

The Project for Improvement of Equipment for Disaster Risk management FY2011 by  
The Government of the Republic of Indonesia

# The Operation and Maintenance Manual (1/4) For Broadband site

2018  
NEC Corporation

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## About This Manual

This manual provides important safety and compliance information, and explains how to operate and maintain the system at each observation site.

This chapter contains the following sections:

- Intended Audience
- Manual Contents
- Precautions

### ● Intended Audience

This manual is intended for use by the system operator responsible for maintaining the system at each observation sites.

Only qualified personnel should operate the system.

### ● Manual Contents

In addition to the information in this chapter, this manual also includes the following:

- Chapter 1-5 , digest for basic operating/maintenance  
(These chapters are just the digests for easy to read and understand, so please read the each equipment's manuals on chapter 6 carefully and thoroughly.)
- Chapter 6 , Manual for each equipment. Please refer for detail.

### ● Precautions

For safe and effective use, observe the whole guidelines and contents written on this manual (chapter1-6).  
The usage that go against these are out of our responsibility.

After finished the warranty period specified in the contract, warranty will expire.

Replacement parts are not included in the contract.

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## 1. General

The objective of this project is to contribute toward improving disaster risk management in Indonesia through the provision and installation of equipment in the facility of the Meteorological, Climatological and Geophysical Agency (hereinafter referred to as "BMKG")

The equipment to be provided and installed are consisted of 20 broadband seismograph, 20 broadband strong motion seismograph, 73 strong motion seismometer, 200 earthquake intensity meter as observation equipment, several servers of BMKG HQ installation and satellite circuit and so on.

This operation and maintenance manual is made to put this system to good use at Broadband Site. It's necessary to maintain periodically before failure and keep using equipment of a main system without a trouble to continue observation activity.

In this dominant, it's described what kind of operation is necessary to do in order to use 24 time 365days-system and what to do when there were daily management, maintenance and defect of equipment.

We expect to require putting daily management of equipment and maintenance into effect as well as doing continual weather monitoring with a main system in BMKG using this document.

\*All rights reserved about this document



## 2. Overview

This chapter indicates the overall view of the system, and setting portion of equipment in the Indonesia, the configuration diagram of the system in this Project.

## 2.1 Overall View of the System

Two types of the Velocity Meter and the Accelerometer will be installed.

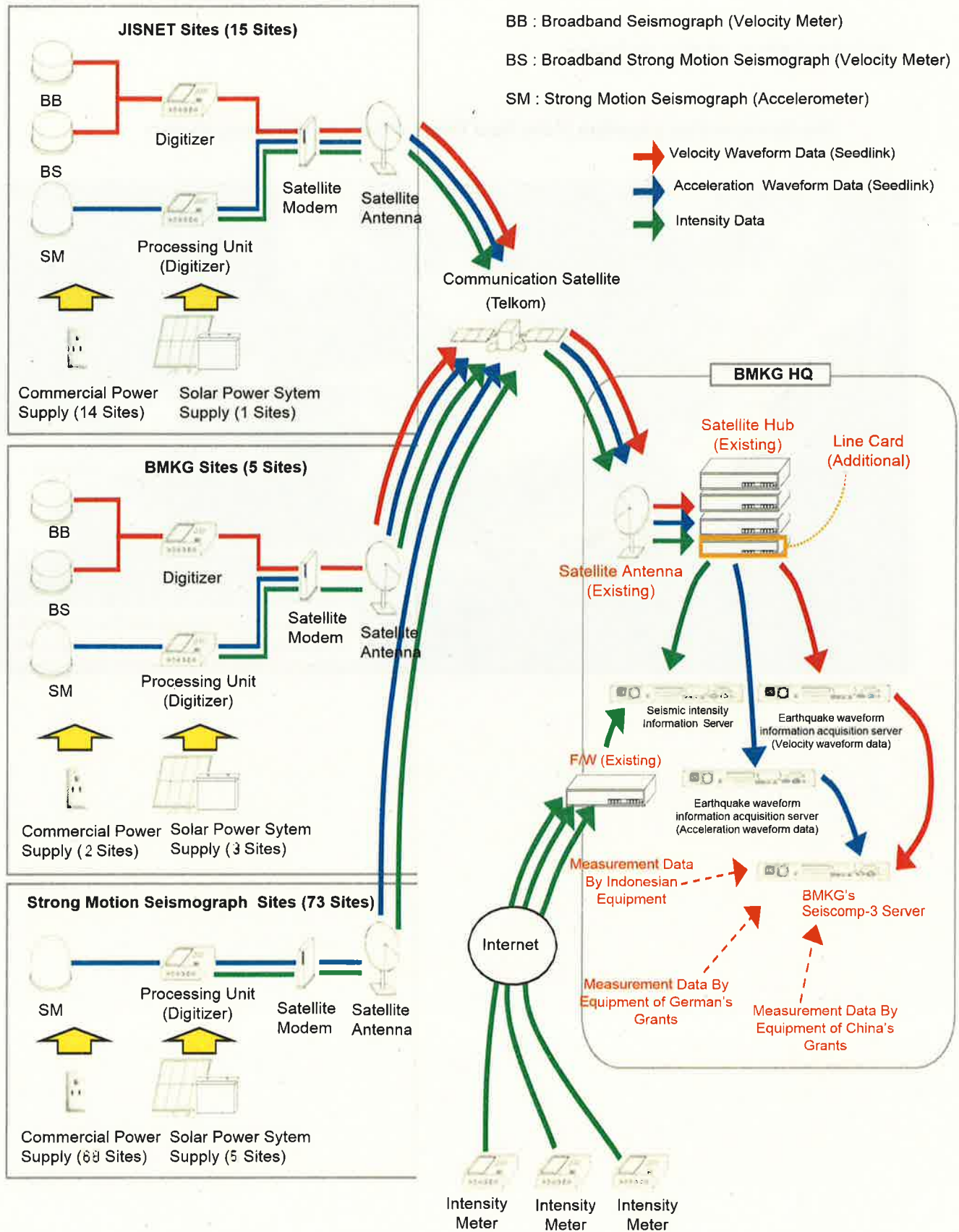
The Velocity Meters and Accelerometers will transmit observed data to the server that will be installed at HQ of BMKG through the VSAT.

The waveform data that is one of observed data is transferred from the server that is installed to the existing server that is managed by the BMKG.

In addition, the Seismic Intensity Meters will be handed over to BMKG, and will be developed all over the country.

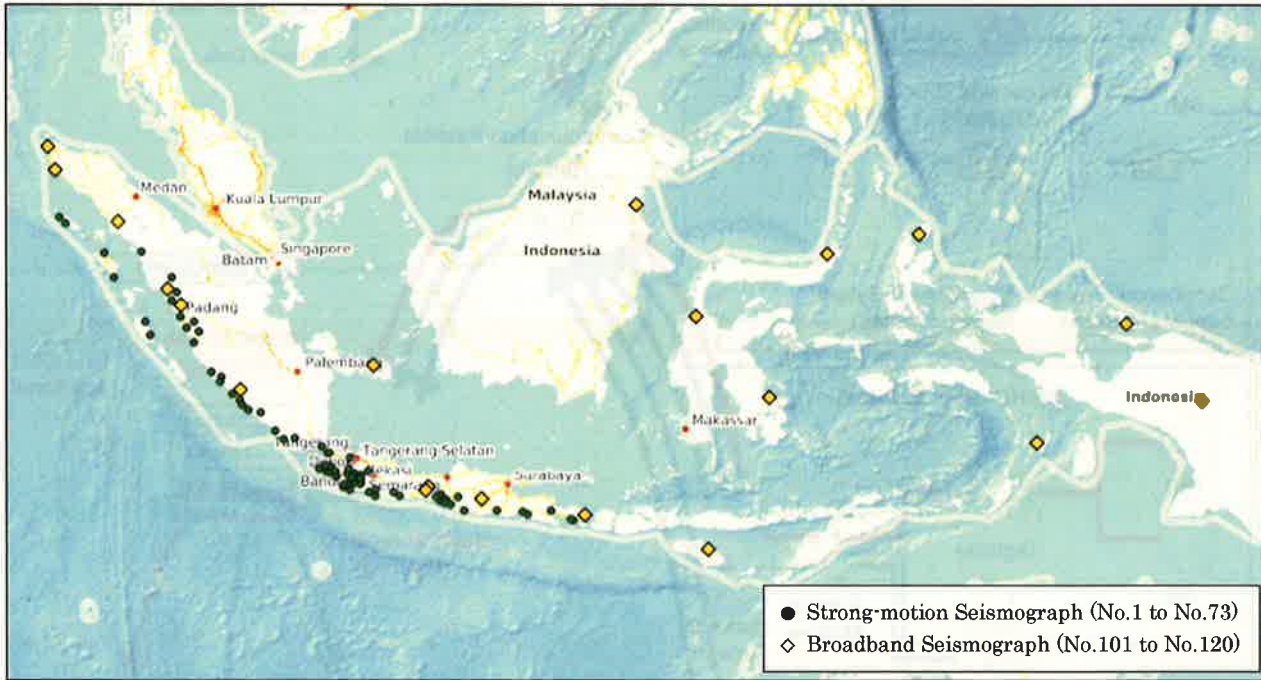
The seismic Intensity Meter will transmit observed data to the HQ server through internet.





