

SHAKE SS300

Smart Seismic Switch



User Manual

V1.12
2022/06

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Version Record

Date	Description	Author
20211027	<ul style="list-style-type: none"> ■ Added JMA Japan Meteorological Agency seismicity standard ■ Add SHAKE_TEST (Modbus triggered earthquake) ■ Modify MAO_RELOAD to MAO_CONTROL ■ Change the sampling rate to 200 SPS <p>Version 1.01</p>	Ching
20211004	<ul style="list-style-type: none"> ■ Added description of 10 and 20 Hz low-pass filter. ■ Added the RTD output must be 19200bps. 	Ching
20211125	<ul style="list-style-type: none"> ■ Corrected the Bit5 error of Intensity Standard JMA setting. ■ Added the description of the output sensitivity count of the RTD packet. ■ Added MODBUS setting in factory setting. <p>Version 1.02</p>	Ching
20211227	<ul style="list-style-type: none"> ■ Modified the default value of RS-485 to 38400 BPS ■ Cancel the Parity control option, fixed at N, 8, 1 <p>Version 1.03</p>	Ching
20211230	<ul style="list-style-type: none"> ■ Modify the maximum voltage input to 28 VDC ■ Modify the wiring terminal description ■ Modify the RTD output control of the control function must be matched with DI3 ON <p>Version 1.04</p>	Ching
20220106	<ul style="list-style-type: none"> ■ Correct the name of Relay 0 to Relay 1 ■ Modify the corresponding of DO to Relay <p>Version 1.05</p>	Ching
20211125	<ul style="list-style-type: none"> ■ Corrected the Bit5 error of Intensity Standard JMA setting ■ Added the description of the output sensitivity count of the RTD packet. ■ Added the factory default value to Modbus point <p>Version 1.02</p>	Ching

Version Record

Date	Description	Author
20211227	<ul style="list-style-type: none"> ■ Modified the default value of RS-485 to 38400 BPS ■ Cancel the Parity control option, fixed at N, 8, 1 <p><i>Version 1.03</i></p>	Ching
20211230	<ul style="list-style-type: none"> ■ Modify the maximum voltage input to 28 VDC ■ Modify the wiring terminal description ■ Modify the RTD output control of the control function must be matched with DI3 ON <p><i>Version 1.04</i></p>	Ching
20220106	<ul style="list-style-type: none"> ■ Correct Relay 0 to Relay 1 ■ Modify the corresponding of DO to Relay <p><i>Version 1.05</i></p>	Ching
20220110	<ul style="list-style-type: none"> ■ Modify Relay numbering starting from 0 <p><i>Version 1.06</i></p>	Ching
20220208	<ul style="list-style-type: none"> ■ Corrected the reading and writing command to 0x1307 and 0x1308. ■ Modified the maximum input voltage to 26VDC(due to VDT). ■ Differentiate the factory settings into a streamlined version and a premium version, and indicate this in the characteristics <p><i>Version 1.07</i></p>	Ching
20220214	<ul style="list-style-type: none"> ■ Modified to 2 sets of DI and two sets of Type C Relay ■ Unified the term to SPS ■ Supplementary instructions: LCD backlight settings are only provided with original factory settings <p><i>Version 1.08</i></p>	Ting

Version Record

Date	Description	Author
20220224	<ul style="list-style-type: none"> ■ Modified to three sets of Relay, one of which is Type A or Type B ■ The newly added points 74, 78, and 82 are the threshold values of the third group of Relay ■ Unified the term to Bit ■ Modify some of the magnitude names in the seismic intensity standard, such as changing the strong magnitude 5 earthquake to the magnitude 5 earthquake ■ The contact capacity is uncertain whether to replace the parts or not, modify after confirmation of replacement. <p><i>Version 1.09</i></p>	Ting
20220428	<ul style="list-style-type: none"> ■ <i>Added a new explanation to the SanDAS operation interface</i> ■ <i>Since the Relay action is an OR operation, a new explanation is added to disable it.</i> <p><i>Version 1.10</i></p>	Ting
20220621	<ul style="list-style-type: none"> ■ Relay control mode adds pulse mode (gas valve control) <p><i>Version 1.11</i></p>	Ting
20230727	<ul style="list-style-type: none"> ■ Added average earthquake intensity function and STA LTA reset threshold <p><i>Version 1.12</i></p>	Paul

1. Characteristics

SHAKE SS300 is an advanced seismic switch with a built-in 100 dB MEMS accelerometer. It offers not only three sets of fully isolated mechanical relays but also supports the Modbus RTU communication protocol for interfacing with upper-level control systems. It is designed for earthquake disaster prevention applications.

By default, the factory setting is the streamlined version, providing access to only a subset of parameters for configuration. For more extensive settings, the premium version can be purchased.

In terms of hardware, the SS300 features a three-axis MEMS accelerometer, a small information display LCD, an RTC (real-time clock), and built-in Flash storage to retain the latest earthquake information. Additionally, it includes two sets of DI (Digital Input) inputs, enhancing ease of setup and use.

Regarding software functionality, the signal sampling rate is set at 200 SPS (Samples Per Second). The SS300 offers two modes: permanent dynamic zeroing and non dynamic zeroing during earthquake events, allowing users to install it at various angles. The built-in low-pass filter effectively filters out artificial vibration noise. The earthquake identification technology comprises PGA (Peak Ground Acceleration) trigger, PGV (Peak Ground Velocity) trigger, and STA/LTA (Short-Term Average/Long-Term Average) trigger to meet diverse application needs.

Three groups of relays (Type A or Type B, pick one from two) can be configured to activate based on different criteria such as PGA, PGV, or earthquake intensity. Users can also monitor or reset these relays through Modbus communication.

To facilitate connection testing with upper-level control systems, the SS300 provides a remote trigger earthquake function. This allows users to simulate PGA and trigger cycles through Modbus.

In terms of earthquake seismicity standards, SS300 complies with various earthquake seismicity standards, including MMI (Modified Mercalli Intensity), PGA (Peak Ground Acceleration), PGV (Peak Ground Velocity), KMA (Korea Meteorological Administration), China Earthquake Administration, JMA (Japan Meteorological Agency), and CWB (Central Weather Bureau).

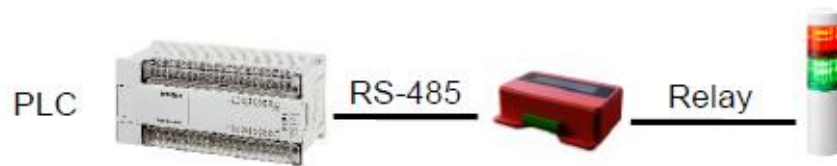
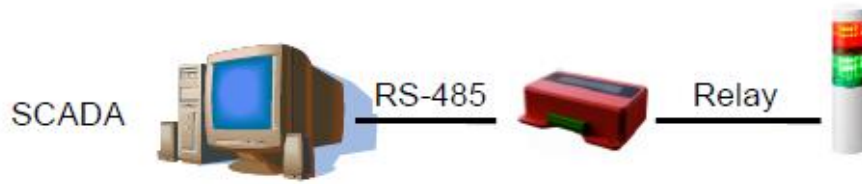
The length of time following an earthquake event's trigger can be flexibly adjusted based on specific requirements. If an upper-level SCADA (Supervisory Control and Data Acquisition) system is in place, it can get real-time information through the Modbus RTU communication protocol. The SS300 provides maximum vibration information per second when no event is occurring and offers real-time information during earthquakes. This feature allows for easy integration into factory or smart building monitoring systems.

Setting up this device is straightforward and intuitive. As long as the user's computer is equipped with an RS-485 communication port, the SS300 can be directly configured and operated through our company's SanDAS software.

We also offer a touch-sensitive human-machine interface called SHAKE Mate, which is ideal for terminal display and control of this device.

For further information or specific requirements, please visit our website at <http://www.sanlien.com>.

2. Application System Architecture



3. Hardware



1. Quick Disconnect Terminal Socket
2. LCD display
3. Mounting screw holes

3-1 Quick Disconnect Connector

3.1.1 Wiring Instruction

Name	Description	Note
PWR	10 - 26 VDC	
GND	0 V	
PS-485 D +	RS 485 data +	
RS-485 D -	RS 485 data -	
RLY0	Relay 0 contact capacity is 60 VDC, 0.3 A	Isolated dry contact, corresponding to DO0
RLY1	Relay 1 contact capacity is 60 VDC, 0.3 A	Isolated dry contact, corresponding to DO1

Name	Description	Note
RLY2	Relay 2 contact capacity is 60 VDC, 0.3 A	Isolated dry contact, corresponding to DO2
DI0	DI0 input	ON when connected to 0 V
DI1	DI1 input	ON when connected to 0 V
PE	Case ground	

3-1-2 DI Function Description

Name	Description
DI	Function
0	Three groups of Relay return
	Display communication port settings
1	Display information of the latest earthquake
	LCD backlight with RTD output enabled

3-1-3 Power on and off

When powering on the machine, it will undergo the following boot procedures:

1. The LCD backlight will turn on.
2. MEMS (Micro-Electro-Mechanical System) initialization will begin, and the LCD will display "Sensor Initializing."
3. MEMS will perform an automatic zero return.
4. The real-time clock (RTC) time will be read.
5. The LCD backlight will turn off.

Shutdown precautions:

- If the user has updated any Modbus data and wishes to save the data to Flash, please refer to the Functional Description of the Modbus table for guidance.
- If the system is in the process of storing earthquake events, shutting down abruptly may lead to errors in the stored data. To avoid this, please ensure that the system is in an event-free state before shutting down. You can check for event occurrences directly on the LCD or confirm it through Modbus points.

3.2 LCD Display

The LCD display of the instrument provides the user with real-time status information and is configured as follows:

- 20 characters across 2 lines, allowing for comprehensive information presentation.

3.2.1 Backlight

The backlight is designed to save power and is normally turned off during regular operation. However, it will be activated automatically in the following two situations:

1. When any Digital Input (DI) is turned ON.
2. When the system detects an earthquake event.

The backlight will automatically turn off when these events cease.

3.2.2 Display content

In the absence of an earthquake event (when all Digital Inputs, DIs, are in the OFF state), the display content is as follows:

- The current time is updated every 3 seconds.
- The current maximum PGA (Peak Ground Acceleration) and PGV (Peak Ground Velocity) are updated every second.

Y	Y	Y	Y	/	M	M	/	D	D		h	h	:	m	m	:	s	s
x	.	x	g	a	l			x	.	x	m	m	/	s				

The first line will display instrument version information every 10 seconds.

S	h	a	k	e		S	S	3	0	0				V	1	.	0	0
x	.	x	g	a	l			x	.	x	m	m	/	s				

During an Earthquake Event (all DIs are OFF)

S	h	a	k	e		S	S	3	0	0					V	1	.	0	0
x	.	x	g	a	l		x	.	x	m	m	/	s						

In this situation, lowercase "o" represents the output status of the three groups of Relays. Each bit corresponds to a specific Relay:

- Bit 0 represents Relay0.
- Bit 1 represents Relay1.
- Bit 2 represents Relay2.

