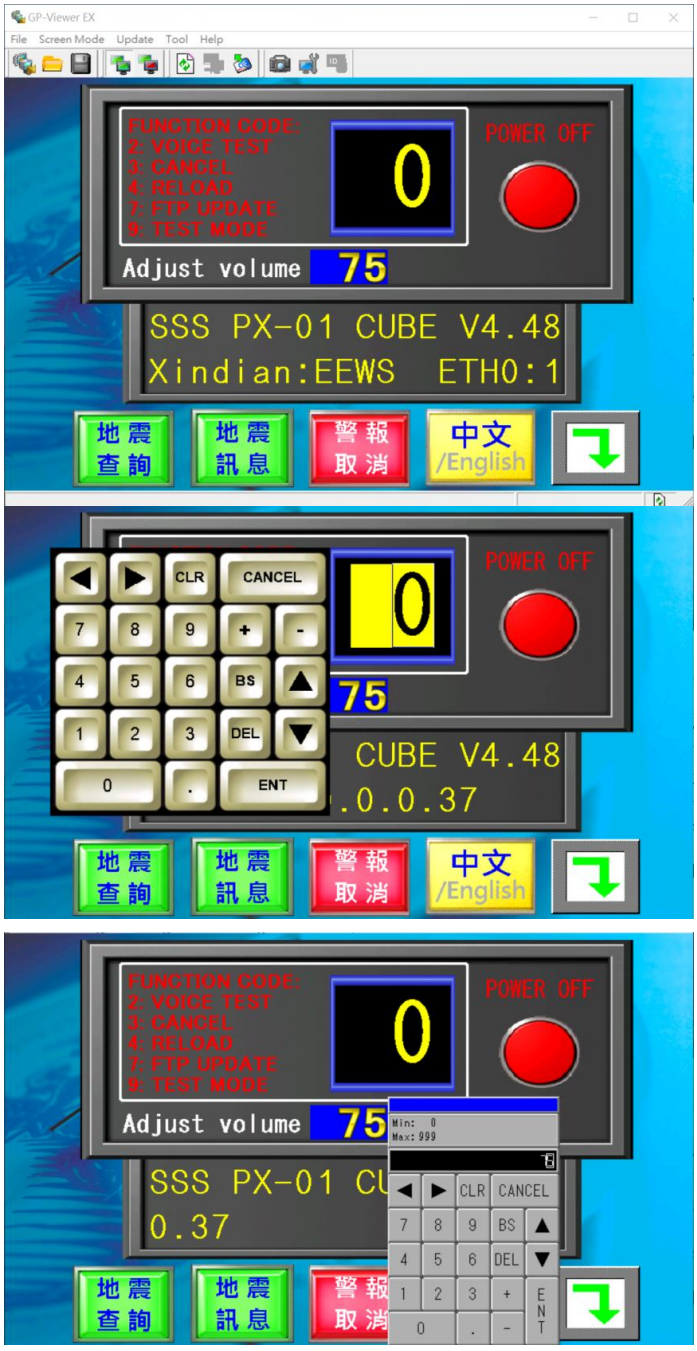
The green color represents a normal connection, and the red color indicates a connection issue or undefined status. In the case of two Palerts, this screen indicates that Palert[1] is in an abnormal state (NG). You can switch to the next page using ↥ and ↧ below.

The next page from this one contains information about on-site earthquake alerts. When CUBE detects an on-site earthquake, it will automatically switch to this page. The displayed information includes the maximum earthquake intensity, PGA (Peak Ground Acceleration), and PGV (Peak Ground Velocity). You can use the Cancel Alert button to stop the alert. Pressing Back to Home will return you to the first page.



9) Hidden Button: accessed by long-pressing the button at position 0. Here's a summary of what each button does:

- Long-press the button at position 0 to access hidden button functions.
- "POWER OFF" button: Long-press to shut down the system.
- "Adjust volume" button: Set the speaker volume (0 to 100). Test the volume after adjusting.
- The Red Time Explanation Area button takes you back to the home page.



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

The CUBE manufactured in 2021 comes with Wi-Fi AP mode for ease of CUBE management. Here are some important points to note:

- When you set CUBE's wireless network to AP mode, CUBE won't be able to connect to other wireless access points (APs).
- In scenarios where multiple CUBEs are in the same area, you must use different SSIDs for each CUBE to differentiate them. Due to the product attribute, all CUBEs currently use the same SSID, "SSS_Cube."
- To enable CUBE's Wi-Fi AP functionality, use the following commands:

```
sudo systemctl enable hostapd
sudo systemctl start hostapd
```

- To disable CUBE's Wi-Fi AP functionality, use the following commands:

```
sudo systemctl stop hostapd
sudo systemctl disable hostapd
```

- Please note that the wireless network is not forwarded to the wired network to prevent users from using CUBE's wired network for internet access.

Sanlien Technology Corp.

3F, No. 190, Sec. 2, Zhongxing Rd., Xindian Dist., New Taipei City 231017, Taiwan (R.O.C.)

TEL:02-8665-9813

FAX:02-8665-9814

Be the frontier of environmental monitoring

www.sanlien.com