## 2.2 Site Map of the System





This item indicates a location of the Real Time Earthquake Monitoring System.



### 3. The Equipment of Broadband site (Composition)

Equipment composition of Broadband site are as follows

Please check on the list the equipment on your site if exists or not.





Equipment	Summary / Function	Photo	Exist /Not
<b>Broadband seismograph</b>			
Broadband seismograph (velocity meter)	Seismograph for observing the earthquake with very broadband performance.		
Broadband strong motion seismograph (velocity meter)	Seismograph for observing the strong earthquake. Frequency Response is flat to ground velocity from 0.01 to 80 Hz (+/-10%).		
Digitizer for velocity meters	Convert Data from Observed Earthquake Data to Specified Format Data, and Transmit to Specified Server. In addition, Seismic Intensity shall be capable of calculating by Specified Intensity Calculation Formula, Displaying Calculation Result on the Monitor connected with this Equipment.		
<b>Strong motion seismograph</b>			
strong motion seismograph (accelerometer) (sensor)	Seismograph for observing the strong earthquake. Sampling frequency is 100Hz.		



<p>Digitizer for strong motion seismograph (accelerometer) (processor)</p>	<p>Convert Data from Observed Earthquake Data to Specified Format Data, and Transmit to Specified Server. In addition, Seismic Intensity shall be capable of calculating by Specified Intensity Calculation Formula, Displaying Calculation Result on the Monitor connected with this Equipment.</p>	
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Other equipment

<p>1) Satellite communication system</p>		<p>Transmission of Monitoring Data for Stations.</p>
<p>2) Power system</p> <p>-1 Commercial power system (ONLY for commercial power sites )</p>		<p>Supply Operational Power from commercial power supply to Seismometer, Digitizer, Satellite Communication System etc.</p>
<p>-2 Solar power system (ONLY for solar power sites)</p>		
<p>a) Solar Panel</p>	<p>Supply Operational Power to Seismometer, Digitizer, Satellite Communication System etc.</p>	
<p>b) Charge Controller</p>	<p>Supplying power generated by solar panel to each equipment and charging in the battery.</p>	
<p>c) Arrester</p>	<p>Protection for the equipment connected from lightning surges intruded through telecommunication line, signal line and power supply line.</p>	

<p><b>3) Wireless communication system (ONLY for Kahang kahang and Padang Panjang )</b></p>	
<p>Send the observed data between two points using 2.4 GHz band.</p>	
<p><b>4) Storage box (ONLY for Sawahan )</b></p>	
<p>Heat shielding outdoor unit box</p>	
<p><b>5) External Diagnostics Equipment (ONLY for the designated site )</b></p>	
<p>Confirm the function and operation of the velocity type strong-motion seismometer (for TSM-1)</p>	
<p>Centering and checking the normarity of the Broadband seismograph (velocity meter) (for 120QA)</p>	



## 4. Operation Manual

This chapter indicates the operation manuals for the Broadband site in this project.

### 4.1 Daily Operation

- At Broad Band Sites, basically, Daily operation is not needed.

### 4.2 Operation when needed

#### 4.2.1 When checking the Intensity value (by digitizer (G210))

Intensity data is always send to HQ, and you can check them at HQ.

But if you need to know the intensity data at your site, you can see the value by checking the strong motion seismograph (G210-P).

##### (1) Current Intensity value (G210)

- Open the outer box of G210-P.
- And look into the display of the "Digitizer for strong motion seismograph (accelerometer) (processor) (G210-P).



(2) Recorded Intensity data (G210)

● “Seismic intensity graph”


You can see recorded data of “Seismic intensity graph” with the display of G210.


G210 Strong Motion Seismometer Instruction manual


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6.2 Seismic intensity graph


Measurement seismic intensity records reproduce by the graph from recording information that is stored in compact flash memory card.

 When the key is touched, it moves to time input.

 When the key is touched, it moves to graph display.

 When the key is touched, it return operation menu.


 It returns time input.

 When the key is touched, it returns operation menu.

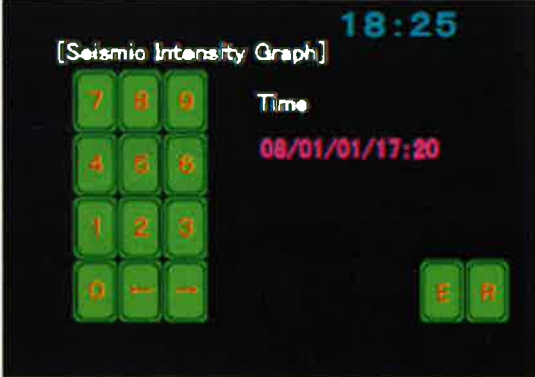
※It is not displayed below the alert standard seismic intensity (item 6.5.1)

※No recording time of compact flash memory is displayed.

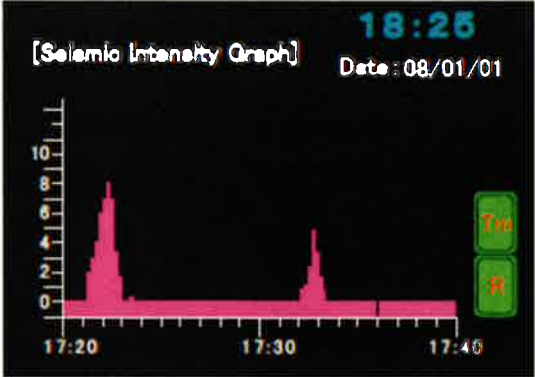
**[Operation menu]**



↓



↓



(For detail, please refer Attachment 4 Page 51)



● “Seismic intensity information”


You can also see recorded data of “Seismic intensity information” with the display

G210 Strong Motion Seismometer Instruction manual

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**6.3.1 Seismic intensity information**

Observed seismic intensity information can be displayed.



 When the key is touched, it is displayed.



※ Please fully understand the contents and implement it since the manual change key “Sent” is explained in this item.

**[Log file display]**




The list of the past 500 earthquakes can be displayed.



  The screen switching is 50units at a time.


  The screen switching is 5units at a time.


**[Seismic Data Selection Display]**



Date	Observed	MMI	PGA	PGV	Sent
14/01/01	17:55:40.1	2.3	0.0123	0.123	F
14/01/01	17:50:41.2	3.4	0.1234	0.123	U
14/01/01	17:45:42.3	4.5	0.5678	0.123	T
14/01/01	17:40:43.4	5.6	0.9876	0.123	F
14/01/01	17:35:44.5	6.7	1.2345	0.123	F

  The selected seismic intensity information (Highlighted) can be moved one by one.

 The details of the seismic intensity information (Highlighted) can be displayed.  
 (Section acceleration every N/S,E/W,U/D, section seismic intensity and section frequency can be displayed.)

 It returns log file display.

(For detail, Please refer Attachment 4 Page 53)

## 4.2.2 When checking the recorded data at the site (by PC or by CF Card)

Observed data is send to HQ, and you can check them at HQ.

But if you need to see the data at your own site, you can check via PC or CF Card.

### 1. Procedure

#### (1) By connecting PC

Connect to the target device via LAN.

Access method, using terminal emulator (ex, Win scp), get the necessary files.

You can see the acquired file by using the waveform tool (ex, seisgram2K).

Methods such as Terminal access and File transfer vary depending on the device.

Please refer to the table below.