Therefore, if only Relay0 is activated, a value of 1 will be displayed. If only Relay1 is activated, a value of 2 will be displayed. If only Relay2 is activated, a value of 4 will be displayed. If both Relay0 and Relay1 are activated simultaneously, the displayed value will be 3. If all three Relays (Relay0, Relay1, and Relay2) are activated simultaneously, the displayed value will be 7.

Second display (During Earthquake Event)

In the second display during an earthquake event, the information is as follows:

Y	Y	Y	Y	/	M	M	/	D	D			h	h	:	m	m	:	s	s
I	:	x	.	x		A	:	x	x		V	:	x	x					

- I: Represents earthquake intensity.
- A: Represents PGA (Peak Ground Acceleration) in units of gal.
- V: Represents PGV (Peak Ground Velocity) in units of mm/sec.

Additionally, if Digital Input 0 (DI0) is ON, the display will show communication port setting information.

Y	Y	Y	Y	/	M	M	/	D	D			h	h	:	m	m	:	s	s
C	O	M	:	b	b	b	b	b	,		p	,		d	,		s		

The information displayed in the first second is as follows:

- bbbbb: Represents the baud rate, which is typically set to 19200.
- p: Represents error checking, usually set to "N" (no error checking).
- d: Represents data length, typically set to 8.
- s: Represents the stop bit, usually set to 1.

Y	Y	Y	Y	/	M	M	/	D	D			h	h	:	m	m	:	s	s
R	T	U		I	D	:	x	x	x										

- xxx: Represents the basic Modbus RTU ID, which is typically set to 101.

If Digital Input 0 (DI0) is ON, the display will show the last earthquake information, which includes:

[E	v	e	n	t]	:	h	h	:	m	m	:	s	s		O	:	o
I	:	x	.	x		A	:	x	x		V	:	x	x					

- The lowercase "o" representing the final output status of the three groups of Relays
 - Bit 0 represents Relay0.
 - Bit 1 represents Relay1.
 - Bit 2 represents Relay2.

3.3 Restore factory settings

If a user forgets the communication port settings of the device, the factory reset function can be used to restore the settings. The process involves the following steps:

1. Turn on both DI0 and DI1 simultaneously.
2. Restart the power supply.
3. The LCD will display "Factory reset..."
4. After this message is displayed, remove DI0 and DI1.
5. Restart the device.

It's important to note that if you have purchased the premium version, the factory settings will be as follows.

Project	Modbus point	Default value
RS 485 Baudrate	0x0055	384, which is 38400 bps
Modbus RTU ID	0x0057	101
Dynamic Offset Mode	0x003C	TRTC
PGA Trig	0x003E Bit0	Disable
PGV Trig	0x003E Bit1	Disable
STA/LTA Trig	0x003E Bit2 0x003E Bit3	Disable
Relay Reset by System	0x003E Bit14	Disable
Single Relay mode	0x003E Bit15	Disable
Intensity Standard	0x003D	1, that is, CWB earthquake intensity standard
Event Seconds	0x003F	60
PGA Event Seconds	0x0041	30
PGV Event Seconds	0x0042	30
STA/LTA Event Seconds	0x0040	30

Project	Modbus point	Default value
STA Seconds	0x0043	20, which is 2 seconds
LTA Seconds	0x0044	300, which is 30 seconds
STA/LTA Trig Treshold	0x0045	35, which is 3.5
LCD Contrast	0x0054	50
JMA_RING	0x0058	10, which is 10 seconds
Relay0 Intensity	0x0048	200, which is 20.0
Relay1 Intensity	0x0049	200, which is 20.0
Relay2 Intensity	0x004A	200, which is 20.0
Relay0 PGA	0x004C	30000, which is 3000.0 g
Relay1 PGA	0x004D	30000, which is 3000.0 g
Relay2 PGA	0x004E	30000, which is 3000.0 gal
Relay0 PGV	0x0050	30000, which is 3000.0 mm/sec
Relay1 PGV	0x0051	30000, which is 3000.0 mm/sec
Relay2 PGV	0x0052	30000, which is 3000.0 mm/sec

Relay trigger threshold set by the original factory

Relay	Intensity	PGA (gal)	PGV (mm/sec)
0	20.0	3000	3000
1	20.0	3000	3000
2	20.0	3000	3000

4. Installation Method

4-1 Installation direction

The three-axis acceleration direction of this machine is defined as follows:

- X represents the north-south direction.
- Y represents the east-west direction.
- Z represents the vertical direction.

4-2 Installation level

This machine features an automatic zeroing function, which means it will automatically reset to zero after being powered on, regardless of the installation angle. However, similarly to the above recommendation, if you are considering the consistency with the upper-end monitoring system in future, it's advisable to adjust the machine's level as accurately as possible during installation.

By following these installation guidelines, you can ensure that the device is installed in a manner consistent with the intended orientation and level for optimal performance.

5. Instrument Settings

All the settings for this machine are configured through the Modbus RTU communication protocol. Users can use the SanDAS software or other standard Modbus RTU software to adjust the settings.

To enhance communication efficiency, this machine consolidates all the fields for reading and writing into the 40XXX address.

If you want to inquire about the settings of the local communication port, you can short-circuit DI0. When DI0 is short-circuited, the LCD will display relevant information about the communication port settings.

These instructions provide a clear overview of how to configure and access the settings of the instrument using Modbus RTU communication.

5.1 Parameter list

SHAKE SS300 Modbus point table (40XXX)				
XXX	Register	R/W	Label	Description
1	0x0001	R	VERSION	Firmware
2	0x0002	W	DO_RESET	Reset relays by write 1, auto clear after DO is reset
3	0x0003	W	DO_TEST	Remote control relays, DO_TEST_ENABLE must enable first
4	0x0004	R	PGA_X	X axis acceleration, 0.1 gal
5	0x0005	R	PGA_Y	Y axis acceleration, 0.1 gal
6	0x0006	R	PGA_Z	Z axis acceleration, 0.1 gal
7	0x0007	R	DOFFSET_X	X axis dynamic offset value, 0.1 gal
8	0x0008	R	DOFFSET_Y	Y axis dynamic offset value, 0.1 gal
9	0x0009	R	DOFFSET_Z	Z axis dynamic offset value, 0.1 gal

SHAKE SS300 Modbus point table (40XXX)				
XXX	Register	R/W	Label	Description
10	0x000A	R	DIO_STATUS	High byte: DI, low byte: DO(Relay)
11	0x000B	R	INTENSITY1S_NOW	Intensity at last second, unit in 0.1
12	0x000C	R	PGA_1S_NOW	Vector acceleration at last second, 0.1 gal
13	0x000D	R	PGA_1S_NOW	Vector velocity at last second, 0.1 mm/sec
14	0x000E	R	PGA_1S_VX	X component of max. vector acceleration at last second, 0.1 gal
15	0x000F	R	PGA_1S_VY	Y component of max. vector acceleration at last second, 0.1 gal
16	0x0010	R	PGA_1S_VZ	Z component of max. vector acceleration at last second, 0.1 gal
17	0x0011	R	PGV_1S_VX	X component of max. vector velocity at last second, 0.1 mm/sec
18	0x0012	R	PGV_1S_VY	Y component of max. vector velocity at last second, 0.1 mm/sec
19	0x0013	R	PGV_1S_VZ	Z component of max. vector velocity at last second, 0.1 mm/sec
20	0x0014	R	PGA_1S_X	X axis max. acceleration at last second, 0.1 gal
21	0x0015	R	PGA_1S_Y	Y axis max. acceleration at last second, 0.1 gal
22	0x0016	R	PGA_1S_Z	Z axis max. acceleration at last second, 0.1 gal

SHAKE SS300 Modbus point table (40XXX)				
XXX	Register	R/W	Label	Description
23	0x0017	R	PGV_1S_X	X axis max. velocity at last second, 0.1 mm/sec
24	0x0018	R	PGV_1S_Y	Y axis max. velocity at last second, 0.1 mm/sec
25	0x0019	R	PGV_1S_Z	Z axis max. velocity at last second, 0.1 mm/sec
26	0x001A	R	STATUS	b0: sensor ok b1: event flag b2: event pga trig b3: event pgv trig b4: event sta/lta trig b5: lta ready b6: offseting b15: RTC data busy
27	0x001B	R/W	SYS_YEAR	System time: year
28	0x001C	R/W	SYS_MONTH	System time: month
29	0x001D	R/W	SYS_MONTH	System time: day
30	0x001E	R/W	SYS_WEEKDAY Y	System time: weekday
31	0x001F	R/W	SYS_HOUR	System time: hour
32	0x0020	R/W	SYS_MINUTE	System time: minute
33	0x0021	R/W	SYS_SECOND	System time: second
34	0x0022	R	STA_LTA	Sta/lta value, unit 0.1
35	0x0023	R	EVENT_YEAR	Time of the event, year
36	0x0024	R	EVENT_MONTH H	Time of the event, month
37	0x0025	R	EVENT_DAY	Time of the event, day

SHAKE SS300 Modbus point table (40XXX)				
XXX	Register	R/W	Label	Description
38	0x0026	R	EVENT_HOUR	Time of the event, hour
39	0x0027	R	EVENT_MINUTE	Time of the event, minute
40	0x0028	R	EVENT_SECOND	Time of the event, second
41	0x0029	R	INTENSITY	Intensity of the event, unit 0.1
42	0x002A	R	INTENSITY_PGA	PGA of the event, unit 0.1 gal
43	0x002B	R	INTENSITY_PGV	PGV of the event, unit 0.1 mm/sec
44	0x002C	R	INTENSITY_PGA_VX	X component acceleration of the event, unit 0.1 gal
45	0x002D	R	INTENSITY_PGA_VY	Y component acceleration of the event, unit 0.1 gal
46	0x002E	R	INTENSITY_PGA_VZ	Z component acceleration of the event, unit 0.1 gal
47	0x002F	R	INTENSITY_PGV_VX	X component velocity of the event, unit 0.1 mm/sec
48	0x0030	R	INTENSITY_PGV_VY	Y component velocity of the event, unit 0.1 mm/sec
49	0x0031	R	INTENSITY_PGV_VZ	Z component velocity of the event, unit 0.1 mm/sec
50	0x0032	R	INTENSITY_PGAX	Max. X acceleration of the event, unit 0.1 gal
51	0x0033	R	INTENSITY_PGAY	Max. Y acceleration of the event, unit 0.1 gal
52	0x0034	R	INTENSITY_PGAZ	Max. Z acceleration of the event, unit 0.1 gal
53	0x0035	R	INTENSITY_PGV_VX	Max. X velocity of the event, unit 0.1 mm/sec

