

# **INSTRUCTION MANUAL**

## **SEISMIC MONITORING SYSTEM**

Model: SW-54  
(Modified Mercalli Intensity Scale)

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## 1. Introduction

Thank you for purchasing Seismic Monitoring System SW-54.

Read this instruction Manual carefully to ensure the best performance and longest product life of the device.

In addition, pay attention to the cautions described below to use the product safely.

### Cautions

1. To set up alarm functions for those products with alarm functions, ensure that the primary personnel responsible for operation will perform settings after confirming that the receiving device of the alarm signal is set to **ALARM OFF**. Otherwise, an emergency situation may be triggered at the receiving device due to the shift in the signal.
2. For heavy devices such as multi-channel and rack-mount devices, the weight is indicated on the rear as **WEIGHT \_\_\_ kg**. Check the weight before moving and/or transporting the device and take necessary precautions to prevent the device from falling on the floor.
3. For devices for which the power supply line need to be connected on the terminal box, confirm that the circuit breaker for the power supply is turned **OFF** prior to making connections. Replace the protective cover after the connection.
4. Ensure that the Class D grounding or higher is taken from the terminal box or binding post by using a separate line from other power devices.
5. Ensure that input signal line from the pickup and output signal lines are installed separately and well apart from the power line and other signal lines that may cause noises.

Should there be a doubt or any abnormal behavior on the device, please do not hesitate to contact the nearest sales office or the Quality Assurance Department listed on the back cover.

## 2. Preparations for Monitoring Seismic Activities

### 2-1. Installation

#### 2-1-1. Installation of Seismic Monitor SW-52

##### a) Location

The ambient temperature and humidity shall be 0 to +50 degrees C and 10 to 100% RH, respectively.

Avoid installation or use of the system in the places described below even if the ambient temperature and humidity satisfy the above:

- Locations where the device may be exposed to direct sunlight or high temperature. (Install the protection cover for outdoor use).
- Locations with corrosive or flammable gases.
- Locations where artificial vibrations are expected (due to traffic or the presence of vibrating devices nearby).
- On a raised floor where there is an empty space under the floor.

##### b) Installation

Fix the device on a floor or foundation block with concrete anchors (M8 × 30).

Choose a flat surface on the concrete and install the device so that the levelness of ±5 degrees or better will be ensured.

For anchoring, always use the attached installation plate. Installation by gauging on the spot without the use of the plate is not allowed under any circumstance.

The alarm and analog outputs from the device have no orientation and, therefore, the orientation of the device does not matter. However, if the use of seismic wave data recorded with the device is intended, install the device so that its mounting axis is in line with the north-south axis.



The built-in acceleration pickup in the device is a device that is designed for extreme precision. Handle the product with care during the transportation and installation to avoid mechanical impacts.

#### 2-1-2. Installation of Seismic Processor SW-54

##### a) Location

The ambient temperature and humidity shall be 0 to +50 degrees C and 10 to 85% RH, respectively.

Avoid installation or use of the system in the places described below even if the ambient temperature and humidity satisfy the above:

- Outdoor.
- Locations where dew condensation is expected from the change in temperature.
- Dusty environment.
- Locations where frequent vibration or shock is expected.



b) Installation

(Refer to the External Dimensions of Seismic Processor at the end.)

Prior to the installation, attach four M6 screws at the spot of installation according to the dimensional drawing and leaving approximately 2 mm protrusion.

Install the unit so that four screws will go through the mounting holes on the back and then tightening the screws.



The weight of the unit is 3 kg.

Handle the product with care during the transportation and installation to avoid mechanical impacts.

2-2. Connecting Cables

Note that a waterproof connector with a screw-locking mechanism is employed for the seismic monitoring system cable.

a) Handling the Connector

■ Fixing

Align the guides on the plug and receptacle and push the plug straight. Then, fasten the coupling nut thoroughly.

(The guides can be aligned by turning the plug.)

■ Removal

Loosen the coupling nut completely and pull out the plug.



Fasten the coupling nut carefully to avoid being jammed.

## b) Pin Assignment

Dedicated Cable		Pin No.	Signal Name	In/Out
Pair	Wire Color			
1	Blue	1	DC4-20mA +	Output
	White	2	DC4-20mA -	
2	Yellow	3	Alarm 1	Output
	White	4	Alarm 2	
3	Green	5	Alarm 3	
	White	6	Alarm COM	
4	Red	7	External reset +	Input
	White	8	External reset -	
5	Purple	9	Time calibration signal +	Input
	White	10	Time calibration signal -	
6	Blue	11	RS422 TXD+	Input/Output (COM1 of SW-54)
	Brown	12	RS422 TXD-	
7	Yellow	13	RS422 RXD+	
	Brown	14	RS422 RXD-	
8	Green	15	RS422 TXD+	Input/Output (COM2 of SW-54)
	Brown	16	RS422 TXD-	
9	Red	17	RS422 RXD+	
	Brown	18	RS422 RXD-	
10	Purple	19	DC24V +	Input
	Brown	20	DC24V -	
Shield		21	GND Class D (former Class 3) grounding	-



Due to the use of a multiple-core twisted-pair cable, there are multiple wires with the same color. Pay attention in the wiring so that each pair is connected correctly. (Refer to the wiring diagram at the end.)

### 2-3. Clamp Filter

EMC Directive requires installation of clamp filters to signal and supply cables of this device. Refer to the instructions below and assemble the clamp filters enclosed in the package.

Clamp Filter (accessories): ZCAT2132-1130 (TDK) (Internal diameter: 11.mm)

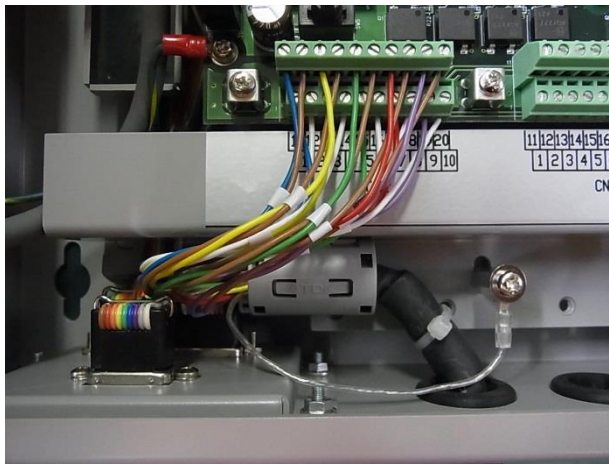
#### ■ Signal Cables

Attach a clamp filter around the cable cores (without sheath). One set of cable cores go through the clamp filter.

#### ■ Supply Cables

Wrap the positive and negative power and the ground cables around a clamp filter. Two sets of 3 cables go through the clamp filter.

Recommended cable size: AWG20 to 14 (0.5sq to 2.0 sq)



Signal Cables with Clamp Filter



Supply Cables with Clamp Filter



The clamp filter should locate inside of the device.

### 3. Storage and Power Supply Operation

#### 3-1. Storage

[1] If a battery is provided

Unplug the battery cord when the device is not used.

The device will operate on the battery whenever the AC power supply cable is not connected.

[2] If a battery is not provided

It is not necessary to worry about the battery.

#### 3-2. Turning the Power ON

This section does not apply to a device with no battery.

If a battery is provided for the device, follow the procedures and notes described below at all times.

The battery cord is not connected when the device is shipped from the factory. Also note that the battery is not fully charged. Therefore, perform the following prior to the use.

[1] Open the front panel.

[2] Connect the power cable and turn ON the power switch.

[3] Confirm that the device will go into the seismic standby mode after the behaviors described on the next page (diagnosis of the power supply and device health).

[4] Connect the battery cable to the white connector (CN8) at the top-left corner of the circuit board.



The battery is not fully charged when it is used for the first time. Ensure that the power supply cable is connected prior to the use.