Equipment name	Terminal access	File transfer	Login name	Password
G210	telnet	ftp	BMKGbmkg	bmkg2017
G1019	ssh / telnet	sftp / scp	user	bmkg2017

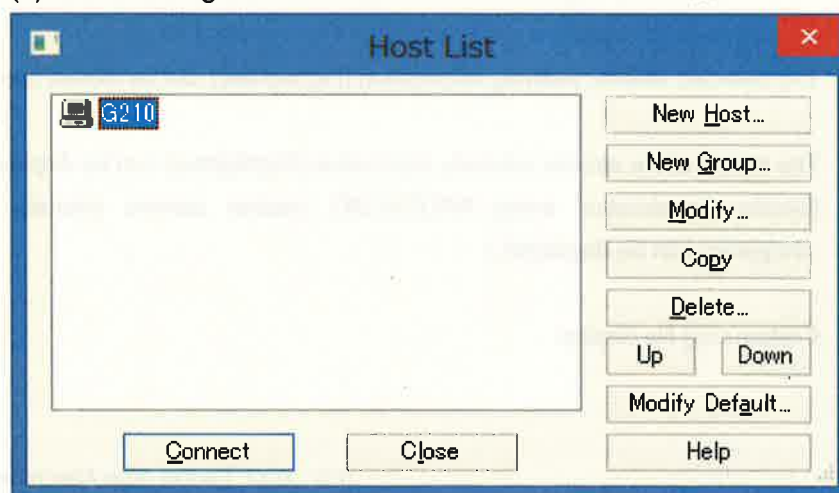
- G210

An example that how to use the ftp tool "FTTTP" on G210 is shown below:

#### How to use FFFTP


(1) Activate FFFTP.

(2) The following screen is launched. Select New Host ....



(3) On the following screen, enter the following items.

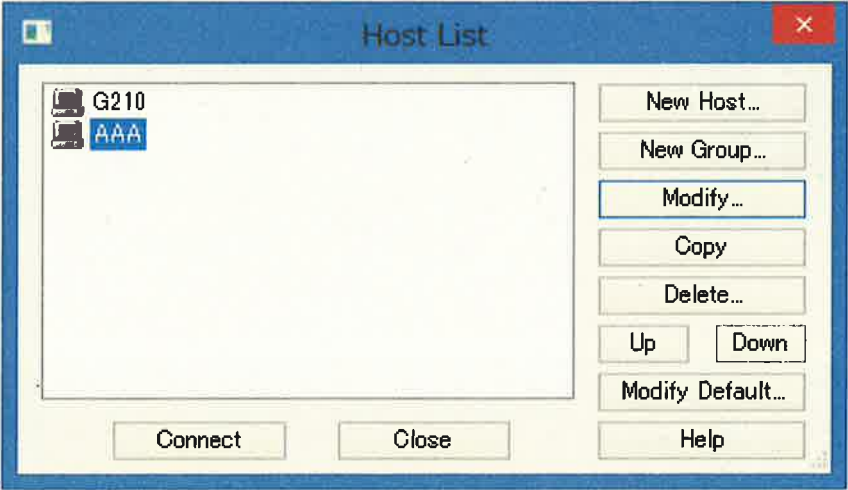
- Profile Name
- Host Name / Address (Enter the address of the connected device)



The image shows a 'Host Setting' dialog box with a blue title bar and a red close button. It has a tabbed interface with 'General' selected. The 'General' tab contains the following fields and options:

- Special** (tab), **Encryption** (tab), **Feature** (tab)
- General** (sub-tab), **Advanced** (sub-tab), **Kanji Code** (sub-tab), **Dialup** (sub-tab)
- Profile Name**: Text box containing 'AAA'
- Host Name/Address**: Text box containing '192.168.0.99'
- Username**: Text box containing 'bmkg'
- Password/Phrase**: Password field with 10 dots, followed by an  **Anonymous** checkbox.
- Initial Local Folder**: Text box with a browse button (...).
- Initial Host Folder**: Text box with a 'Current Folder' button.
- Use last accessed folder as default**
- OK**, **Cancel**, **Help** buttons at the bottom.

(4) The new connection destination is displayed. Enter the information of (3).



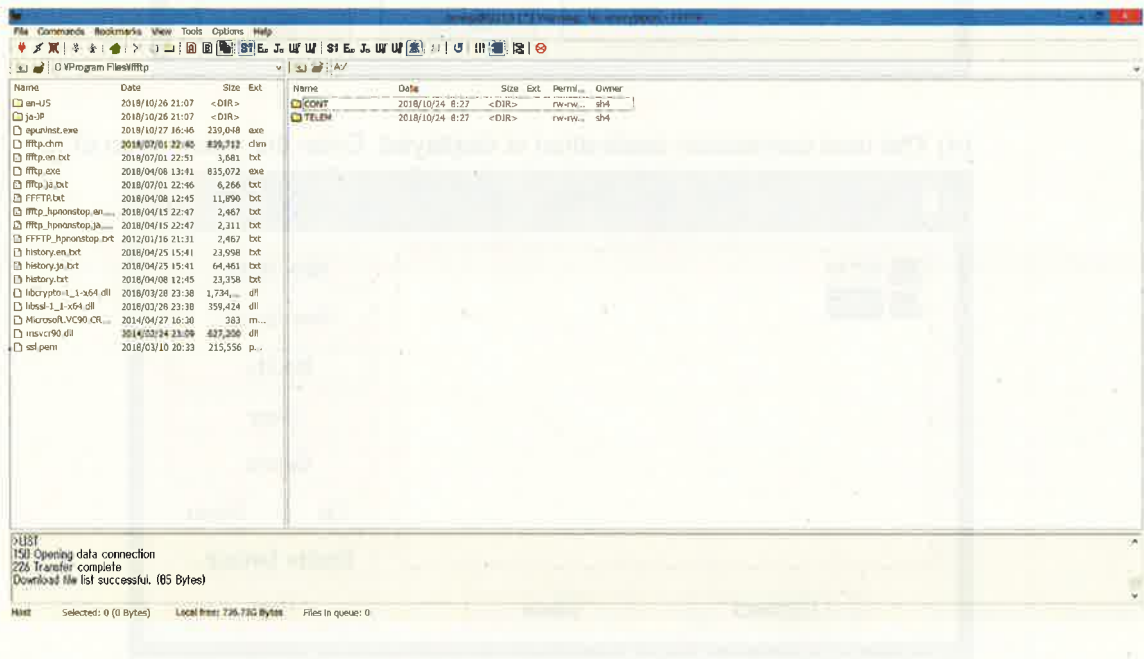
The image shows a 'Host List' dialog box with a blue title bar and a red close button. It contains a list of hosts and a set of action buttons:

- Host List**: A list box containing two entries: 'G210' and 'AAA' (highlighted in blue).
- Buttons**: **New Host...**, **New Group...**, **Modify...** (highlighted in blue), **Copy**, **Delete...**, **Up**, **Down**, **Modify Default...**, **Help**.
- Bottom Buttons**: **Connect**, **Close**.

(5) Enter the information of (3).

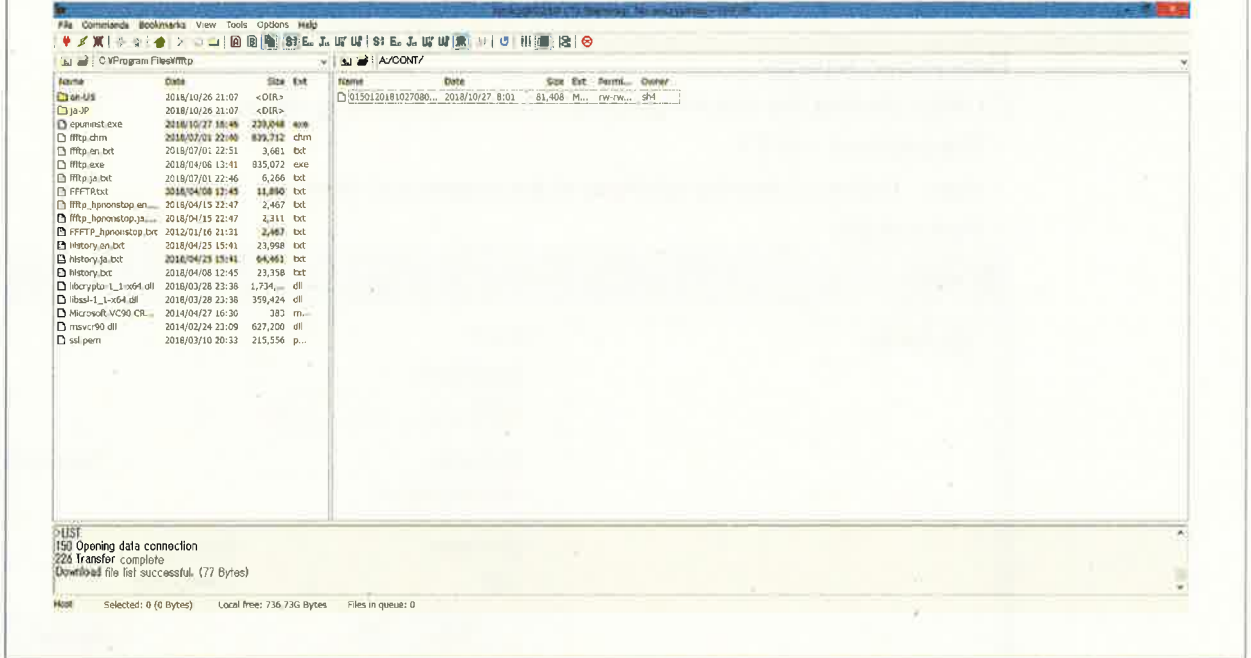


(6) Select the A: / CONT folder.