SHAKE SS300 Modbus point table (40XXX)				
XXX	Register	R/W	Label	Description
54	0x0036	R	INTENSITY_P GVY	Max. Y velocity of the event, unit 0.1 mm/sec
55	0x0037	R	INTENSITY_P GVZ	Max. Z velocity of the event, unit 0.1 mm/sec
56	0x0038	R	INTENSITY_D O	Relay status of the event
60	0x003C	R/W	DOFFSET_MO DE	Dynamic offset mode 0: NTU 1: TRTC 2: NONE
61	0x003D	R/W	INTENSITY_S TANDARD	Intensity standard, low bit has higher priority b0: CWB b1: MMI_PGA b2: MMI_PGV b3: KMA b4: CEA b5: JMA 0~9 b6: JMA 0~4, 5.1, 5.9, 6.1, 6.9, 7
62	0x003E	R/W	TRIG_MODE	Event trig algorithm b0: PGA trig b1: PGV trig b2: STA/LTA trig(PGA relay control) b3: STA/LTA trig(PGV relay control) b14: Relay reset by system b15: Single Relay mode
63	0x003F	R/W	EVENT LENG TH	Event max. seconds
64	0x0040	R/W	STALTA_EVEN T_LENGTH	Event length of sta/lta trig

SHAKE SS300 Modbus point table (40XXX)				
XXX	Register	R/W	Label	Description
65	0x0041	R/W	PGA_EVENT_LENGTH	Event length of pga trig
66	0x0042	R/W	PGV_EVENT_LENGTH	Event length of pgv trig
67	0x0043	R/W	STA	Sta length, unit 0.1 second
68	0x0044	R/W	LTA	Lta length, unit 0.1 second
69	0x0045	R/W	STALTA_TH	Sta/ltatrig threshold, unit 0.1
70	0x0046	R/W	PGA_TH	Pga trig threshold, unit 0.1 gal
71	0x0047	R/W	PGV_TH	Pgv trig threshold, unit 0.1 mm/sec
72	0x0048	R/W	DO0_INTENSITY	Relay0 intensity trig threshold, unit 0.1
73	0x0049	R/W	DO1_INTENSITY	Relay1 intensity trig threshold, unit 0.1
74	0x004A	R/W	DO2_INTENSITY	Relay2 intensity trig threshold, unit 0.1
75	0x004B	-		
76	0x004C	R/W	DO0_PGA	Relay0 pga trig threshold, unit 0.1 gal
77	0x004D	R/W	DO1_PGA	Relay1 pga trig threshold, unit 0.1 gal
78	0x004E	R/W	DO2_PGA	Relay2 pga trig threshold, unit 0.1 gal
79	0x004F	-	Reserved	
80	0x0050	R/W	DO0_PGV	Relay0 pgv trig threshold, unit 0.1 mm/sec

SHAKE SS300 Modbus point table (40XXX)				
XXX	Register	R/W	Label	Description
81	0x0051	R/W	DO1_PGV	Relay1 pgv trig threshold, unit 0.1 mm/sec
82	0x0052	R/W	DO2_PGV	Relay2 pgv trig threshold, unit 0.1 mm/sec
83	0x0053	-	Reserved	
84	0x0054	R/W	LCD_CONTRAST	LCD contrast adjust
85	0x0055	R/W	BAUD	RS-485 speed, unit in 100 bps
86	0x0056	-	Reserved	
87	0x0057	R/W	RTU_ID	RTU ID
88	0x0058	R/W	JMA_RING	JMA spectrum length, seconds
89	0x0059	R	SERIAL_NO	Serial number, high word
90	0x005A	R	SERIAL_NO	Serial number, low word
91	0x005B	R	GAIN_X	Gain of X axis
92	0x005C	R	GAIN_Y	Gain of Y axis
93	0x005D	R	GAIN_Z	Gain of Z axis
94	0x005E	R	OFFSET_X	Offset of X axis
95	0x005F	R	OFFSET_Y	Offset of Y axis
96	0x0060	R	OFFSET_Z	Offset of Z axis

SHAKE SS300 Modbus point table (40XXX)				
XXX	Register	R/W	Label	Description
100	0x0064	W	CONTROL	0x0180: force flashing and reload 0x5244: RTD output with checksum 0x5245: RTD output
101	0x0065	W	SYS_TIME_LOCK	Disable RTC updating Modbus time (Address 0x001B ~ 0x0021)
102	0x0066	W	RTC_CONTROL	0x1308: write Modbus time to RTC 0x1307: write RTC to Modbus time
103	0x0067	R/W	DO_TEST_ENABLE	0x0001: Enable DO_TEST for DO (Address 0x0003) 0x0921: Simulate PGA by using address 0x0068.
104	0x0068	R/W	SHAKE_TEST	High byte PGA, low byte count

5.2 Modbus point description

5.2.1 Address 1, Firmware Version

The current firmware version of this machine is set only once by the system during initialization. Therefore, if a user changes this address later, the system will not restore the content. This address typically stores information about the firmware version of the device, providing a reference for system initialization and maintenance.

5-2-2 Address 2, Relay Reset

This address is used to control the reset behavior of the Relays, and the machine provides two options:

1. Automatic Reset: In this mode, the Relay will automatically reset after the occurrence of an earthquake event.
2. Manual Reset: When set to manual reset, the Relay will remain in its last state after an action and will not reset itself. It will only reset when DI0 is turned ON or when a value of 1 is written to this address.

Please note that the content of this address is automatically cleared to zero.

5-2-3 Address 3, Relay test

This address allows users to test the three sets of Relays through Modbus, which is a useful feature for hardware testing during installation. The individual bits represent the following Relays:

- Bit0: Relay0
- Bit1: Relay1
- Bit2: Relay2

Please note that the content of this address doesn't directly control the output of the three groups of Relays. Instead, it performs a logical OR operation with other output conditions. For example, if a single Relay action (address 62, Bit15) is enabled, Relay0 will turn OFF when Relay1 is turned ON.

To prevent accidental interference with normal operation in the future, changing this address may cause malfunction. To use this feature, you must first adjust the "address 103, Relay Test function enable control" to a value of 1. This will allow the output to be OR'ed with the three groups of Relays.

This setup ensures that Relay testing is done safely and doesn't disrupt regular operation.

5-2-4 address 4, X -axis real-time value

X-axis instant acceleration output, unit is 0.1 gal.

5-2-5 address 5, Y -axis real-time value

Y-axis instant acceleration output, unit is 0.1 gal.

5-2-6 address 6, Z -axis real-time value

Z-axis instant acceleration output, unit is 0.1 gal.

5-2-7 Address 7: X-Axis Dynamic Zero Value

Address 7 stores the real-time dynamic zero value of the X-axis in 0.1 gal units. The machine performs zero-point calculations after power-on and at the end of an earthquake event. Additionally, if the user activates the dynamic auto-zero function (address 60), the system will automatically reset to zero dynamically.

5-2-8 Address 8: Y-Axis Dynamic Zero Value

Similar to Address 7, Address 8 stores the real-time dynamic zero value of the Y-axis in 0.1 gal units. The zero-point calculation occurs after power-on and at the end of an earthquake event. If the dynamic auto-zero function (address 60) is activated, the system will perform dynamic zeroing automatically.

5-2-9 Address 9: Z-Axis Dynamic Zero Value

Address 9 stores the real-time dynamic zero value of the Z-axis, and the value is in units of 0.1 gal. Zero-point calculations occur after power-on and at the end of an earthquake event. If the dynamic auto-zero function (address 60) is enabled, the system will perform dynamic zeroing automatically.

5-2-10 address 10, DI, DO (Relay) status

Address 10 is used to access the status of local Digital Inputs (DI) and Digital Outputs (DO), also known as Relays. The following bits represent specific inputs and outputs:

- Bit0: DO0 (Relay0)
- Bit1: DO1 (Relay1)
- Bit2: DO2 (Relay2)
- Bit8: DI0
- Bit9: DI1

These bits provide information about the status of these inputs and outputs, allowing users to monitor their state.

5-2-11 address 11, maximum real-time earthquake intensity per second

Address 11 provides the maximum seismic intensity value per second, and the unit is 0.1. This value is essential for monitoring earthquake activity and its impact.

For selecting the specific seismic intensity standards, you should refer to address 61. Address 61 covers the seismic intensity standards of various countries. This machine supports multiple seismic intensity standards, including:

MMI PGA (Peak Ground Acceleration)

MMI PGV (Peak Ground Velocity)

KMA (Korea Meteorological Administration)

China Earthquake Administration

CWB (Central Meteorological Bureau) Earthquake Seismic Intensity Standard

CWB defines seismic intensity classification as ranging from 1 to 7. The value at this address corresponds to the seismic intensity level as defined by CWB, with values associated with the following table, which categorizes seismic intensity.

Seismic intensity	1	2	3	4	5 weak	5 strong	6 weak	6 strong	7
Value	10	20	30	40	51	59	61	69	70

5-2-12 address 12, maximum synthetic acceleration in degrees per second (PGA)

Maximum resultant acceleration value per second, unit 0.1 gal.

5-2-13 address 13, maximum combined velocity value (PGV) per second

The maximum synthetic speed value per second, unit 0.1 mm/sec.

5-2-14 address 14, maximum synthetic acceleration in degrees per second X component value

The X-axis component value of the maximum resultant acceleration per second, unit 0.1 gal.

5-2-15 Address 15, the maximum resultant acceleration in degrees per second Y component value

The maximum resultant acceleration Y axial component value per second, unit 0.1 gal.

5-2-16 Address 16, the Z component value of the maximum synthetic acceleration in degrees per second

The Z-axis component value of the maximum synthetic acceleration per second, unit 0.1 gal.

5-2-17 Address 17, the X component value of the maximum resultant speed per second

The X-axis component value of the maximum resultant speed per second. The unit is 0.1 mm/sec. This value is obtained by integrating the acceleration.

5-2-18 Address 18, the Y component value of the maximum resultant speed per second

The Y-axis component value of the maximum resultant speed per second, unit 0.1 mm/sec. This value is obtained by integrating the acceleration.

5-2-19 Address 19, the Z component value of the maximum resultant velocity per second

The Z-axis component value of the maximum resultant velocity per second. The unit is 0.1 mm/sec. This value is obtained by integrating the acceleration.

5-2-20 Address 20, Maximum X- axis acceleration value per second

Maximum X-axis acceleration value per second, unit 0.1 gal.

5-2-21 Address 21, Maximum Y -axis acceleration value per second

Maximum Y-axis acceleration value per second, unit 0.1 gal.

5-2-22 Address 22, Maximum Z -axis acceleration value per second

Maximum Z-axis acceleration value per second, unit 0.1 gal.

5-2-23 Address 23, maximum X- axis speed value per second

Maximum X-axis speed value per second, unit 0.1 mm/sec. This value is derived from acceleration through integral calculation.

5-2-24 Address 24, maximum Y- axis speed value per second

Maximum Y-axis speed value per second, unit 0.1 mm/sec. This value is derived from acceleration through integral calculation.

5-2-25 Address 25, maximum Z- axis speed value per second

Address 25 provides the maximum Z-axis velocity value per second, with the unit of 0.1 mm/sec. This value is calculated by integrating the acceleration data from the Z-axis. It represents the maximum ground velocity in the vertical direction during an earthquake event.