When the battery runs out after a shut down of the main power supply, the device may not be powered up even if the power supply is restored. If this happens, follow the procedure explained above to turn on the power again.

## 4. Operation of the Device

### 4-1. Display on the Main Unit

#### 4-1-1. Turning ON the Power ... Starting the Seismic Monitoring

##### a) Seismic Monitor SW-52

When the power is turned on, the device will display the firmware version for about five seconds.

Then there will be a power-on reset period of approximately five minutes before starting the seismic monitoring.

During the power-on reset, the LEDs will turn off gradually as time passes until the rightmost dot starts blinking, which indicates the start of seismic monitoring.

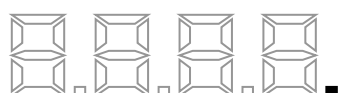
○ Firmware version display (for about five seconds)



○ During the power-on reset (for about five minutes)



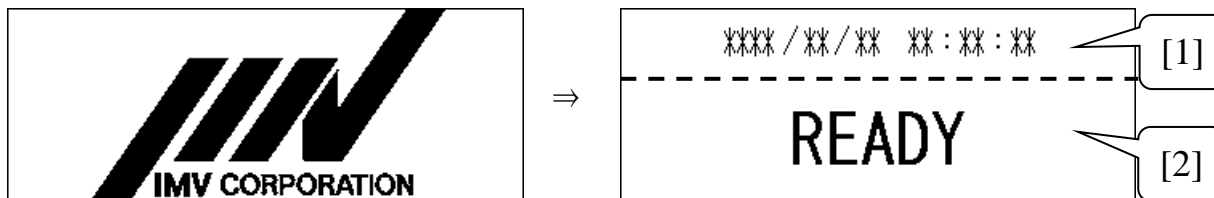
○ In seismic monitoring



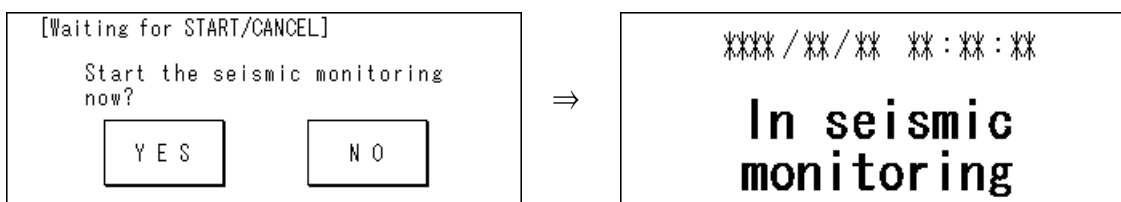
(The rightmost dot will blink.)

##### b) Seismic Processor SW-54

When the power is supplied to the unit, the word "READY" will appear on the screen after the display of the IMV logo.



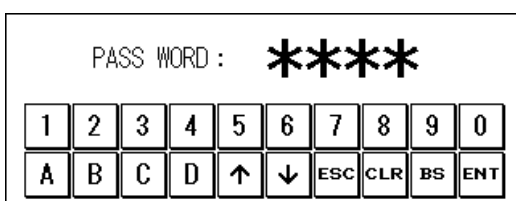
At this time, it is possible to reduce the power-on reset period by touching the current date and time display at [1]. (This function will be effective in about thirty seconds after the start-up.)



Since the device performs an automatic offset adjustment during the power-on reset, do not cancel the power-on reset unless it is necessary.

Upon completion of the power-on reset, the display of "In seismic monitoring" will appear to indicate the start of seismic monitoring.

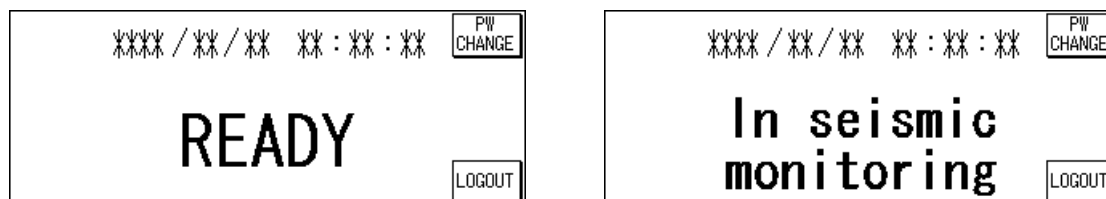
Touching the area [2] of the READY display or any area of the In Seismic Monitoring display will bring up the password entry screen.



The password entry screen shows "PASS WORD : \*\*\*\*\*" at the top. Below it is a numeric keypad with digits 1-0 and a second row with letters A-D, up/down arrows, and function keys ESC, CLR, BS, and ENT.

Entering the correct password will let you log in to the system.

The screen will go back to the previous one.



This block contains two side-by-side screen representations. The left screen is labeled "READY" and the right screen is labeled "In seismic monitoring". Both screens show the date and time at the top. In the top right corner of each screen, there is a "PW CHANGE" button. In the bottom right corner of each screen, there is a "LOGOUT" button.

"PW CHANGE" and "LOGOUT" options will appear once you log in.

Touching the screen one more time will enable the operation.



The system has no automatic logout function.  
Be sure to log out when you finish your operation.



Manage the change in password carefully.  
Resetting due to the missing password requires the return of the product to the factory.

#### 4-1-2. In seismic monitoring ... During an Earthquake ... Ceasing of an Earthquake

##### a) Seismic Monitor SW-52

While in seismic monitoring mode, the rightmost decimal point will blink with a cycle of one second.

When an earthquake occurs, the measured value will be displayed according to the setting (acceleration or spectrum intensity).

##### ○ In seismic monitoring



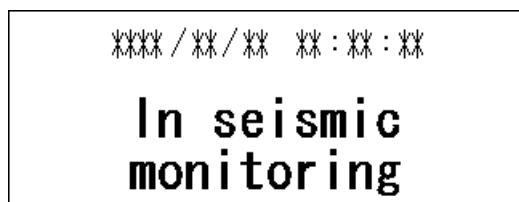
##### ○ During an Earthquake (acceleration, spectrum intensity: 999.9 or less/1000 or more)



##### b) Seismic Processor SW-54

The display changes as depicted below for the seismic monitoring mode, during an earthquake, and while the alarm is held after an earthquake.

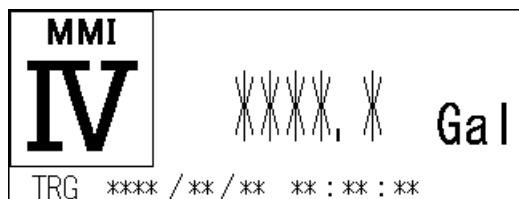
##### ○ In seismic monitoring (Green)



[Display] Current date and time

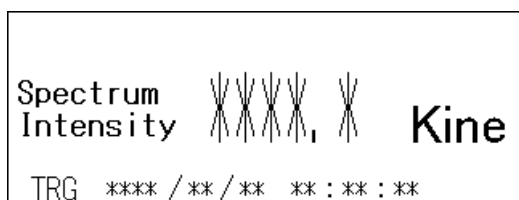
[Operation] Touch the screen ⇒ Password entry screen  
⇒The Basic Menu screen

##### ○ During an Earthquake (Red)

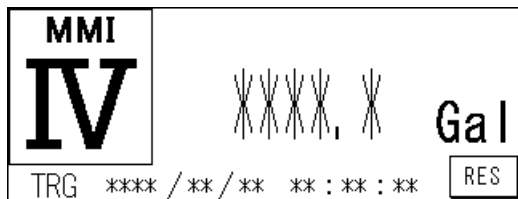


[Display] Measured value according to the display setting,  
triggered date and time

[Operation] None

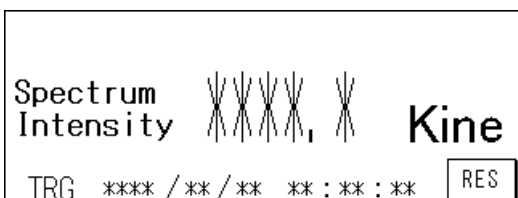


## ○ Alarm Hold (Orange)



[Display] Measured value according to the display setting, triggered date and time

[Operation] Reset ⇒ Reset the alarm being held  
Return to the seismic monitoring mode



Password is required to reset.