(7) Select the waveform file and acquire the file.

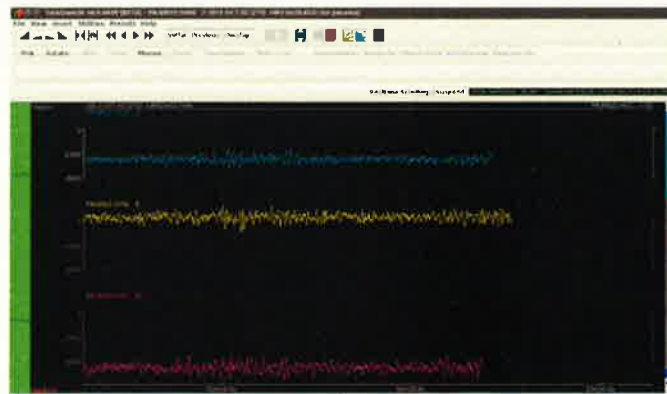


(For reference)

It is possible to see the waveform data by the viewer software on your PC.

**CAUTION:**

Viewer software is not provided by this project.  
When using a viewer software, please make sure the software is safe.  
We don't have any responsibility about the software.



● **Sensitivity**

Digitizer	G1019	G1019	G210P
sensor name	TSM-1	Trilium 120QA	G210S
AD resolution	24 bit	24 bit	24 bit
Measurement range	±20 V	±20 V	±3000 gal
sensitivity	$20V/2^{23} \text{bit} * 0.166667$ $= 0.000000397364361661968$ (m/s)/digit	$20V/2^{23} \text{bit} * 0.000833$ $= 0.00000000198682149251302$ (m/s)/digit	$3000\text{gal}/2^{23} \text{bit}$ $= 0.0003576278$ gal/digit

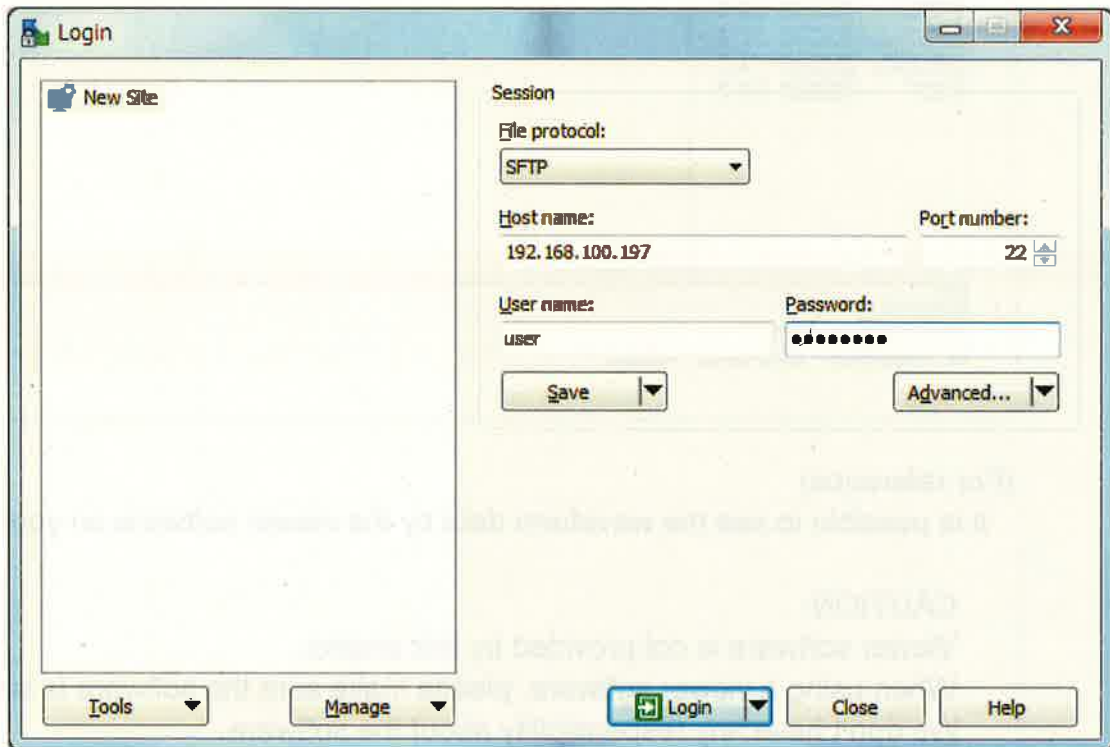
- G1019

We describe an example that how to use the scp tool “Winscp” on G1019 below:

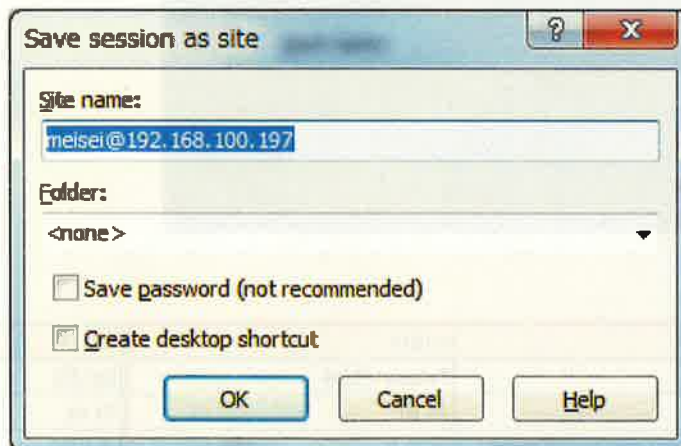
### How to use Winscp

(1) After starting the following screen, enter the following items.

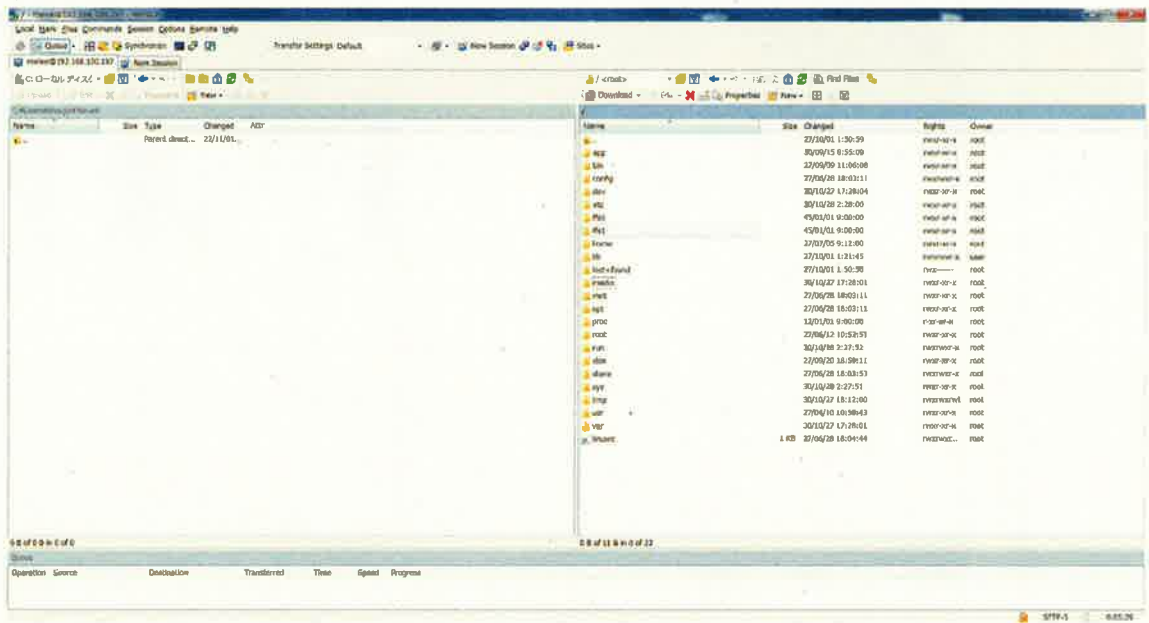
- File protocol : SFTP
- Host Name (Enter the address of the connected device)
- Port number