5-2-26 Address 26, System Status

Address 26 contains important status information about the system. It consists of several bits that indicate various aspects of the system's behavior:

Bit0: Sensor OK - This bit indicates the status of the sensor. When it is set to 1, the sensor is functioning correctly.

Bit1: Event flag - This bit is set to 1 when an earthquake event is detected.

Bit2: Event PGA trig- It is set to 1 when the Peak Ground Acceleration (PGA) triggers an event.

Bit3: Event PGV trig- This bit is set to 1 when the Peak Ground Velocity (PGV) triggers an event.

Bit4: Event STA/LTA trig - It is set to 1 when the Short-Term Average to Long-Term Average (STA/LTA) trigger mechanism detects an event.

Bit5: LTA ready - When the STA/LTA trigger mechanism is ready, this bit is set to 1.

Bit6: Offsetting- This bit is set to 1 when the machine performs zeroing calculations. Zeroing can occur during system initialization and after an earthquake event.

Bit15: RTC data busy - When this bit is set to 1, it means that the system is updating the real-time clock (RTC) data to the Modbus point. During this time, the system time at addresses 27~33 may be unreliable. SCADA systems should check for this bit to ensure accurate data when capturing the system time.

5-2-27 Address 27, system time – year

The system time of this machine, the first year of the West.

5-2-28 Address 28, system time – month

The system time of this machine, month.

5-2-29 Address 29, system time – day

The system time of this machine, day.

5-2-30 Address 30, system time – week

The system time of the machine on the day of the week, day of the week 0~6, 0 represents the day of the week.

5-2-31 Address 31, system time – hour

The system time of this machine, hour, 0~23.

5-2-32 Address 32, system time – minute

The system time of this machine, minutes, 0~59.

5-2-33 Address 33, system time – seconds

The system time of this machine, seconds, 0~59.

5-2-34 Address 34, STA/LTA real-time value

If the STA/LTA trigger logic is turned on, this address will store the real-time STA/LTA value. The unit is 0.1. Generally, during normal operation if there is no interference, the value of this address should hover around 10.

5-2-35 Address 35, earthquake event time – year

When the earthquake event is triggered (the event is positive), this address stores the first year of the occurrence.

5-2-36 Address 36, earthquake event time – month

When the earthquake event is triggered (the event is positive), this address stores the month of occurrence.

5-2-37 Address 37, earthquake event time – day

When the earthquake event is triggered (the event is positive), this address stores the day of occurrence.

5-2-38 Address 38, earthquake event time – time

When the earthquake event is triggered (the event is positive), this address stores the time of occurrence.

5-2-39 Address 39, earthquake event time – minute

When the earthquake event is triggered (the event is positive), this address stores the minute of occurrence.

5-2-40 Address 40, earthquake event time – seconds

When the earthquake event is triggered (the event is positive), this address stores the seconds of occurrence.

5-2-41 Address 41, Earthquake Event - Seismic Intensity

This address stores the maximum seismic intensity of the earthquake event, the unit is 0.1.

5-2-42 Address 42, Seismic event - synthetic acceleration value (PGA)

This address stores the maximum synthetic acceleration PGA value of the earthquake event, the unit is 0.1 gal.

5-2-43 Address 43, Earthquake Event - Synthetic Velocity Value (PGV)

This address stores the maximum synthetic acceleration PGV value of the earthquake event, the unit is 0.1 mm/sec.

5-2-44 Address 44, Seismic event-synthetic acceleration degree X component value

This address stores the X-axis component value of the maximum synthetic acceleration of the seismic event, unit 0.1 gal.

5-2-45 Address 45, Earthquake event-synthetic acceleration degree Y component value

This address stores the Y-axis component value of the maximum synthetic acceleration of the earthquake event, unit 0.1 gal.

5-2-46 Address 46, Earthquake event - Z component value of the synthetic acceleration degree

This address stores the Z axis component value of the maximum synthetic acceleration of the earthquake event, unit 0.1 gal.

5-2-47 Address 47, Seismic event-synthetic velocity X component value

This address stores the X-axis component value of the maximum synthetic velocity of the seismic event, unit 0.1 mm/sec.

5-2-48 Address 48, Seismic event-synthetic velocity Y component value

This address stores the Y-axis component value of the maximum synthetic velocity of the seismic event, unit 0.1 mm/sec.

5-2-49 Address 49, Earthquake event-Synthetic velocity Z component value

This address stores the Z-axis component value of the maximum composite velocity of the earthquake event, in unit 0.1 mm/sec.

5-2-50 Address 50, Earthquake Event - Maximum X- axis Acceleration Value

This address stores the maximum X-axis acceleration value of the earthquake event, in unit 0.1 gal.

5-2-51 Address 51, Earthquake Event - Maximum Y- axis Acceleration Value

This address stores the maximum Y-axis acceleration value of the earthquake event, in unit 0.1 gal.

5-2-52 Address 52, Earthquake Event - Maximum Z -axis Acceleration Value

This address stores the maximum Z-axis acceleration value of the earthquake event, in unit 0.1 gal.

5-2-53 Address 53, Earthquake Event - Maximum X- axis Velocity Value

This address stores the maximum X-axis velocity value of the earthquake event, in unit 0.1 mm/sec.

5-2-54 Address 54, Earthquake Event - Maximum Y- axis Velocity Value

This address stores the maximum Y-axis velocity value of the earthquake event, in unit 0.1 mm/sec.

5-2-55 Address 55, Earthquake Event - Maximum Z- axis Velocity Value

This address stores the maximum Z-axis velocity value of the earthquake event, in unit 0.1 mm/sec.

5-2-56 Address 56, Earthquake Event-Relay Status

This address stores the Relay action status during earthquake events.

Bit0: Relay0

Bit1: Relay1

Bit2: Relay2

5-2-57 Address 60, the dynamic zero mode

Address 60 is associated with the dynamic zeroing mode of the accelerometer. Dynamic zeroing is a process that helps compensate for zero drift caused by factors such as the level or environment of the installation site. This address allows you to configure the dynamic zeroing mode, and it offers three options:

NTU Mode (0): In this mode, dynamic zeroing is always performed. This means that the system will continuously adjust and recalibrate the zero point, regardless of whether there is an earthquake event or not.

TRTC Mode (1): In TRTC mode, dynamic zeroing is not performed except during earthquake events. This mode is designed to save power and reduce recalibration during normal, non-seismic periods.

None Mode (2): This mode disables dynamic zeroing altogether. The system will not perform any automatic recalibration, whether during or after an earthquake event or during normal operation.

The choice of dynamic zeroing mode depends on your specific requirements and considerations for power consumption, calibration accuracy, and system behavior.

5-2-58 Address 61: Seismic Intensity Standard

Address 61 is used to configure the seismic intensity standard for this machine. It supports multiple seismic intensity standards, including MMI PGA, MMI PGV, KMA, China Earthquake Administration, CWB (Central Meteorological Bureau), and JMA (Japan Meteorological Agency) seismic intensity standards. The setting method is as follows:

Bit0: CWB (Central Meteorological Bureau)

- 5.1: Represents a weak earthquake
- 5.9: Represents a strong earthquake
- 6.1: Represents a weak earthquake
- 6.9: Represents a strong earthquake
- 7: Represents a magnitude 7 earthquake

Bit1: MMI PGA (Peak Ground Acceleration)

Bit2: MMI PGV (Peak Ground Velocity)

Bit3: KMA (Korea Meteorological Administration)

Bit4: CEA (China Earthquake Administration)

Bit5: JMA (Japan Meteorological Agency) seismic intensity standard (0-9)

The meaning of seismic intensity standards after 5:

- 5.1: Represents a weak earthquake
- 5.9: Represents a strong earthquake
- 6.1: Represents a weak earthquake
- 6.9: Represents a strong earthquake
- 7: Represents a magnitude 7 earthquake

It's important to note that the lower bits have higher priority. For example, if Bit0, Bit2, and Bit4 are checked at the same time, the machine will use the CWB earthquake magnitude standard. Also, the choice of seismic intensity standard may affect the low-pass filter frequency, which is 20 Hz when JMA is selected and 10 Hz for other standards.

The low-pass filter used is a Butterworth filter with a 4th-order filter design. When selecting the JMA seismic intensity standard, you can use address 88 (JMA_RING) to set the frequency domain calculation time length used, with the default and recommended value being 10 seconds.

5-2-59 Address 62: earthquake trigger and Relay control modes

Address 62 allows you to configure earthquake trigger modes and Relay control options. Here are the available settings:

Earthquake Trigger Modes:

1. Bit0: PGA trig - Select synthetic acceleration PGA as the trigger mode.
2. Bit1: PGV trig - Select synthetic velocity PGV as the trigger mode.
3. Bit2: STA/LTA trig (PGA determines Relay) - Select STA/LTA trigger mode and use PGA to determine the output of the Relay.
4. Bit3: STA/LTA trig (PGV determines Relay) - Select STA/LTA trigger mode and use PGV to determine the Relay output.

These trigger modes are OR operations, meaning that if any of the selected trigger modes are triggered, the system will consider it a seismic event.

Relay Control Options:

1. Bit13: Relay pulse 2 seconds - Select Relay to be ON for only 2 seconds. This mode is suitable for controlling devices like gas valves.
2. Bit14: Relay reset by system - Choose whether Relay will be automatically reset by the system.
3. Bit15: Single relay mode - Select whether only one Relay will be ON.
 - When Bit14 is not selected, Relay will remain ON after activation until DI0 is ON or address 2 is written to 1.
 - When Bit15 is selected, the system will enable only one Relay to be ON. If multiple Relays meet the ON conditions, only one will be activated.
 - Note that when Bit13 is selected, the system will automatically enable Bit14.

5-2-60 Address 63: earthquake event length

Address 63 allows you to set the maximum length of an earthquake event in seconds. When the earthquake event exceeds this specified duration, the system will initiate several actions:

1. Reset relay.
2. Clear the earthquake flag (bit Address 26, Bit1~4) to zero.
3. Perform automatic reset to zero.

In other words, if an earthquake event persists longer than the time configured at this address, the system will reset and clear the event-related settings.

5-2-61 Address 64, STA/LTA event length

Address 64 is used to set the number of seconds for the earthquake event window when the STA/LTA (Short-Term Average to Long-Term Average) is triggered. If another STA/LTA trigger occurs within this earthquake event window duration, the system will reset the earthquake event window seconds.

Bit 4 at address 26 will be set to 1 during the earthquake event window seconds, indicating that an STA/LTA trigger is active.

5-2-62 Address 65, PGA event length

Address 65 allows you to set the number of seconds for the earthquake event window when the PGA (Peak Ground Acceleration) is triggered. If the PGA is triggered again within this earthquake event window duration, the system will reset the earthquake event window seconds.

Bit 2 at address 26 will be set to 1 during the earthquake event window seconds, indicating that a PGA trigger is active.