If the alarm is not in effect when an earthquake has ceased, the display will go back to the seismic monitoring screen (green).

The Alarm Hold screen (orange) appears when some alarm is in effect when the earthquake has ceased.

The seismic monitoring screen (green) will be restored when all alarms has been reset.

### 4-2. Seismic Detection (Trigger) Operation

The device employs acceleration and velocity, which is calculated from acceleration, as parameters to trigger the operation.

The use of acceleration level will make the frequency spectrum flat to detect the S-wave.

If the velocity level setting is used, a filtering operation will be performed on the input signal (acceleration) to extract the P-wave component, integration will be performed to convert to the velocity, and then detection of a seismic activity will be determined based on the velocity level.

If both the acceleration and velocity level settings are made, detection of a seismic activity will be declared if one of the criteria is satisfied.

To disable either setting, set the detection level to “0 (0.0)”.

Ceasing of an earthquake is determined based on the acceleration level.

If the terminal block is encountered while the magnitude of acceleration is held below the preset level for five seconds, then it is considered that the earthquake has ceased.

## ○ Range of settings

Judgment component: XYZ•XY•Z (Select one)

Judgment condition: OR•AND (Select one)

Acceleration level: 0.1–99.9 Gal

Velocity level: 1–999 mKine

(Set the level to “0 (0.0)” if either setting is not used.)



Note that the earthquake detection will not be performed if both acceleration and velocity levels are set to “0 (0.0)”.



○ P-wave detection:

In the seismic wave caused by an earthquake, there are a small tremor called the preliminary tremor (P-wave) and a large tremor called the main tremor (S-wave).

The P-wave travels faster than the S-wave and can be detected earlier at a location away from the epicenter.

On a ground of average solidity, the frequency of P-wave will be around 8 Hz.

(Low ← soft ground [seismic frequency] solid ground → high)

For this reason, the device focuses on the frequencies around 8 Hz in the input signal from the acceleration sensor.

If the velocity of this frequency component exceeds the predefined threshold, the device recognizes it an earthquake and starts its operation.

The relationship between acceleration and velocity is expressed by the following equation.

$$V = \frac{1000}{2 \pi f} A$$

V: Velocity (mKine)

A: Acceleration (Gal)

f: Frequency (Hz)

The acceleration and velocity correspondence at 8 Hz  
(characteristic points)

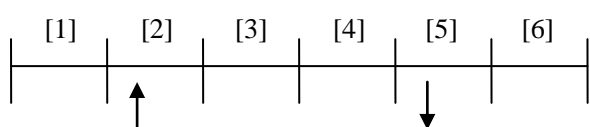
Acceleration (Gal)	Velocity (mKine)
0.5	10
1.0	20
2.0	40
3.0	60
4.0	80
5.0	100

#### 4-3. Duration of an Earthquake

When an earthquake is detected, it is defined as follows using blocks of 10 seconds.

a) Earthquakes lasting less than one minute

A total of five blocks, including the block in which an earthquake is detected, and a block immediately before the detection (pre-trigger) will be processed to represent an earthquake.

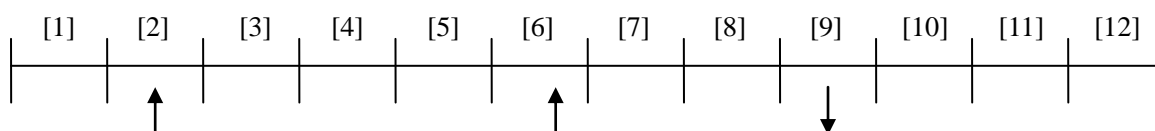


Earthquake detection      Below the detection level

Block [6] and [12]  
are called the  
terminal blocks.

b) Earthquakes lasting longer than one minute, but less than two minutes

If the earthquake was determined to be continuing or another earthquake was detected in the terminal block [6], the duration will be extended for another six blocks.



Earthquake detection      Continuation of an earthquake      Below the detection level

c) Earthquakes lasting longer than two minutes

If the earthquake was determined to be continuing or another earthquake was detected in the added terminal block [12], the process for the initial trigger will be repeated. (Block [11] will be treated as the pre-trigger, while block [12] will be treated as the detection block.)

As long as an earthquake is continuing, the peak acceleration value will be held.

#### 4-4. Recording the Seismic Wave Data

The device comes with a seismic wave recording function.

Records of the largest earthquake in the past and up to ten recent earthquakes can be retained in the unit.

a) Earthquakes lasting less than one minute

Data will be recorded as a single file of 60 seconds.

b) Earthquakes lasting longer than one minute, but less than two minutes

Data will be recorded as a single file of 120 seconds.

c) Earthquakes lasting longer than two minutes

After the data is recorded as described in b), the earthquake will be treated as a new earthquake.

If multiple wave data are recorded for an earthquake lasting for an extended period, the earthquake information (date and time of earthquake, the maximum value) will be the same for all files.



To download the wave data, an optional software “Maintenance Software will be necessary.

#### 4-5. Earthquake Information History

The device has a function to save the history of earthquake information.

Up to fifty earthquake data can be stored and displayed on the screen.

For further information, refer to “5-2. History List”.

#### 4-6. Alarm Output (Alarm 1–10 and buzzer)

When an earthquake was detected and the acceleration level exceeded a preset value, alarms are activated.

The alarms will be reset after a certain period of time, which is set on the alarm reset timer, from the point when the acceleration level drops below the setting.

If the acceleration level exceeds the setting during the counting of reset timer, the timer operation will be reset.

○ Alarm contact specifications

Construction: 1a (photo-MOS relay)

Two independent COM terminals (one each for ALM1–5 and ALM6–10)

Ratings: 200 V, 0.65 A (common for AC and DC, peak value)

○ Buzzer specifications

Sound: Continuous

Acoustic pressure: 85 dB

- Setting range (common for Alarm 1–10 and buzzer)
  - Alarm level: 0.1 to 999.9 (the value of 0.0 will not trigger an alarm)
  - Hold time: 1 to 9999 seconds (the value of “0” will not reset the alarm automatically)
  - Output factor: Acceleration (Gal)/spectrum intensity (Kine) (select one)

The scale of seismic intensity corresponds to the PGAI as shown below.

For setting the alarm based on the intensity scale, use respective threshold values for the setting.

MMI I:	$PGA < 1.7$
MMI II - III:	$1.7 \leq PGA < 13.7$
MMI IV:	$13.7 \leq PGA < 38.3$
MMI V:	$38.3 \leq PGA < 90.2$
MMI VI:	$90.2 \leq PGA < 176.5$
MMI VII:	$176.5 \leq PGA < 333.4$
MMI VIII:	$333.4 \leq PGA < 637.4$
MMI IX:	$637.4 \leq PGA < 1216.0$
MMI X+:	$1216.0 \leq PGA$



If the alarm level is below the triggering level, an alarm is activated when an earthquake is detected.



If the hold time is set to the value of “0”, automatic reset will not be performed. Reset the alarm by pressing the RES switch on the Alarm Hold screen or an external reset switch.



To check the conductivity at the head of terminal screws, do so after tightening the screws.  
The check may yield a result of “non-conductive” if the screw is open or insufficiently tightened.

#### 4-7. FAULT Contact Output

This contact will activate an alarm when the system power is down or a fault in the pickup is detected (normally closed). The type of contact (NO or NC) can be chosen with a sliding switch provided on the internal circuit board. The factory default is NC. The contact will close at the power up and open if a fault is detected. Resetting the FAULT output shall be done by restarting the system after eliminating the cause of an error.