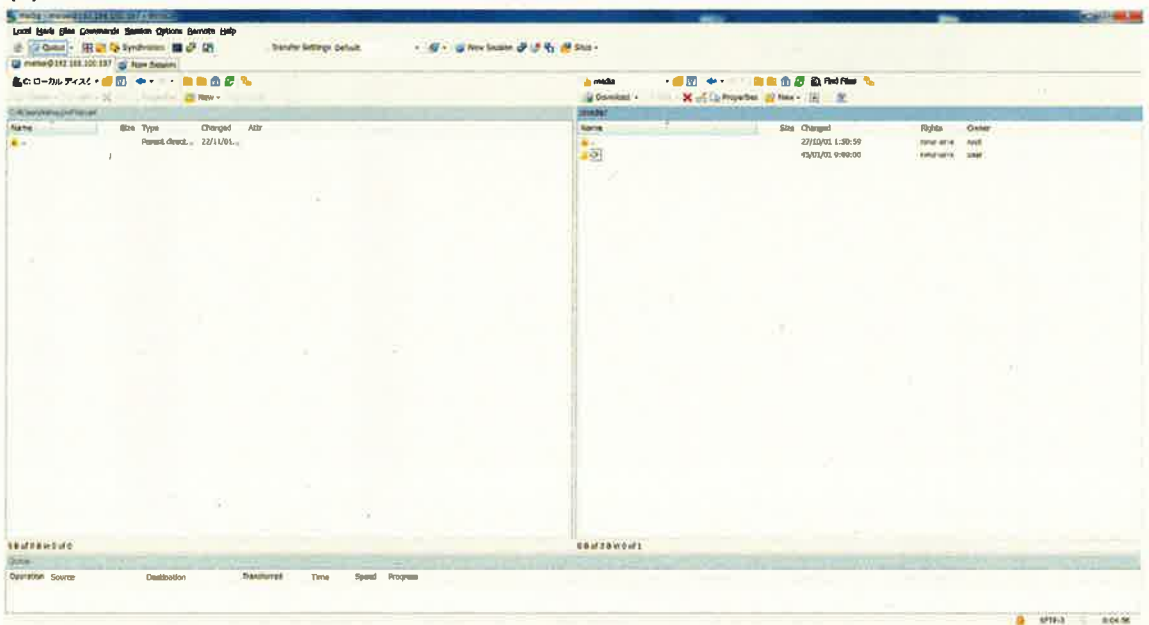
(2) The following screen is displayed. Press the OK button.



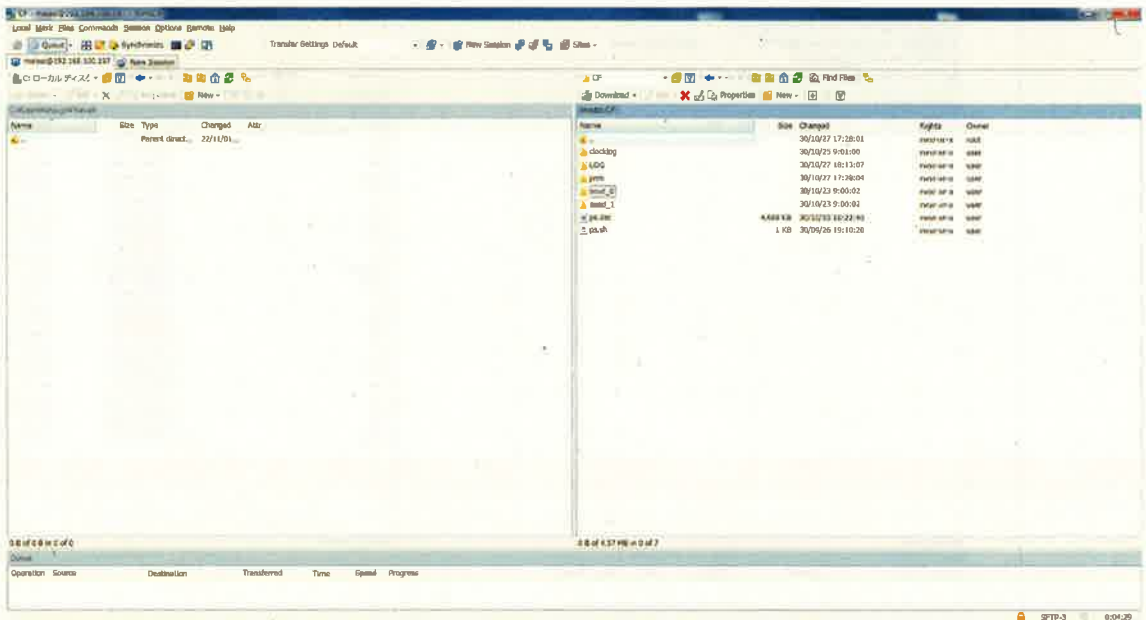
(3) Select the media folder.



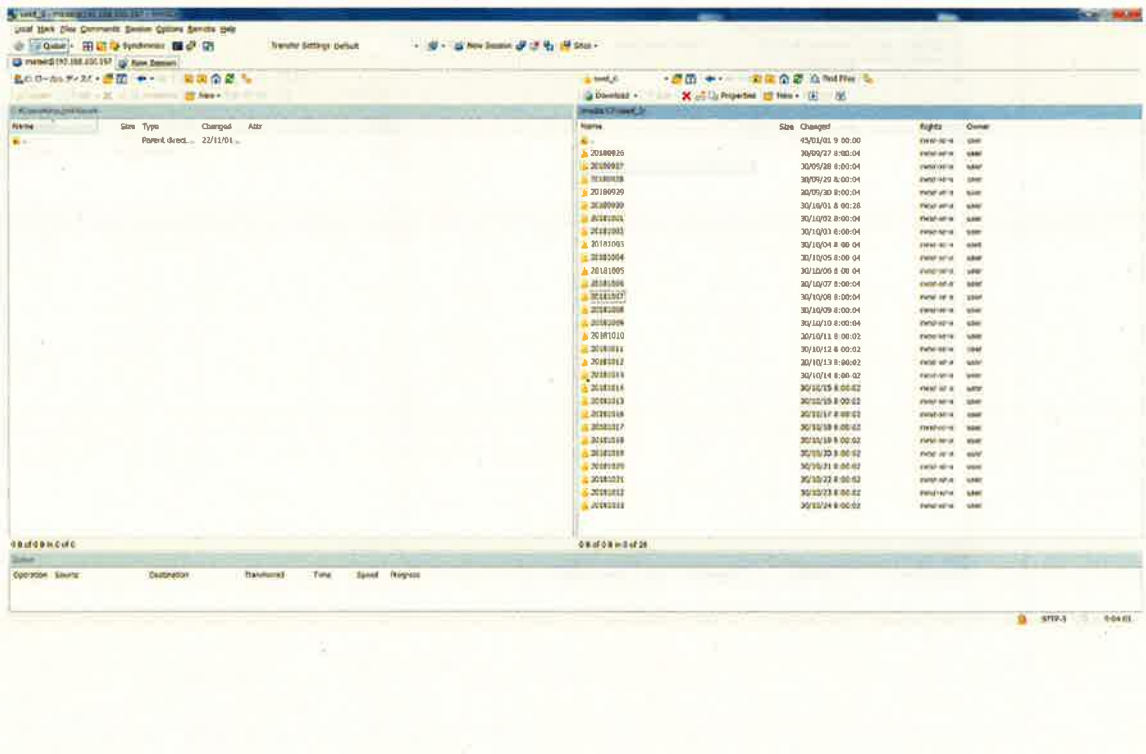
(4) Select the CF folder.



(5) Select the seed folder.