5-2-63 Address 66, PGV event length

Address 66 is used to set the number of seconds for the earthquake event window when the PGV (Peak Ground Velocity) is triggered. If the PGV is triggered again within this earthquake event window duration, the system will reset the earthquake event window seconds.

Bit 3 at address 26 will be set to 1 during the earthquake event window seconds, indicating that a PGV trigger is active.

5-2-64 Address 67, STA length

Address 67 determines the duration of the short-term average (STA) component in the STA/LTA trigger mode. The unit is 0.1 seconds, and it is recommended to set it to 20, which corresponds to 2 seconds. A longer short-cycle duration provides better resistance to sudden interference.

5-2-65 Address 68, LTA length

This address controls the duration of the long-term average (LTA) component in the STA/LTA trigger mode. The unit is 0.1 seconds, and the recommended setting is 350, equivalent to 35 seconds. A longer long-cycle duration results in higher sensitivity.

5-2-66 Address 69, STA/LTA trigger threshold

Sets the trigger threshold of STA/LTA trigger mode. The unit is 0.1. It is recommended to set it to 35, which is 3.5.

5-2-67 Address 70, PGA trigger threshold

sets the trigger threshold of PGA trigger mode, the unit is 0.1 gal.

5-2-68 Address 71, PGV trigger threshold

sets the trigger threshold of PGV trigger mode, the unit is 0.1 mm/sec.

5-2-69 Address 72, Relay0 earthquake intensity trigger threshold

Set the earthquake intensity trigger threshold of Relay0, unit 0.1. Setting -1 will disable this threshold.

5-2-70 Address 73, Relay1 earthquake intensity trigger threshold

Set the earthquake intensity trigger threshold of Relay1, the unit is 0.1. Setting -1 will disable this threshold.

5-2-71 Address 74, Relay2 earthquake intensity trigger threshold

Set the earthquake intensity trigger threshold of Relay2, the unit is 0.1. Setting -1 will disable this threshold.

5-2-72 Address 76, Relay0 seismic PGA trigger threshold

Set the seismic PGA trigger threshold of Relay0, unit 0.1 gal. Setting -1 will disable this threshold.

5-2-73 Address 77, Relay1 seismic PGA trigger threshold

Set the seismic PGA trigger threshold of Relay1, unit 0.1 gal. Setting -1 will disable this threshold.

5-2-74 Address 78, Relay2 seismic PGA trigger threshold

Set the seismic PGA trigger threshold of Relay2, unit 0.1 gal. Setting -1 will disable this threshold.

5-2-75 address 80, Relay0 earthquake PGV trigger threshold

Sets the earthquake PGV trigger threshold of Relay0, unit is 0.1 mm/sec. Setting -1 will disable this threshold.

5-2-76 Address 81, Relay1 earthquake PGV trigger threshold

Set the earthquake PGV trigger threshold of Relay1, unit 0.1 mm/sec. Setting -1 will disable this threshold.

5-2-77 Address 82, Relay2 earthquake PGV trigger threshold

Sets the earthquake PGV trigger threshold of Relay2, unit is 0.1 mm/sec. Setting -1 will disable this threshold.

5-2-78 address 84, LCD contrast control

Sets the LCD contrast control, ranging from 1 to 100.

5-2-79 address 85, RS-485 communication speed

This address allows you to configure the communication speed of RS-485 in units of 100 bps. The default setting is 384, which translates to 38400 bps. The available communication speeds for this machine are 9600, 19200, 38400, 57600, and 115200 bps. The response time for Modbus RTU polling is 0.1 seconds.

Please note that if you require RTD output (address 100), the communication speed must be set at 19200 bps or higher. This is because the machine samples data at a rate of 200 SPS (Samples Per Second), and lower communication speeds may lead to incorrect RTD data.

The communication format of this machine is fixed at "N, 8, 1."

5-2-80 Address 87, Modbus RTU ID

Sets the Modbus RTU ID of this machine, the default value is 101.

5-2-81 Address 88, JMA_RING

Sets the frequency domain calculation time length used when using the JMA seismicity standard. The default is 10 seconds.

5-2-82 Address 89~90, serial number of this machine

This serial number can provide traceability of the factory. This field is read-only.

5-2-83 Address 91, Factory calibration of this machine - X- axis gain

Calibration information of this machine, X-axis gain, 10000 represents 1, this field is read-only.

5-2-84 Address 92, factory calibration of this machine - Y- axis gain

Calibration information of this machine, Y-axis gain, 10000 represents 1, this field is read-only.

5-2-85 Address 93, factory calibration of this machine - Z- axis gain

Calibration information of this machine, Z-axis gain, 10000 represents 1, this field is read-only.

5-2-86 Address 94, factory calibration of this machine - X- axis zero value

Calibration information of this machine, X-axis offset value, unit 0.01 gal, this field is read-only.

5-2-87 Address 95, factory calibration of this machine - Y- axis zero return value

Calibration information of this machine, Y-axis offset value, unit 0.01 gal, this field is read-only.

5-2-88 Address 96, factory calibration of this machine - Z- axis zero value

Calibration information of this machine, Z-axis offset value, unit 0.01 gal, this field is read-only.

5-2-89 Address 100, local control function

0x0180: Reload, write parameters and restart

0x5245: RTD_OUT without checksum

0x5244: RTD_OUT with checksum

- When the user modifies any parameters, the relevant settings are not written into the Flash. Only writing 0x0180 to this address will be written to Flash and perform a restart.
- The writing life of Flash is limited, generally about 10,000 times
- When the system starts to execute RTD_OUT, it will no longer accept any Modbus RTU commands. The only way is to power off and restart.
- Note that because the sampling rate of this machine is 200 SPS, the communication speed must be greater than or equal to 19200 bps, otherwise the data an error will occur
- Note that the RTD output control is effective only when DI1 is ON to avoid miscontrol
- The format of RTD is as follows
- The output sensitivity of RTD packet is 2g / 32767, that is, 1 count is 0.059816 gal.

5-2-89 Address 100, local control function

This address provides control options for local operations:

0x0180: Reload, write parameters, and restart.

0x5245: RTD_OUT without checksum.

0x5244: RTD_OUT with checksum.

When a user modifies any parameters, these changes are not immediately written into the Flash memory. To save the changes and perform a restart, you need to write 0x0180 to this address. Keep in mind that the Flash memory has a limited writing life, typically around 10,000 write cycles.

Once the system initiates RTD_OUT, it will no longer accept any Modbus RTU commands. The only way to regain control is by powering off and then restarting the device.

It's important to note that due to the machine's sampling rate of 200 SPS (Samples Per Second), the communication speed must be set at 19200 bps or higher; otherwise, data errors may occur.

Additionally, the RTD output control is only effective when DI1 is ON to prevent accidental control. The RTD format is as follows:

16 bit without checksum checkSum = 0x0A + 0x0D + XH + XL + YH + YL + ZH + ZL									
Byte	0	1	2	3	4	5	6	7	8
Data	0x0A	0x0D	XH	XL	YH	YL	ZH	ZL	checkSum

5-2-90 Address 101, system time update suspend

To change the RTC time of the system, follow these steps:

1. Write the value 1 to this address (101) to prevent the system from continuing to update the RTC time stored in addresses 27 to 33 (system time).
2. Write the correct time into addresses 27 to 33 (system time).
3. Write the value 0x1308 to address 102.
4. The system will then write the time from addresses 27 to 33 (system time) to the RTC.
5. Finally, write 0 to this address (101) to allow the RTC to update its time from the values stored in addresses 27 to 33 (system time).

5-2-91 Address 102, real-time clock function control

- 0x1307: This instruction tells the system to write the RTC time to addresses 27 to 33 (system time).
- 0x1308: This instruction tells the system to write the values from addresses 27 to 33 (system time) to the RTC.

The system updates the values at addresses 27 to 33 (system time) every 0.5 seconds.

5-2-92 Address 103, test function

When the user wishes to test the Relay, it can be controlled using address 3, but this address must be written with 1. After the test is completed, please write this address with 0 to ensure the stability of the connected control system.

When the user wants to simulate a PGA-triggered earthquake event, they can write this address as 0x0921, and the system will read the data at address 104 to generate the PGA and cycle.

5-2-93 Address 104, PGA trigger test content

When the above address 103 is written with 0x0921, the system will consider the high byte of this address as PGA and the low byte as the trigger number. For example:

- Address 104 is written as 0x0a64.
- Address 103 is written as 0x0921.

In this case, the system will first increase the acceleration of the next 100 sets of three-axis by 10 gal. Then, from 101 to 200, the acceleration of the three axes will be reduced by 10 gal. The system will set the address 103 to 0 to clear it.

5-2-94 Address 105, STA LTA reset threshold (high point)

This address is used to adjust the characteristic reset high point threshold of the STA LTA trigger algorithm. The unit is 0.1. The default value is 110 (1.1), and it must not be set lower than this default value. If a value lower than this default is set, the system will automatically set it to this default value to prevent insensitivity to vibration caused by its characteristics.

5-2-95 Address 106, STA LTA reset threshold (low point)

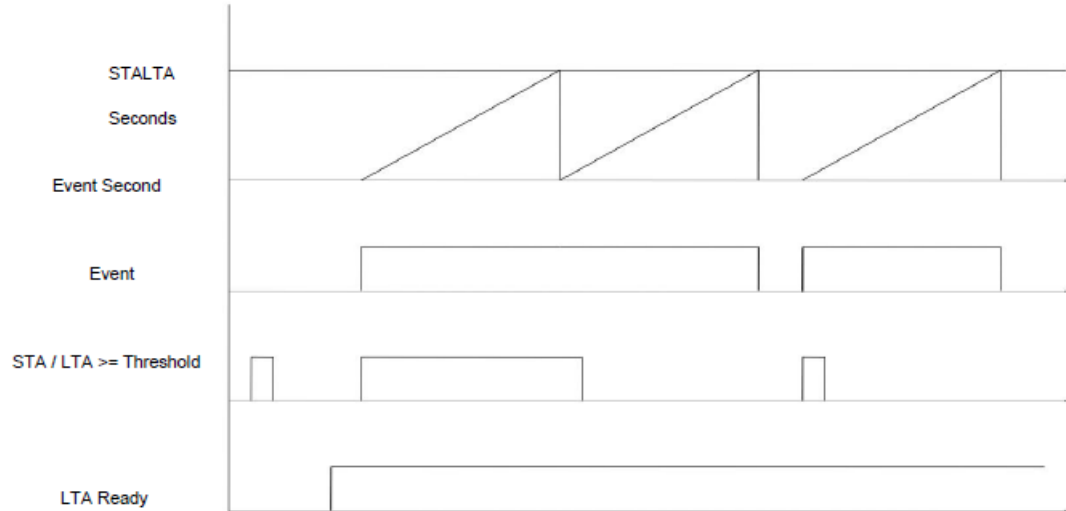
This address is used to adjust the characteristic reset low threshold of the STA LTA triggering algorithm. The unit is 0.1. The default value is 60 (0.6), and it must not exceed 90 (0.9). If it exceeds 90, the system will automatically set it to 90 (0.9) to prevent insensitivity to vibration caused by its characteristics.