- Contact specifications
  - Construction: NO or NC × 1 (mechanical relay)
  - Ratings: 2 A, 30 VDC (maximum voltage/current: 220 VDC/2 A)

#### 4-8. Analog Output (4 - 20 mA)

When an earthquake is detected, an electric current corresponding to the full-scale value set will be output.

During an earthquake, the output is held to the peak value.

The output will be turned OFF (4 mA) as soon as the earthquake ceases.

The allowable resistive load is 300 ohms or less.

##### ○ Setting range

Output factor: Acceleration (Gal)/MMI seismic intensity/spectrum intensity (Kine) (select one)

Full-scale output: 10 to 3000 Gal

10 to 1500 Kine

Fixed (MMI seismic intensity)

If the scale of seismic intensity is selected for the output factor, the full-scale setting will be fixed. (The set-up screen will not appear.)

The output will be stepped with an interval of 1.6 mA that corresponds MMI seismic intensity.

No earthquake:	4.0mA
MMI I:	7.2mA
MMI II - III:	8.8mA
MMI IV:	10.4mA
MMI V:	12.0mA
MMI VI:	13.6mA
MMI VII:	15.2mA
MMI VIII:	16.8mA
MMI IX:	18.4mA
MMI X+:	20.0mA

#### 4-9. Alarm Reset Input

The alarm contact output and buzzer operation will be reset by a no-voltage contact input.

This function supersedes the operation of reset timer.

The FAULT contact output will not be reset.

#### 4-10. Time Correction Input

A  $\pm 30$  second time adjustment will be performed by a no-voltage contact input.

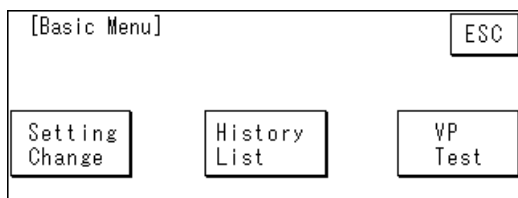
When an input is detected, the current time is set to the "00" second.

(If the current time before the adjustment was xx:30 to xx:59, the time will be advanced to the next minute.)

## 5. Operation Screen

Touching the screen when “READY” or “In seismic monitoring” is displayed will bring up the password entry screen. Once you enter the correct password, the Basic Menu screen can be brought up.

This screen allows the user to perform the following operations.



Change the current date and time, system settings, and output settings.

Display up to fifty earthquake information history.

Perform a pickup test.



Avoid touching the keys quickly.

Perform the operation slowly by touching a key for about one second.



Note that the seismic monitoring will not be done when pickup test is being performed. (The menu operation other than the pickup test will not interrupt the monitoring condition.)

## 5-1. Setting Menu

Touching a button will bring up a corresponding setting screen.

[Setting Menu]			ESC
Time Date	System	Output	

Time Date: Changes the current date and time.

System: Sets up the triggering conditions and spectrum intensity damping.

Output: Sets up the alarms, buzzer operation, and 4-20 mA full scale output.

### 5-1-1. Current date and time

[Time/Date]							ESC	
****	/	**	/	**	:	**	:	**
								SET

yyyy/mm/dd hh:mm:ss: Touch the display item to be modified.

Use this button to cancel the change.

Use this button to make the change effective.

[Year]	7	8	9	ESC
Input the year by the numeric keypad	4	5	6	
	1	2	3	
****	0	.	CLR	

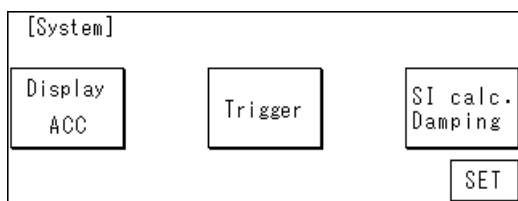
[Second]	7	8	9	ESC
Input the second by the numeric keypad	4	5	6	
	1	2	3	
**	0	.	CLR	

By touching the number displayed, a keypad will be displayed.

After entering a number, touch the number display again to make the change effective.

To cancel the operation, touch the ESC button.

### 5-1-2. System settings



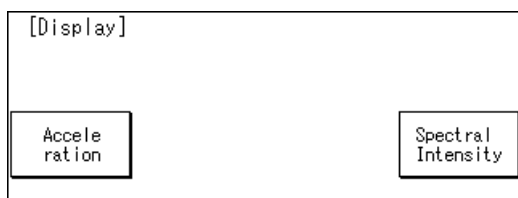
Display: Sets up the items to be displayed at the time of an earthquake.

Trigger: Sets up conditions for determining an earthquake.

SI calc.: Sets up the parameters for performing the spectrum intensity calculation.

SET: Touching this button makes the change effective and brings up the previous screen.

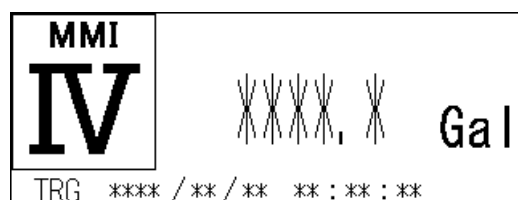
#### a) Display



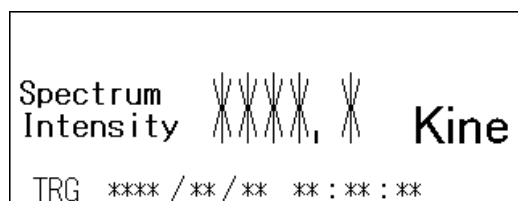
Select the measured value to be displayed at the time of an earthquake.

Display examples for each setting

○ Acceleration (ACC)



○ Spectrum intensity (SI)



b) Trigger Conditions

[Trigger]		
Component	Condition	Level
X/Y/Z	OR	**.* ***
SET		

Component: Selects the component used to determine an earthquake.

Condition: Selects the condition used to determine an earthquake.

Level: Top ... Sets the acceleration level. (Unit: Gal)

Bottom ... Sets the velocity level. (Unit: mKine)

SET: Touch this button to apply the change displayed on the screen.

To change the settings, refer to “4-2. Seismic Detection (Trigger) Operation”.

[Judgment Component]		
X/Y/Z 3-D	X/Y 2-D	Z Vertical

[Judgment Condition]	
OR	AND

Selection is made by touching a button.

If the component “Z” alone was selected, the conditions “OR” and “AND” both mean the same.

[Acceleration Level]				
Input the acceleration level by the numeric keypad	7	8	9	ESC
	4	5	6	
	1	2	3	
	0	.	CLR	
**.* Gal				

[Velocity Level]				
Input the velocity level by the numeric keypad	7	8	9	ESC
	4	5	6	
	1	2	3	
	0	.	CLR	
*** mKine				

By touching the number displayed, a keypad will be displayed.

After entering a number, touch the number display again to make the change effective.

To cancel the operation, touch the ESC button.

c) SI calculation damping

[ SI Calc. ]				
Input the damping coefficient by the numeric keypad	7	8	9	ESC
	4	5	6	
	1	2	3	
	0	.	CLR	
** %				

By touching the number displayed, a keypad will be displayed.

After entering a number, touch the number display again to make the change effective.

To cancel the operation, touch the ESC button.



### 5-1-3. Output

Alarm 1	80.0 Gal	300 S	ESC
Alarm 2	250.0 Gal	300 S	SET
Alarm 3	400.0 Gal	300 S	
Alarm 4	0.0 Gal	0 S	NEXT

Alarm 9	0.0 Kine	0 S	ESC
Alarm10	0.0 Kine	0 S	SET
Buzzer	0.0 Gal	0 S	
4-20mA	2000 Gal		NEXT

Alarm 1–10/Buzzer/4-20 mA:

Current settings are displayed.

The unit indicates respective output factors.

(Gal: acceleration, Kine: spectrum intensity)

Touching a desired item will bring up a screen for setting.