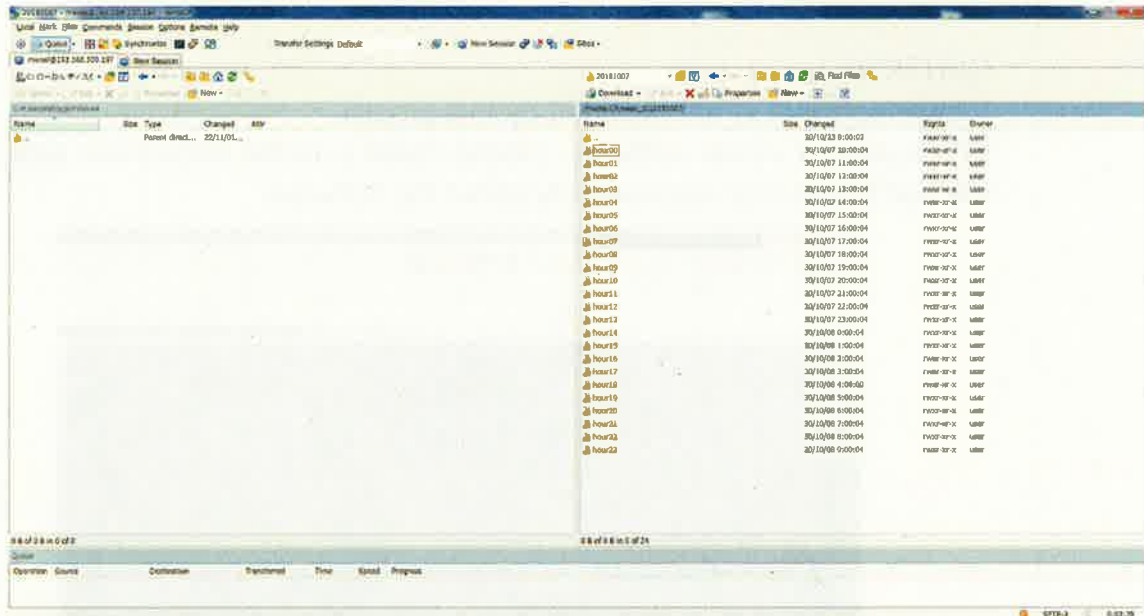


(6) The folder for each date is displayed.

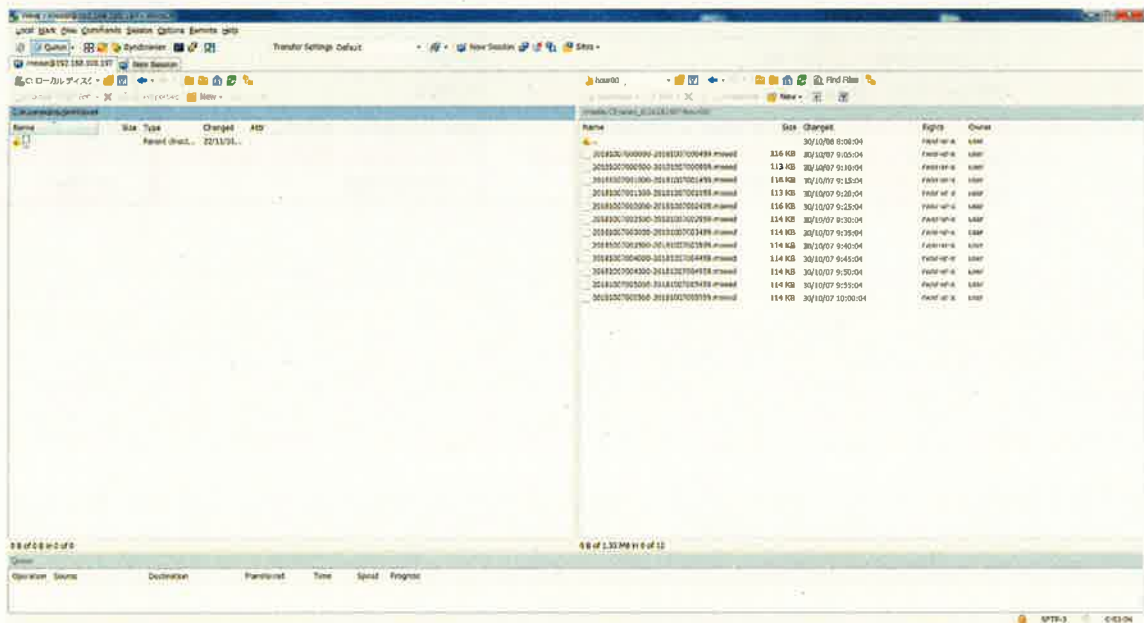




(7) The folder for each hour is displayed.



(8) Select the waveform file and acquire the file.



(For reference)

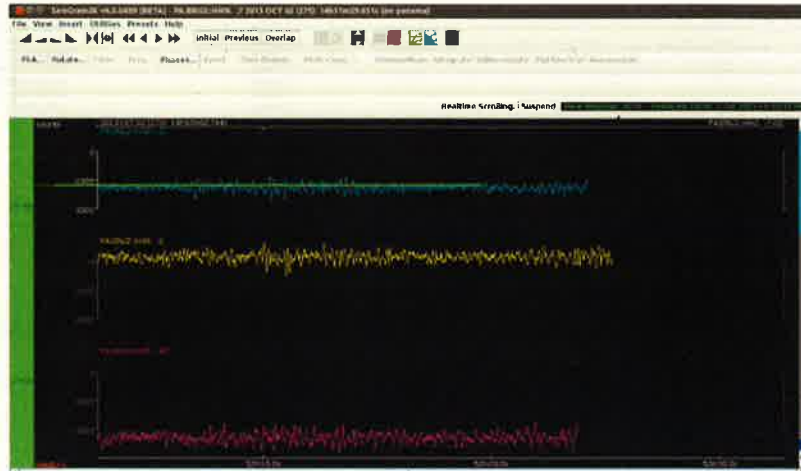
- It is possible to see the waveform data by the viewer software on your PC.

**CAUTION:**

Viewer software is not provided by this project.

When using a viewer software, please make sure the software is safe.

We don't have any responsibility about the software.



- Sensitivity

Digitizer	G1019	G1019	G210P
sensor name	TSM-1	Trilium120QA	G210S
AD resolution	24 bit	24 bit	24 bit
Measurement range	± 20 V	± 20 V	± 3000 gal
sensitivity	$20V/2^{23bit} * 0.166667$ $= 0.000000397364361661968$ (m/s)/digit	$20V/2^{23bit} * 0.000833$ $= 0.0000000198682149251302$ (m/s)/digit	$3000gal/2^{23bit} gal/digit$ $= 0.0003576278$ gal/digit

(2) Via the CF card

You can remove the Compact flash card from the digitizer with the procedure written after:  
To access the CF Card, please prepare CF card reader.

**CAUTION:**

- Please proceed with the instruction written after.  
Otherwise the data may be lost.
- Please remove the CF card according to the manual of each device.
- When using the CF card with other devices (PC etc.), do not remove the CF card while the power is ON.

● The procedure to remove CF Card (G1019)

There are 2 ways to remove the CF Card.

1) Procedure described below: 2) After all power is shut off, remove the CF card.

G1019 Multichannel Digitizer Instruction manual

8.4.2. CF card exchange procedure

- 1. Condition View →
- 2. Parameter View →
- 3. IP Address Setup →
- 4. Control →

Rotate the rotary switch from the main menu, select "4. Control" and press the enter button.

- 1. Reboot →
- 2. Media Access →
- 3. Shutdown →

Rotate the rotary switch from the menu on the left figure, select "2. Media Access" and press the enter button.

- 1. CF →
- 2. microSD1 →
- 3. microSD2 →

Select CF from the menu on the left and press the enter button.

- 1. Unmount →
- 2. Mount →
- 3. Format →

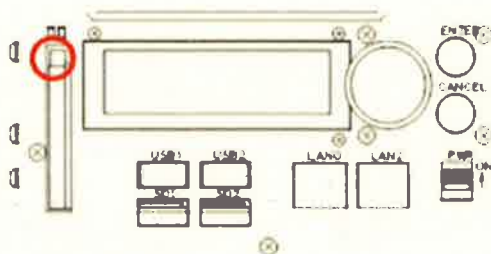
Select "Unmount" from the menu on the left and press the enter button.

- Unmount
- Cancel
- OK

Select "OK" from the confirmation menu on the left figure and press the enter button.