5-2-96 Address 107, average earthquake intensity threshold

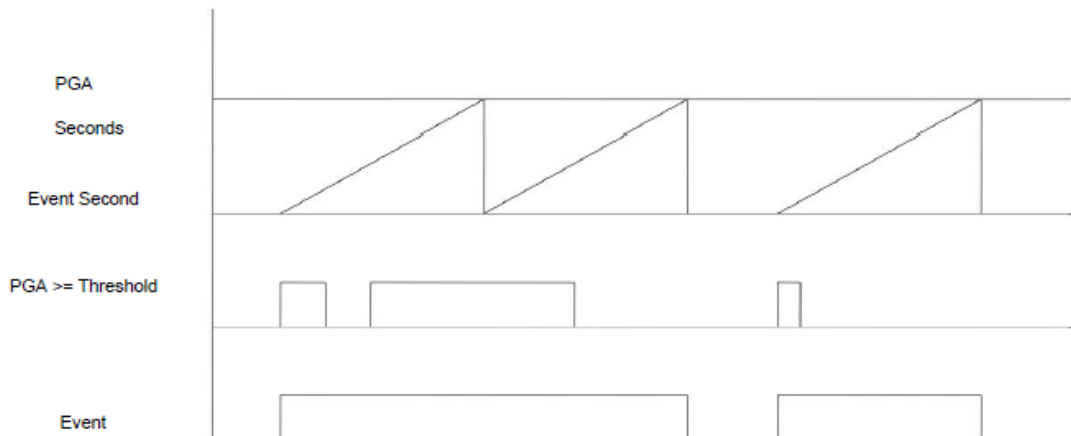
This address represents the average earthquake intensity threshold within 1 second. The unit is 0.01, with a default value of 50 (level 0.5). It cannot exceed 1200 (level 12). If it exceeds this value, the system will automatically reset it to the default value. The average earthquake intensity is calculated by averaging the earthquake intensity at each data sampling point within a second.

6. Timing Diagram

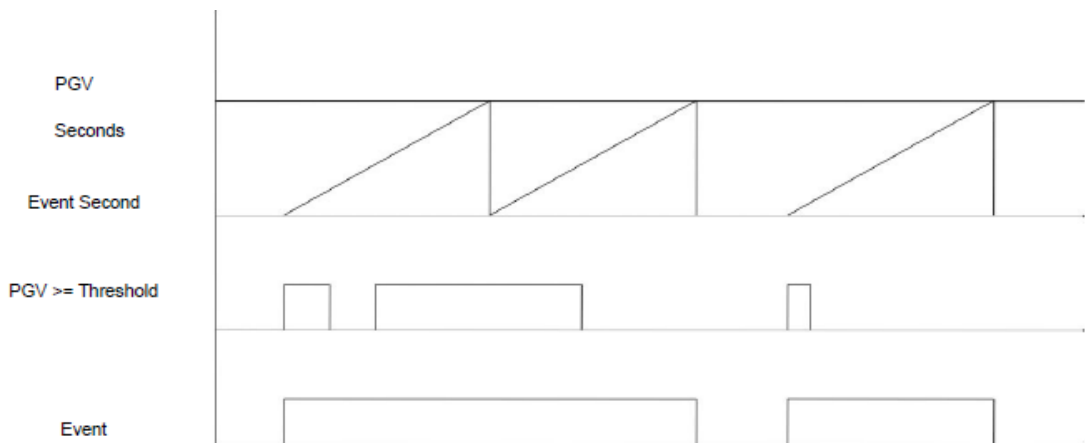
6-1 STALTA earthquake detection timing diagram



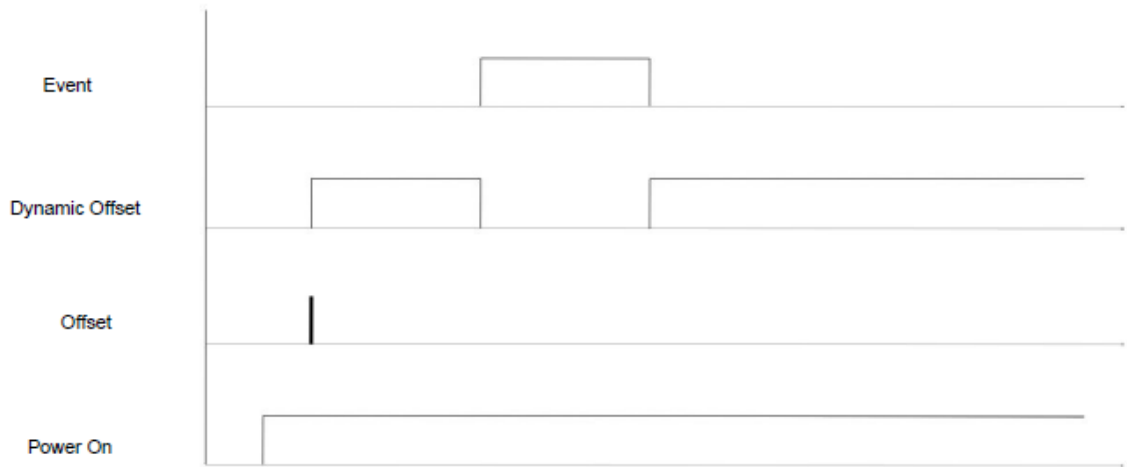
6-2 PGA earthquake detection timing chart



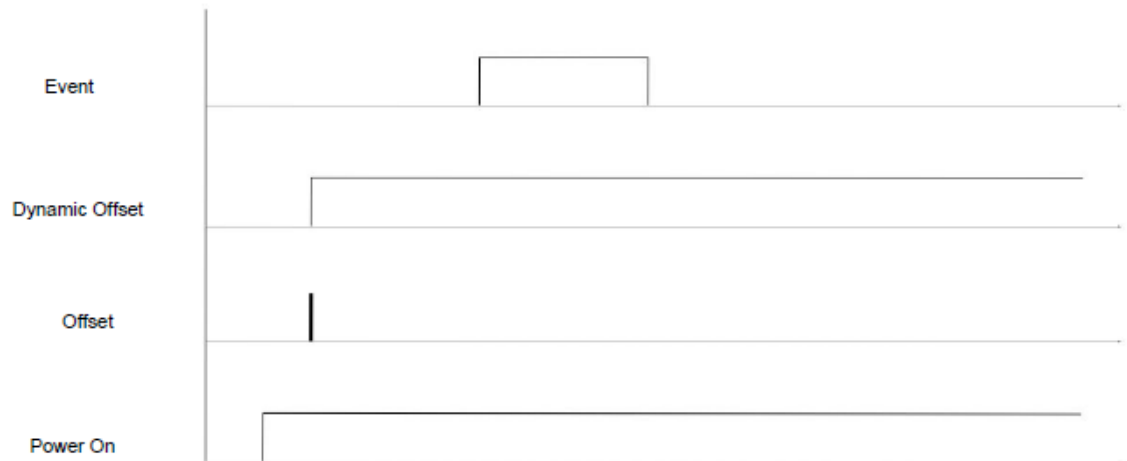
6-3 PGV earthquake detection timing diagram



6-4 Zeroing process (DOFFSET_MODE = TRTC)

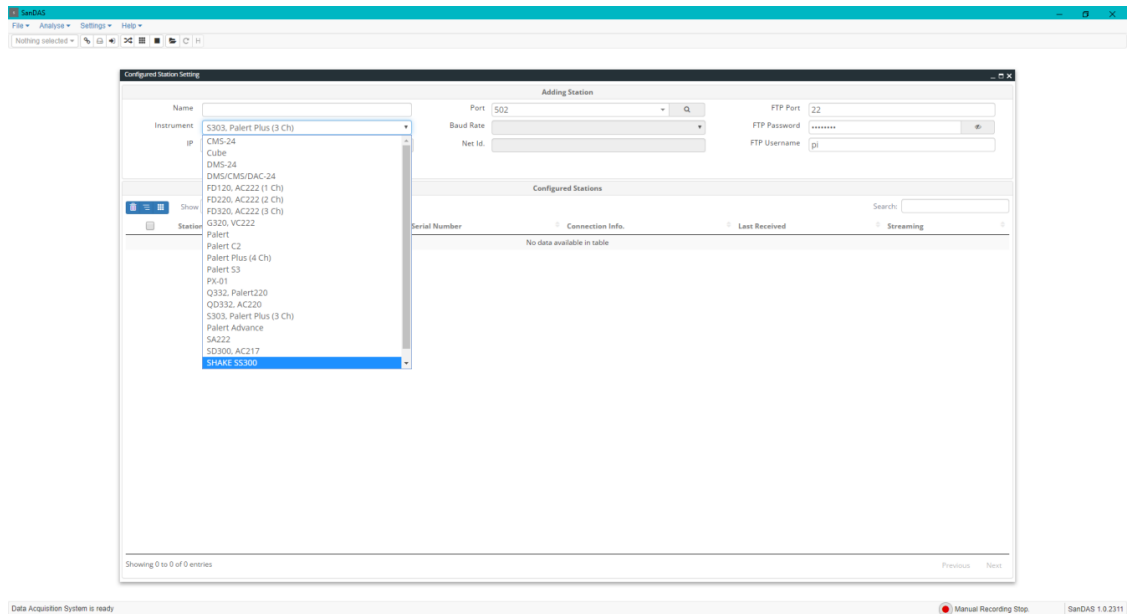


6-5 Zeroing process (DOFFSET_MODE = NTU)

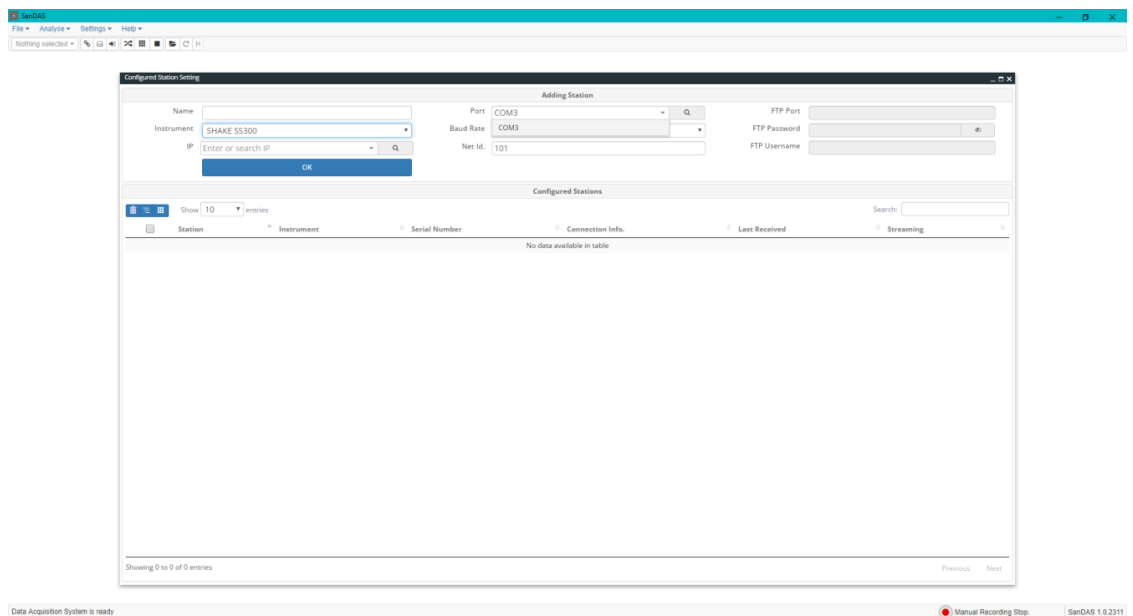


7. SanDAS Operation Interface

After launching SanDAS, click on "Settings" in the function bar, and you will be directed to the "Configured Station Setting" page. On this page, you can select "SHAKE SS300" from the drop-down menu under the "Instrument" section.