ESC: Touch this button to cancel the change.

SET: Touch this button to make the change effective.

NEXT: Touch this button to proceed to the next page.

#### a) Alarm and Buzzer Settings

[Alarm1 Factor]

Accele  
ration

Spectral  
Intensity

Selecting an alarm output factor will bring up the screens for setting the alarm level and reset timer.

[Alarm1 Level]

Input the alarm level  
by the numeric keypad

\*\*\*.\*

7	8	9
4	5	6
1	2	3
0	.	CLR

→

[Alarm1 Reset]

Input time in second  
for the reset timer  
by the numeric keypad

\*\*\*\* sec

7	8	9
4	5	6
1	2	3
0	.	CLR

By touching the number displayed, a keypad will be displayed.

After entering a number, touch the number display again to make the change effective.

To cancel the operation, touch the ESC button.

## b) 4-20 mA Settings

[4-20mA Factor]

Accele  
ration

Intensity  
Scale

Spectral  
Intensity

Selecting a 4-20 mA output factor will bring up the full-scale setting screen.

[4-20mA FullScale]

Input the full scale  
by the numeric keypad

\*\*\*\*

7	8	9	ESC
4	5	6	
1	2	3	
0	.	CLR	

By touching the number displayed, a keypad will be displayed.

After entering a number, touch the number display again to make the change effective.

To cancel the operation, touch the ESC button.

### Full-scale setting range

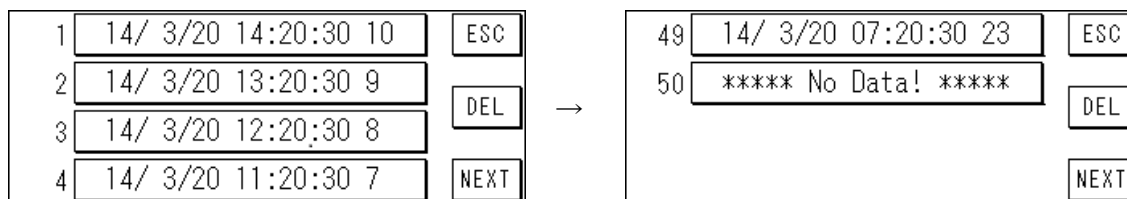
Acceleration FS: 10 to 3000 (Gal)

Spectrum intensity FS: 10 to 1500 (Kine)

Seismic intensity scale FS: Fixed MMI seismic intensity.

(The output will be stepped with an interval of 1.6 mA).

## 5-2. History List



Up to fifty earthquakes experienced in the past will be displayed.

Information display window: Touching the window will display detailed information again.

ESC: Exits the history list.

DEL: Deletes all earthquake information and seismic data.

NEXT: Displays the next entry on the history list.

Seismic intensity displayed in the history list corresponds to the MMI as below.

Display	MMI
1	MMI I
2 3	MMI II – III
4	MMI IV
5	MMI V
6	MMI VI
7	MMI VII
8	MMI VIII
9	MMI IX
10	MMI X+

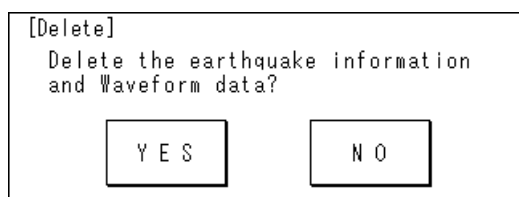
### 5-2-1. Detailed Information



ESC: Returns to the history list.

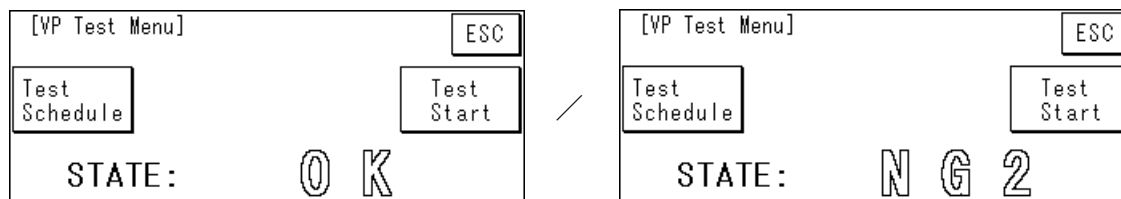
NEXT: Moves to the next screen (acceleration/intensity scale → spectrum intensity).

### 5-2-2. Delete All History Data



Touching the YES button will erase all earthquake information and waveform data stored in the memory.

### 5-3. VP (Vibration Pickup) Test Menu



Test Schedule: Move to the automatic test schedule setting screen.

Test Start: Start the test manually.

STATE: Show the current status of the pickup.

#### a) STATE

“OK” is shown when there is no problem in the pickup.

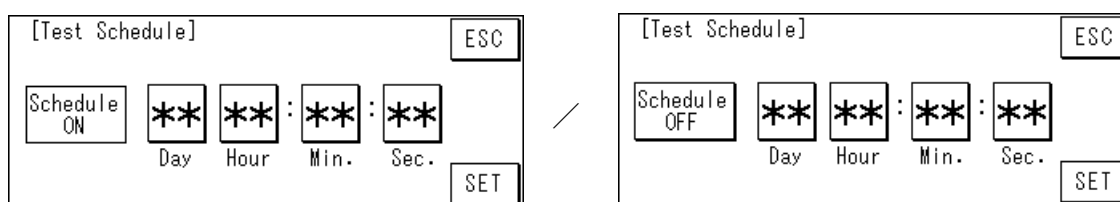
“NG1” or “NG2” indicates the pickup may have a problem.

You can confirm the result by the following method.

NG1: Restart the device and wait till “In seismic monitoring” will appear. Do not reduce the power-on reset period at this time. Then, check the STATE again.

NG2: Perform the VP test one more time and check the result.

#### b) Test Schedule

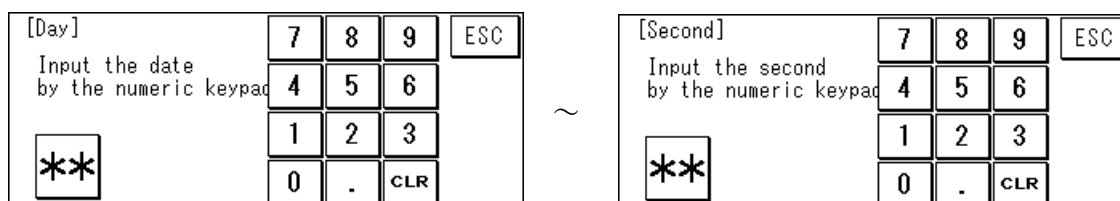


Test Schedule: Switches ON and OFF.

Day Hour Min Sec: Touch the section where you want to change.

ESC: Cancel the change.

SET: Confirm the setting.



Once you touch the number(s) indicated, ten-key numeric keypad will appear.

After entering the respective number, touch the number(s) indicated to fix the change.

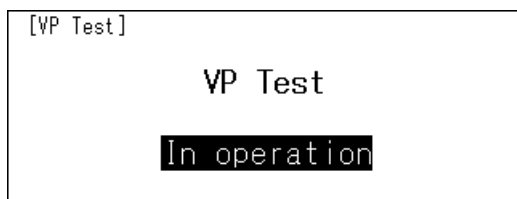
In order to cancel the change, touch “ESC.”

Once you set the date and time while the schedule is ON, the VP test is to be performed once a month automatically.

If you enter “0” in the Day section, the VP test will be performed every day at the time of setting.