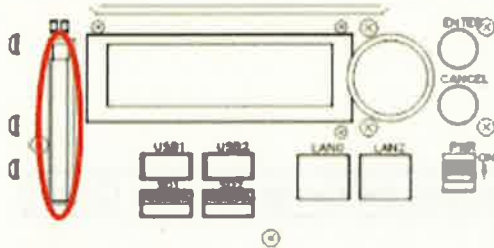
Unmounting media.

The message shown on the left is displayed and you can remove it if you return to the original menu.

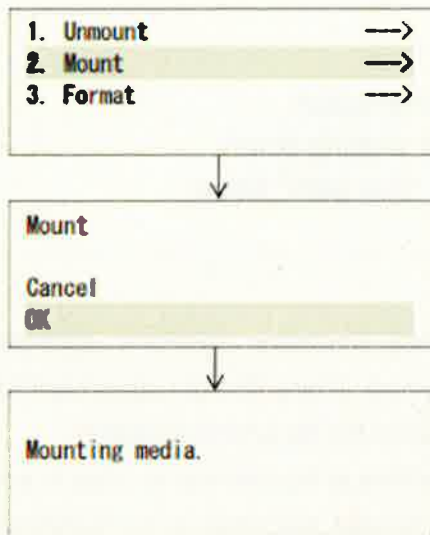


By pressing the button at the top of the CF card you can remove the CF card.

G1019 Multichannel Digitizer Instruction manual



Pay attention to the orientation of the CF card and insert a new CF card.



Select "Mount" from the menu on the left figure and press the enter button.

Select "OK" from the confirmation menu on the left figure and press the enter button.

The message on the left is displayed, and if you return to the original menu, the replacement operation is over.

- The procedure to remove CF Card (G210-P)

Contents in CF Card

Waveform data,  
Earthquake information  
Parameter  
Operation Log

- Procedure

Shut down G210-P \*



Remove the Compact Flash Card.

\* CAUTION

- To shut down G210-P, please refer the instruction  
(Attachment 4 : P33-34 Instruction to shutting down)
- When shutting down, please check the "One point" below:

**One point !**

G210-P equips with compact flash memory card. Recording waveform, earthquake information, parameter, operation log are stored in the memory. These files are stored by FAT 32 file system. The decided procedure should be shut down since the file system is broken.

There is the file that is writing once every 10 minutes in the memory in order to extend the product life of the compact flash memory card. If the decided procedure is not performed, the data just before the shut down will be lost (max: 10 min).

(Appendix: Attachment 4 : P34 Instruction to shutting down)



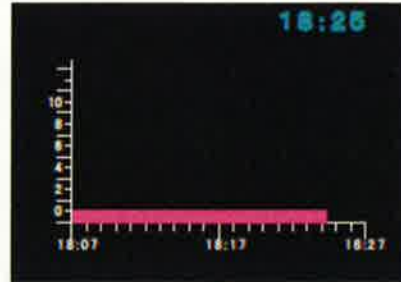
G210 Strong Motion Seismometer Instruction manual

5.2 Shut down

Touch panel can be operated as shown on the right.

At first, when the standby display (wherever) can be touched, it is moved on to top menu.

The result is the same as item 7.1.



[Top menu]

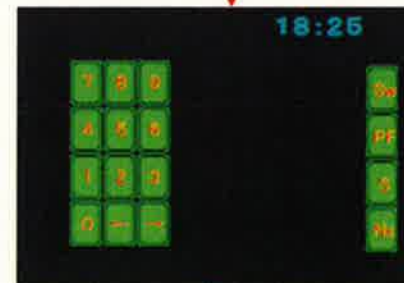
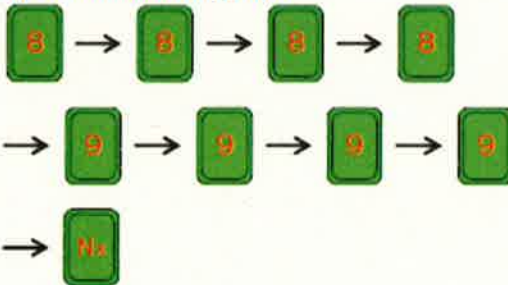


Touch the key.



[Pass word]

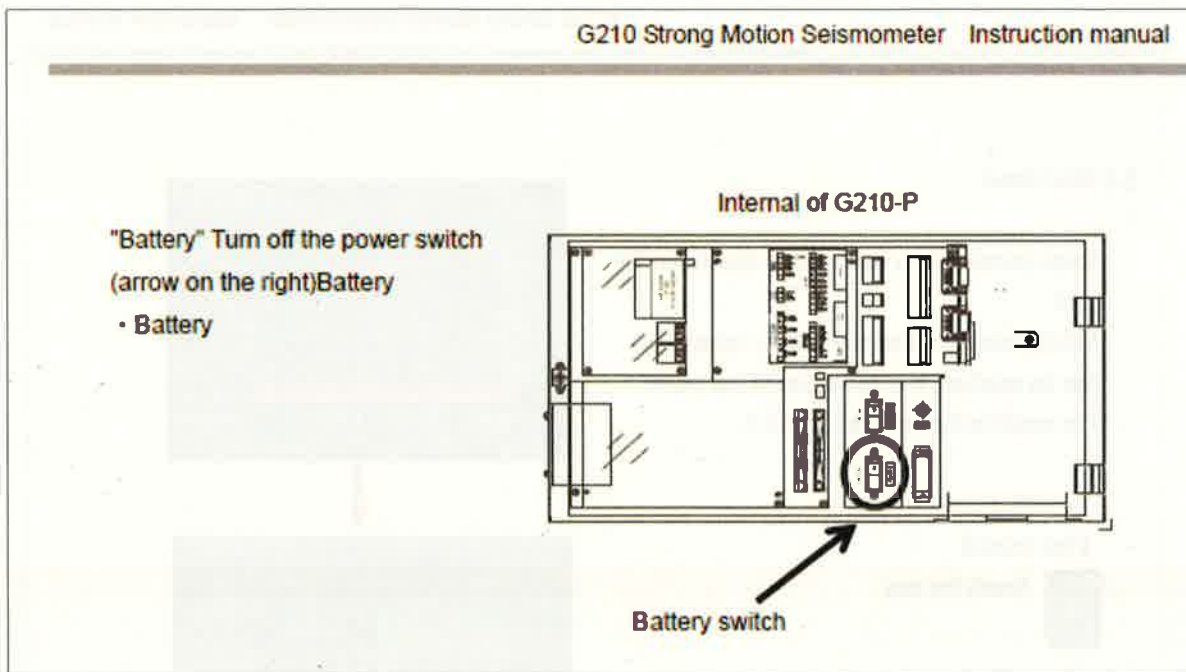
Operate the following order.



(Start over from the beginning if you make a mistake)

"Ready to turn off the power" can be Displayed as shown on the right.







## 2 Directory structure

### G1019

#### 2.3 Digitizer for velocity meters G1019

Folder name	File name	Use
clocklog	clock01.txt	No use
	:	
	clock31.txt	
	phasevcxo01.txt	No use
	:	
	phasevcxo31.txt	
LOG *	Log.bk1	No use
	:	
	Log.txt	
prm	g1019.xml	Parameter file
	vce1061.xml	Same as above
win		No use
seed_0	YYYYMMDD	mSeed waveform file ※1
:	-YYYYMMDDhhmmss.mseed	
seed_6		

※1 seed\_(station number)

Waveform file of mSeed format is stored.

Waveforms up to 5 minutes at the observation time (hour \*\*) directory under the name of the observation day name (YYYYMMDD) with the name of the 1st file save start date and time - end date and time (YYMMDDhhmmss - YYMMDDhhmmss.mseed) Save it as a file.

As an example, the waveform of February 9, 2016 from 13:40:00 to 44:59 is saved in "20160209 / 160209134000-160209134459.mseed".

We keep the file for three months (100 days).

Create a waveform file every 5 minutes.

When the sampling frequency is 100 Hz, it is about 128 Kbytes per file.

It is 36.8 Mbytes per day.

On 100 days it will be about 3.7 GB.

When the sampling frequency is 200 Hz, it is about 230 KB per file.

It becomes 66.2 Mbytes per day.

For 100 days it will be about 6.6 Gbytes.

Waveform files can not be saved when the capacity becomes full.

Real-time waveform transmission is performed.

Missing information can not be acquired.