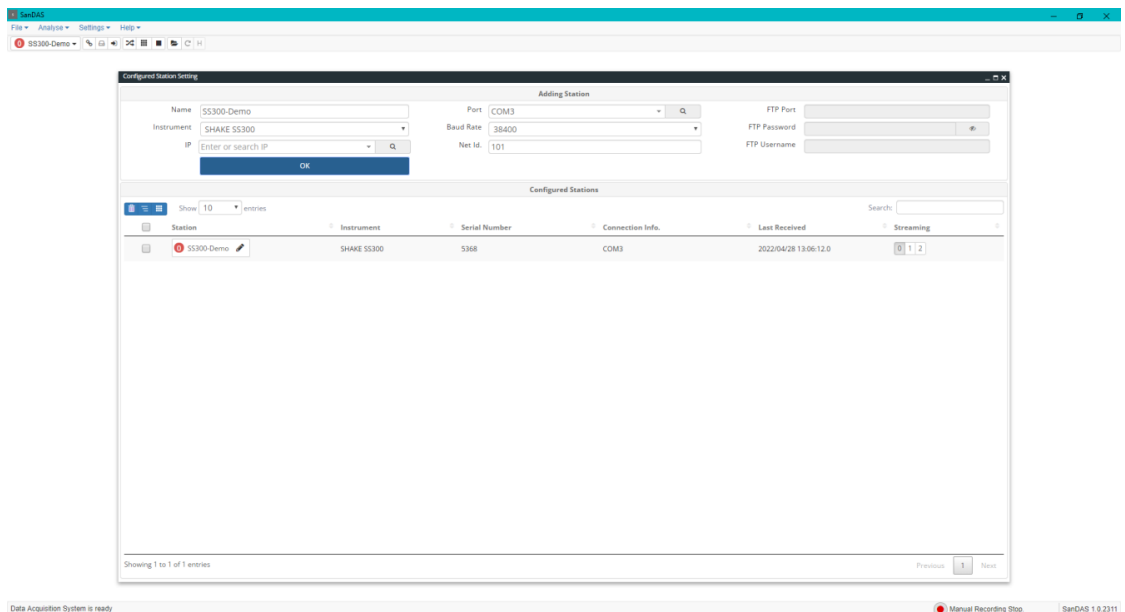
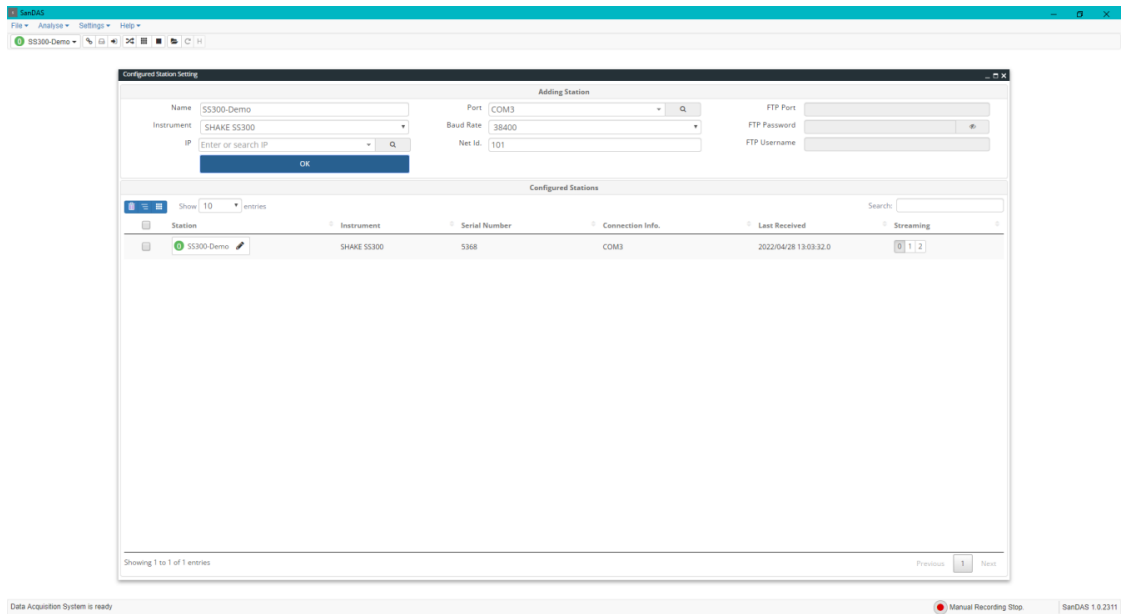


Once you have selected "SHAKE SS300" from the drop-down menu, the "Port" settings should automatically switch to COM port mode, and you can proceed to select the correct COM port for your SHAKE SS300 device. This ensures that your software is properly configured to communicate with the device.

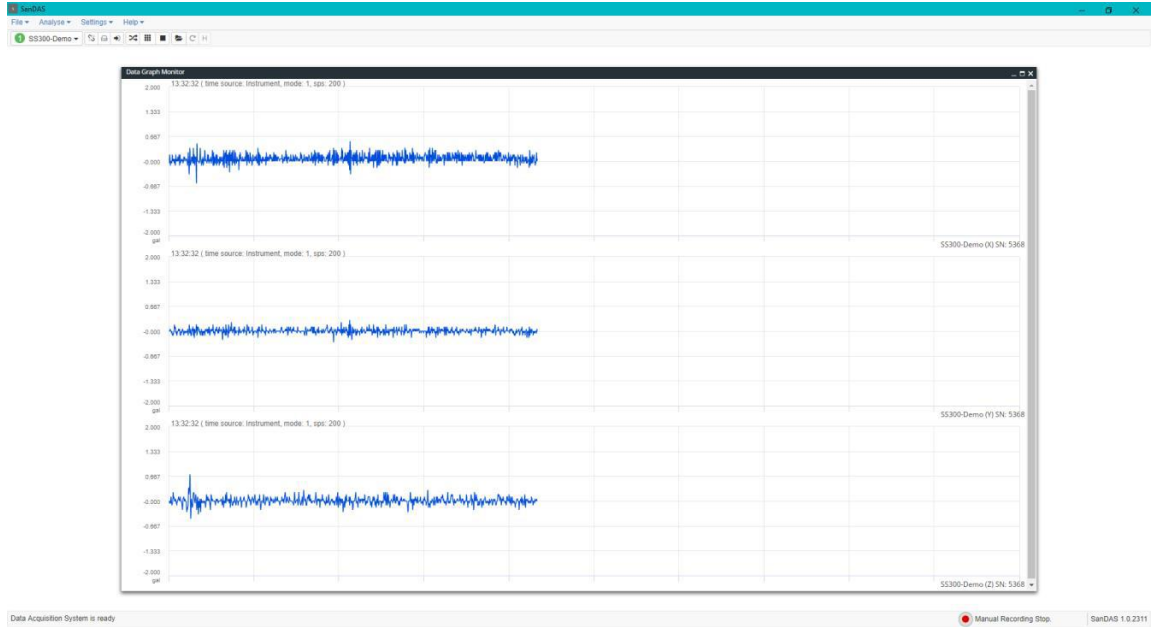


The factory default Baud rate is 38400, and the Modbus RTU ID is 101. If you need to check or query these settings, you can refer to the description of DI0 in section 3.2.2 "Display Content."

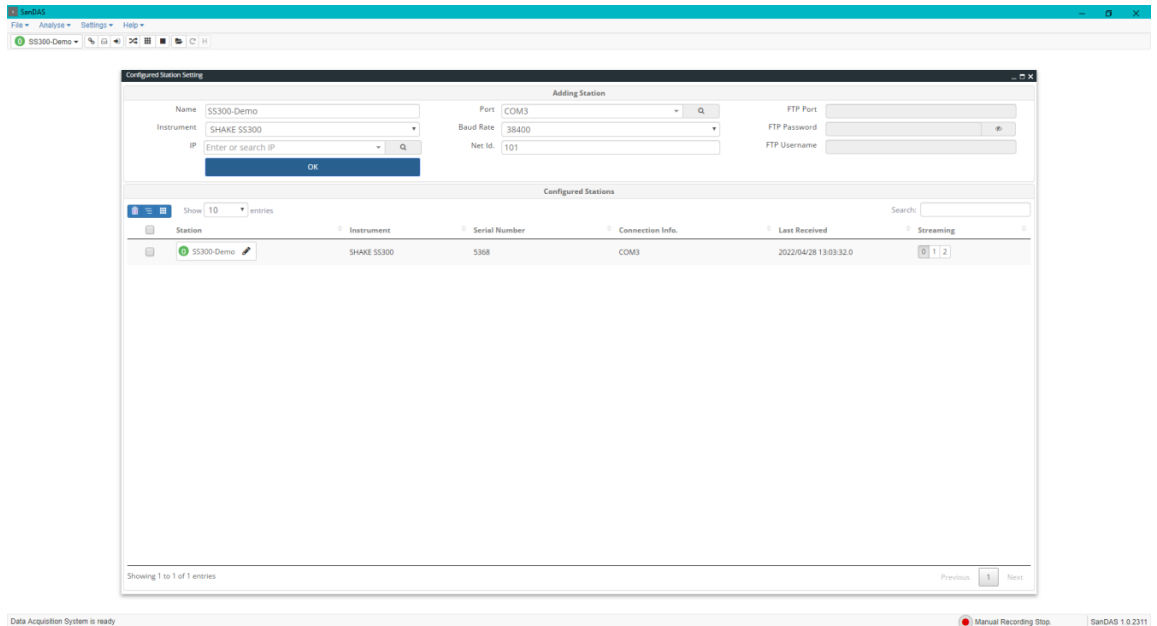
To create a configuration file in SanDAS, enter the name in the Name field and press OK. After the file creation is complete, SanDAS will attempt to establish a connection with your device. The connection indicator in front of the file will show a green light if it successfully connects and communicates with the device. If it cannot connect, the indicator will show a red light. The number in the connection status light indicates the RTD receiving status: 0 means no RTD is received, 1 means receiving RTD without Checksum, and 2 means receiving RTD with Checksum. If you want to enable the RTD function, please refer to address 100 in section 5.2.89, "Local Control Function."