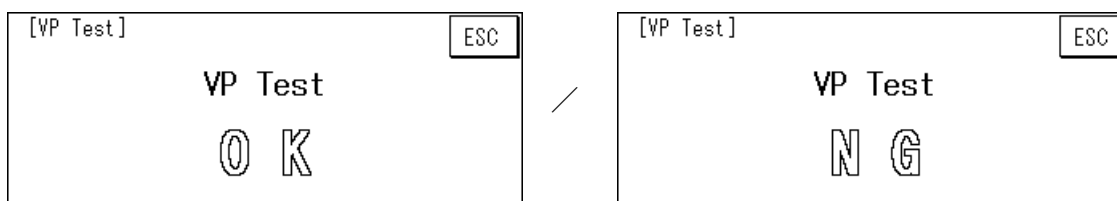
If the day in the setting does not exist in the month (e.g., 31 in November), the VP test will be skipped in that month.

## c) Test Start



Perform the pickup test.

The result will be shown upon completion of the test (approximately 2 mins).



ESC: End the VP test.

## 5-4. Present Measuring Value Output (RS232C)

### 1) Communication Conditions

Communication Medium: RS232C (3-line connection)

Communication Speed: 9600 bps

Data Length: 8 bit

Parity: None

Stop: 1 bit

### 2) Output Terminals

SW-54 AUX Connector (D-sub 25 pin type)

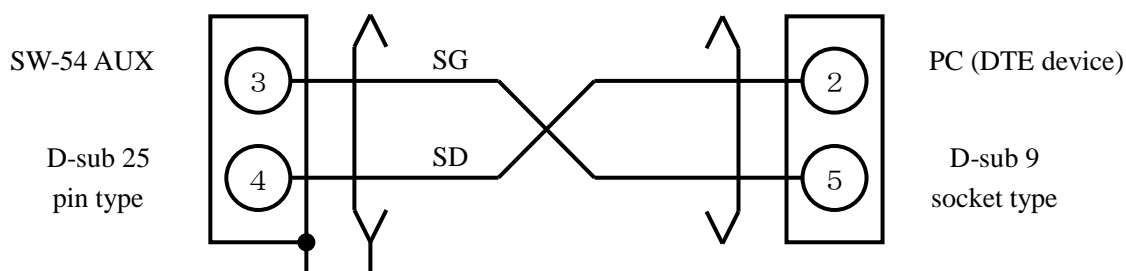
Pin 4: SD

Pin 3: SG

Pin 8: RD (Not in use)

### 3) Connection

Refer to the diagram below for cable to be used.



#### 4) Telegram Output

The seismic monitoring system transmits the data unilaterally in no control sequence without monitoring the control line. It reads out the following string of characters every second:

Date Time: 2014/ 8/22 10:20:300<CR><LF>	: Present time
ALARM: A,A,N,N,N,A,A,A,N,N,N <CR><LF>	: Alarm status A: Activated N: Not activated
	Alarm 1 to 10, 11: Bell
VEC:540.7 7 0.0 108.5<CR><LF>	: Three-component vector synthesis acceleration
	Mercalli intensity scale
	Instrumental seismic intensity (Fixed: 0.0)
	SI Value (Kine)
CH1:311.2<CR><LF>	: CH1 (NS) Component of acceleration (Gal)
CH2:310.8<CR><LF>	: CH2 (EW) Component of acceleration (Gal)
CH3:311.5<CR><LF>	: CH3 (UD) Component of acceleration (Gal)
TRG:A<CR><LF>	: Trigger status A: Activates N: Not activated
FAULT:N<CR><LF>	: Fault status A: Activates N: Not activated

Each value shown in the VEC to CH3 describes below:

Trigger status A (during earthquake): Peak-hold value

Trigger status N (during monitoring earthquake): Real-time value (measurement value at the time of telegram output).

In the trigger status N, calculation of seismic intensity is not implemented. Hence, the scale of an earthquake or instrumental seismic intensity is fixed at 0.0.

Please note the measurement values fluctuate while the trigger status is "N" when the system is right after turned ON or during the VP test running. The receiving device needs to be programmed to always monitor the trigger status.

## 6. Default Settings

Below is the standard initial setting of this equipment.

Initial setting can be amended if there were any customer requests.

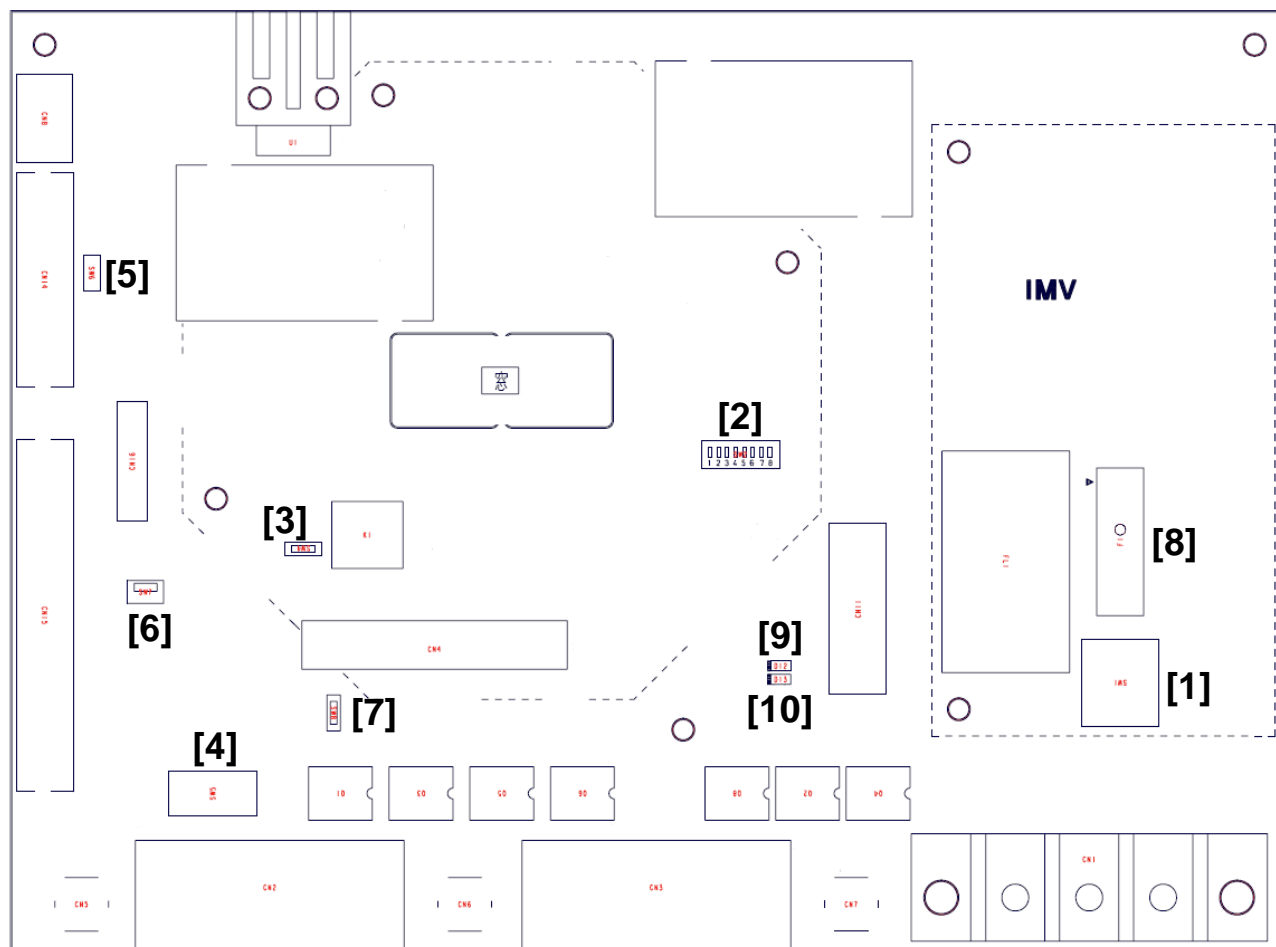
### 6-1. Settings accessible from the touch-panel

Trigger	Judgment component	Judgment condition	Acceleration level (Gal)	Velocity level (mKine)
Setting range	XYZ/XY/Z	OR/AND	0.1–99.9 (0.0 means disabled)	1–999 (0 means disabled)
Default settings	XYZ	OR	5.0	100

Alarm and Buzzer	Output factor	Level	Reset (seconds)
Setting range	ACC/SI	0.1–999.9 (0.0 means disabled)	1–9999 (0 means disabled)
Default settings			
Alarm 1	ACC (Gal)	80.0	300
Alarm 2	ACC (Gal)	250.0	300
Alarm 3	ACC (Gal)	400.0	300
Alarm 4	ACC (Gal)	0.0	0
Alarm 5	ACC (Gal)	0.0	0
Alarm 6	SI (Kine)	10.0	300
Alarm 7	SI (Kine)	20.0	300
Alarm 8	SI (Kine)	30.0	300
Alarm 9	SI (Kine)	0.0	0
Alarm 10	SI (Kine)	0.0	0
Buzzer	ACC (Gal)	0.0	0

4-20 mA	Output factor	Full scale
Setting range	ACC (Acceleration) SCL (Intensity scale) SI (Spectrum intensity)	10–3000 Gal Fixed 10–1500 Kine
Default settings	ACC (acceleration)	1000 (Gal)

## 6-2. Settings of the Switches on the Internal Circuit Board



Symbol/Part No./Form	Name	Default Settings (position)
[1] SW1 (Toggle)	Power supply	ON (up)
[2] SW2 (DIP)	Present value output	Bit 1 ON (up)
[3] SW4 (Slider)	FAULT output configuration	NC (right)
[4] SW5 (Push)	SW-52 reset	Not pushed
[5] SW6 (Slider)	Communication control line (RTS/CTS)	Return (down)
[6] SW7 (Slider)	Communication switch	Display (left)
[7] SW8 (Slider)	Not used	OFF (down)
[8] F1 (Pull-up)	Circuit protector	Pushed
[9] D12 (Red LED)	SW-52 indicator	Normal: blinking (1 sec. interval)
[10] D13 (Red LED)	SW-54 indicator	Normal: lit



## 7. Maintenance and Inspection

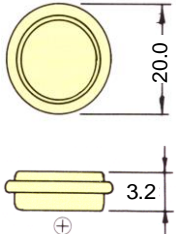
The system is normally in the standby mode for detecting an earthquake. Therefore, ensure to perform maintenance and inspection regularly.

Moreover, please consult about precision check and exchange of consumables to our company.

### ○ Maintenance and inspection list

Inspection Item	Short-term	Long-term
Deformation, scratches, and other abnormalities in the appearance	○	
Loose bolt	○	
Loose screw on the I/O terminal box	○	
Abnormal noise, heating, and/or display	○	
Abnormal power supply voltage		○
If the seismic activity detection is done when the unit is shaken manually		○
If the alarm contact outputs are activated when the unit is shaken manually		○
If the analog signal output is activated when the unit is shaken manually		○

### ○ List of consumables

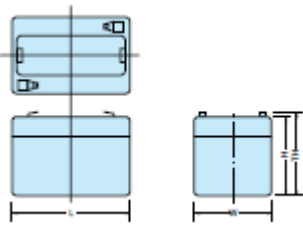
Name/Type/Built-in Unit	Sketch	Quantity
Coin battery  CR2032 or equivalent  SW-52		1

(Purpose: Backup power for the memory)

(Service life: 8 years of no power distribution at 20 degrees C)

The power supply of seismic monitoring equipment does not exhaust a battery at the time of ON (under turning on electricity).

(If a battery is provided)

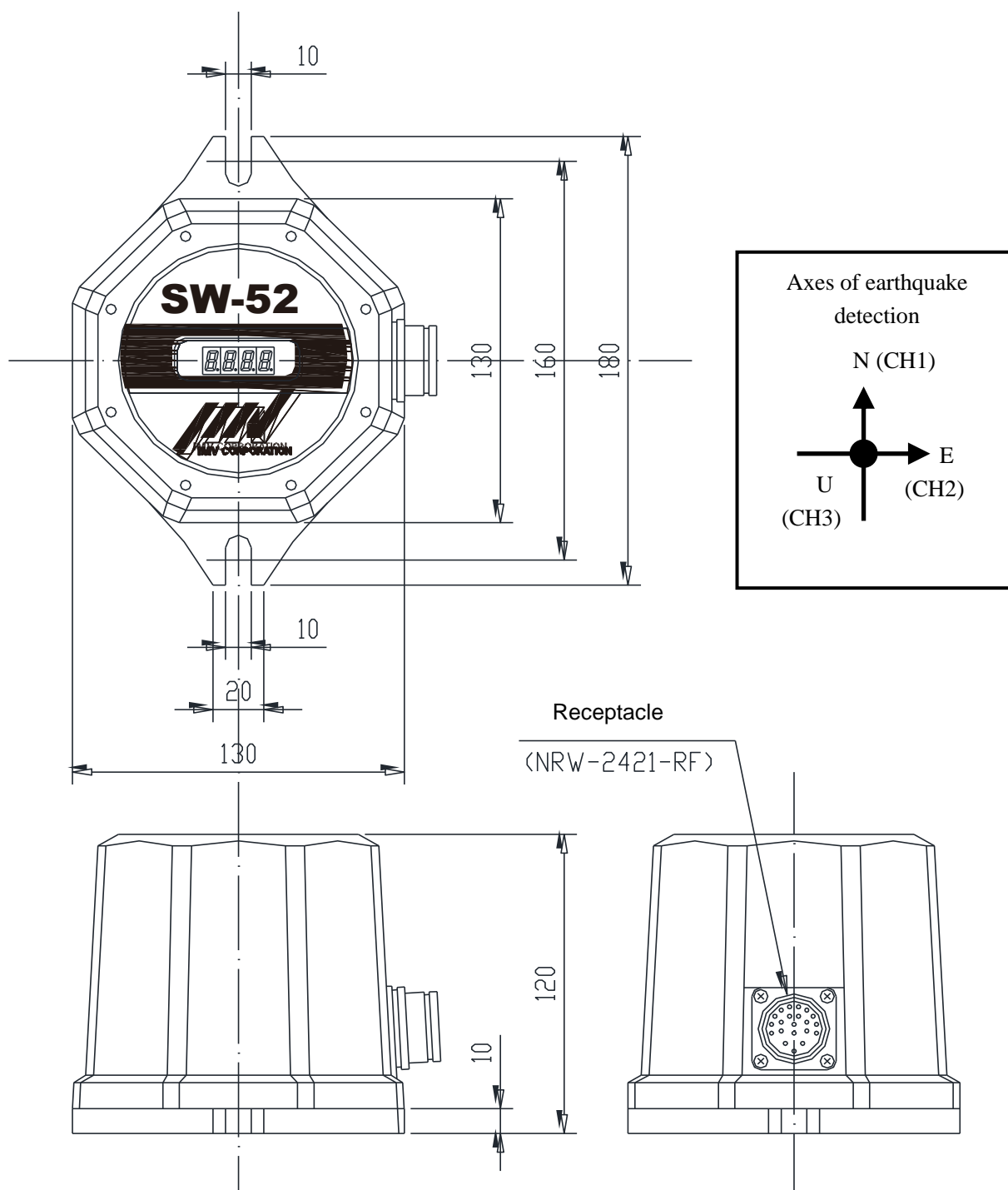
Name/Type	Sketch	Quantity
Lead storage battery  PE12V0.8  SW-54	 L:96, W:25, H:61.5	1

(Purpose: Backup power for the main unit)