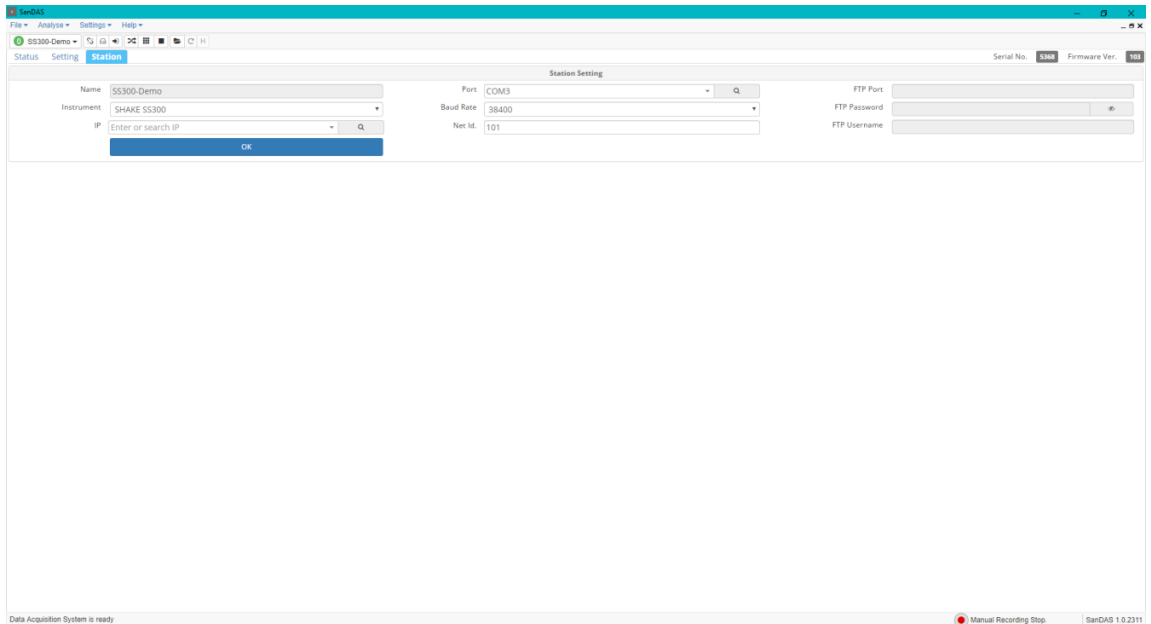
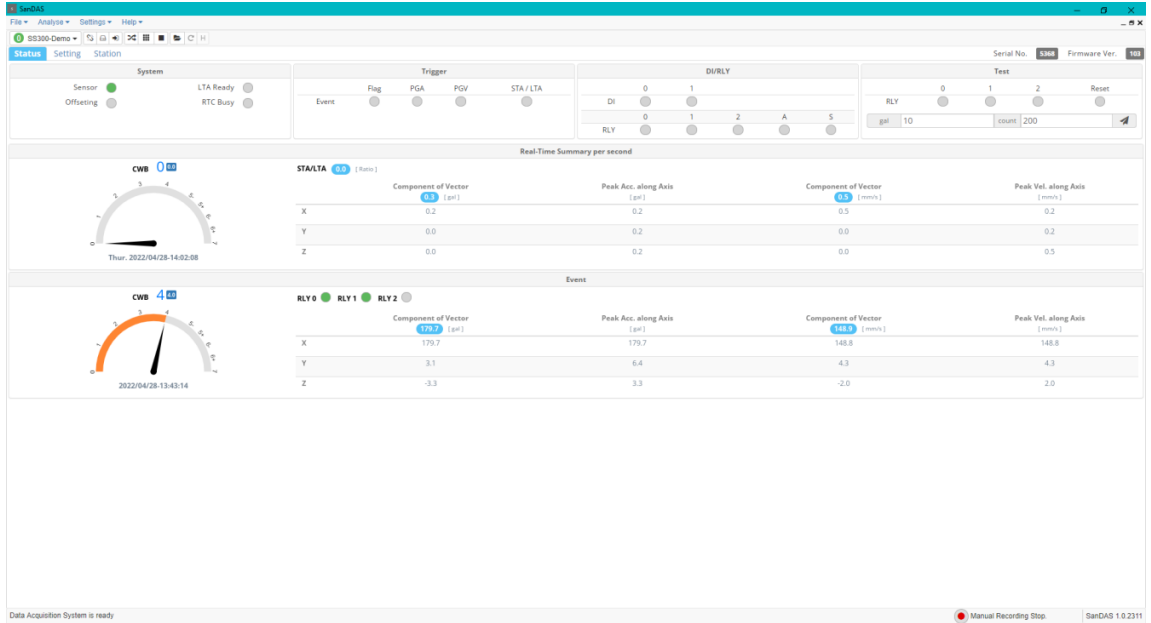
If you successfully enable the RTD function, please note that the Modbus RTU functionality will not be available. If you want to restore the Modbus RTU functionality, you will need to restart the SS300 device.



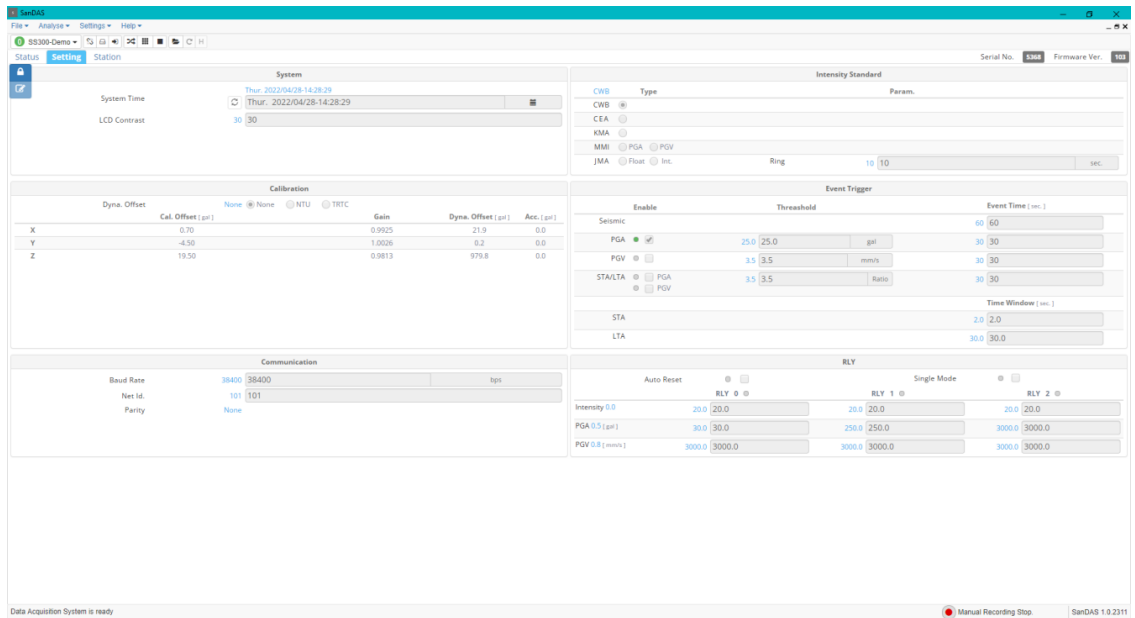
To modify the settings of SS300, you can click in the Station field after creating the file to enter the SS300 settings page.



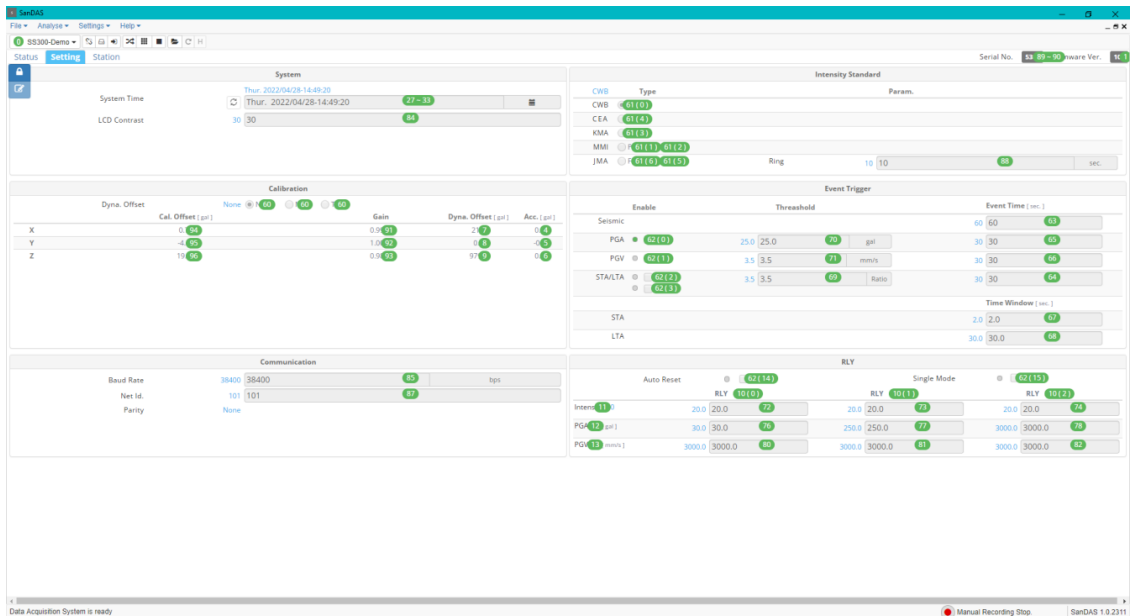
There are three tabs in SS300: Status, Setting, and Station. The Status tab displays the real-time status of the SS300, including system information, trigger logic, Relay status, and more. It provides summaries of data collected every second, the latest trigger information, and other relevant details. The Station tab is used to update information for new files and configurations.



The Setting tab includes a protection mechanism that requires unlocking before making parameter modifications. To unlock, click the designated option, and it will indicate that the tab is unlocked. After making the necessary parameter changes, click "Write Parameters" to save the modifications.



The document refers to a figure for Modbus point descriptions, illustrating how to set the device system time. Specifically, it mentions that you need to modify address 27 to address 33. For detailed instructions, you should refer to page 21 of the document.



The SHAKE SS300 uses OR operations for both event triggering and Relay control. For example, if you enable both the PGA and PGV trigger modes simultaneously, the SS300 will enter the trigger state when the vibration reaches the PGA trigger threshold, even if the PGV trigger threshold has not been reached yet. To avoid this situation, it is recommended to turn off any unused trigger logic or adjust the trigger thresholds and Relay action thresholds as needed.



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