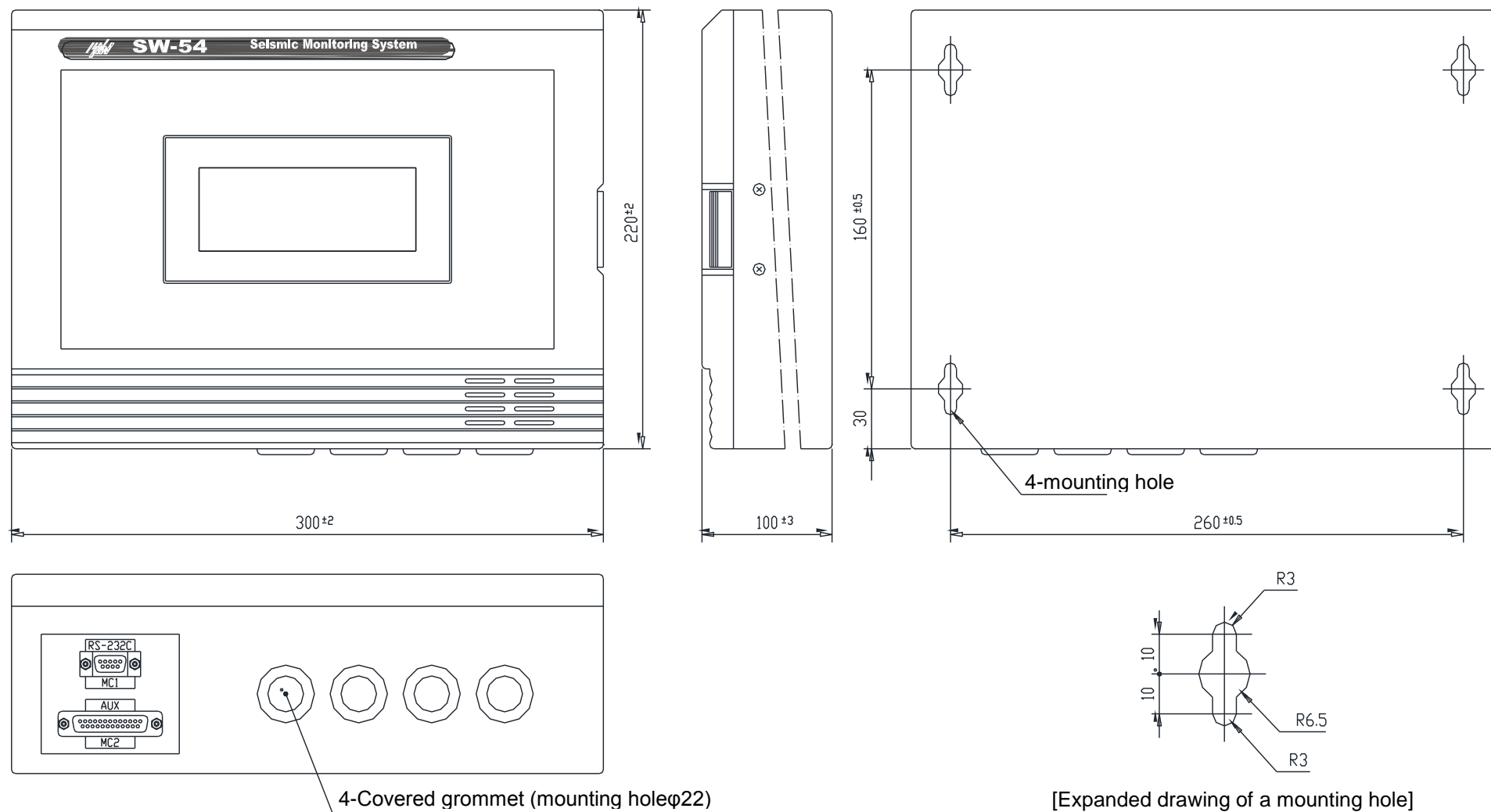
(Service life: 3 years irrespective of the existence of a power failure)

## 8. Attached Drawings

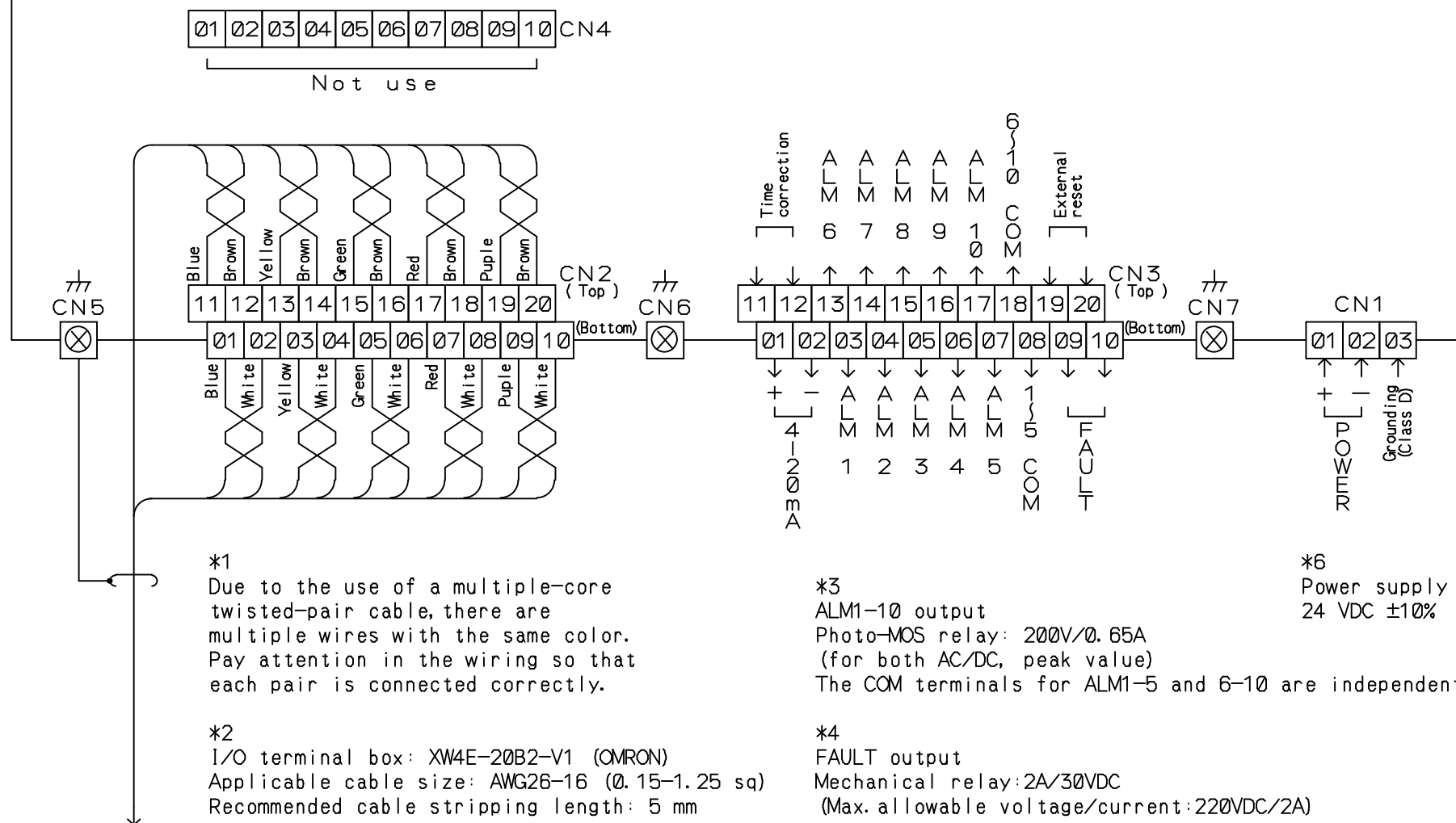
### 8-1. Seismic Monitor SW-52



8-2. Seismic Processor SW-54



## Seismic Processor SW-54 (circuit board)



To the Seismic Monitor  
SW-52 (connector)

**IMV CORPORATION**

Model	Title	P
SW-54 (Ver. 3.xx)	Input & Output Wiring	