※2 LOG data:

For detail, Refer Attachment3 (P12) . You can check the LOG also by PC. Refer Attachment3 (P63-)

G210

2.2 Strong motion seismograph G210

Folder name	File name	Use
Log		No use
	phasevcxo01.txt	No use
	phasevcxo31.txt	
OSISWAVE	YYMMDDhhmmss****.win	trigger recording ※1
OSISWAVE32	****YYYYMMDDhhmmss.w32	trigger recording ※1
PRM		Parameter file
OSISSIM		No use
CONT	**** YYYYMMDDhhmmss.MS EED	continuous recording ※2
NOWCAST	-	No use
SYSTEM	-	No use
PROG		No use
GIJI1	-	No use
GIJI2	-	No use
GIJI3	-	No use
SEED	**** YYYYMMDDhhmmss.M SEED	trigger recording ※1

※1 Waveform recording in case of earthquake occurrence (trigger recording)

When the earthquake occurs, earthquake waveform is stored in the followings.

1. MEISEI original format

- File : \*\*\*\*YYYYMMDDhhmmss.w32
- Folder : CF memory card (B:¥ OSISWAVE32)
  
- File : YYMMDDhhmmss\*\*\*\*.win
- Folder : CF memory card (B:¥ OSISWAVE)

2. SEED format

- File : \*\*\*\*\* YYYYMMDDhhmmss.MSEED
- Folder : CF memory card (B:¥ SEED)

Recording time is the followings.

MM I	Normal trigger recording time	Seismic intensity Recording time
I (0.5 ~<1.5)	2 min	1 min
II (1.5 ~<2.5)	3 min	2 min
III (2.5 ~<3.5)	4 min	3 min
IV (3.5 ~<4.5)	5 min	4 min
V (4.5 ~<5.5)	5 min	5 min
VI (5.5 ~<6.5)	5 min	5 min
VII (6.5 ~<7.5)	5 min	5 min
VIII (7.5 ~<8.5)	5 min	5 min
IX(8.5 ~<9.5)	5 min	5 min
X(9.5 ~<10.5)	5 min	5 min
X I (10.5 ~<11.5)	5 min	5 min
X II (11.5 ~)	5 min	5 min

The number is recordings is the below.

- In measurement intensity order : 300 waveforms
- In the latest order : 200 waveforms

※It is possible to retrieve the data with FTP protocol directly.

Please only copy operation from the B:¥OSISWAVE folder.

Deletion inadvertently causes the memory card error since file management (in large order) is performed.

Stored data is digit data. The amount of information per 1digit is as follows.

$$3000\text{gal} \div 223 = 0.3576\text{mgal/digit}$$

※2 Waveform recording in case of earthquake occurrence (continuous recording)

Regardless of earthquake occurrence, earthquake waveform is stored in CF memory card (B:¥CONT) .  
Recording file is in 10-minute miniseed format. File name is added region/point number of station + first time  
of recording waveform. It is recorded in the following format.

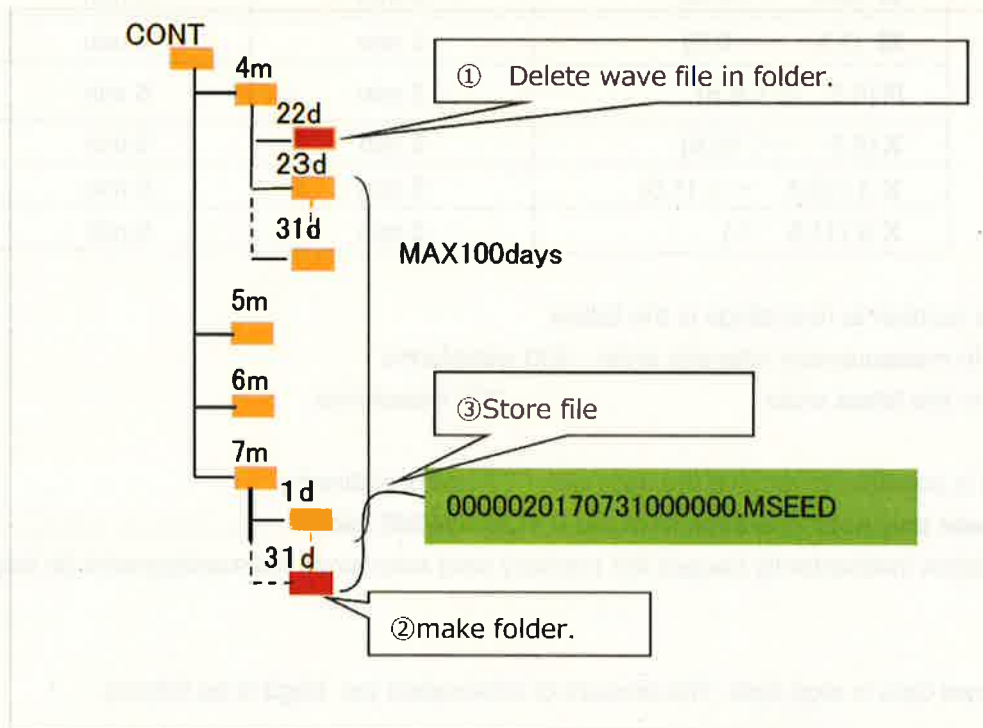
\*\*\*\* YYYYMMDDhhmmss.MSEED

First time of recording waveform

Region/point number of station

It saves up to 100 days of the waveform file. And it makes the folder of month and day based on first time of  
recording waveform. Please refer to the following.

Sample of waveform recording. It makes new file and store at 2017/7/31



※3 LOG data:

Refer Attachment3 (P52-) also.

### 4.2.3 When putting off or on the power of seismograph

Please follow the procedure below:

**CAUTION:** if the procedure failed, the data may be lost. Please refer the manual

- Putting off the broadband equipment (120QA, TSM-1, G1019)

1. Put off the power for G1019 (inside the waterproof box)

\* Please follow the instruction (Appendix: Attachment 3 : P9)

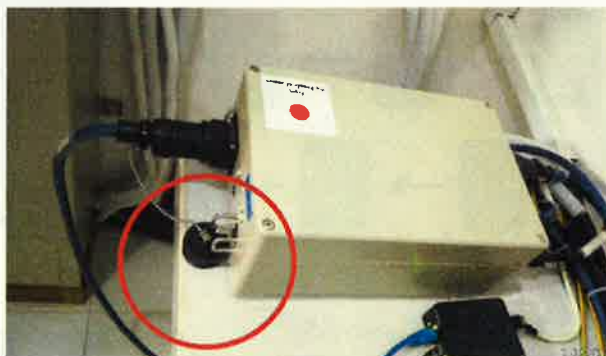
(-> G1019 will be shut down and power supply to 120QA will cut off)

2. Put off the Red switch in the waterproof box.



3. Put off the power switch of power distributor dox.

(→ Power supply to TSM-1 will cut off)



- Putting on the broadband equipment (120QA, TSM-1, G1019)

Please proceed in reverse order of putting off.



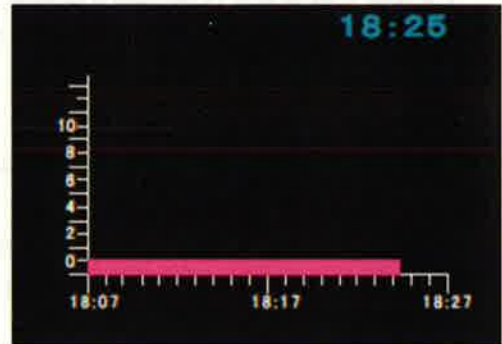
- Putting off the strong motion seismograph (G210-P, G210-S)  
 Put off the power for G210P (inside the waterproof box) following instruction below:

### 5.2 Shut down

Touch panel can be operated as shown on the right.

At first, when the standby display (wherever) can be touched, it is moved on to top menu.

The result is the same as item 7.1.



#### 【Top menu】

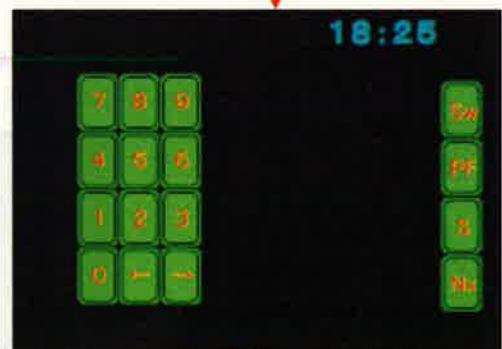
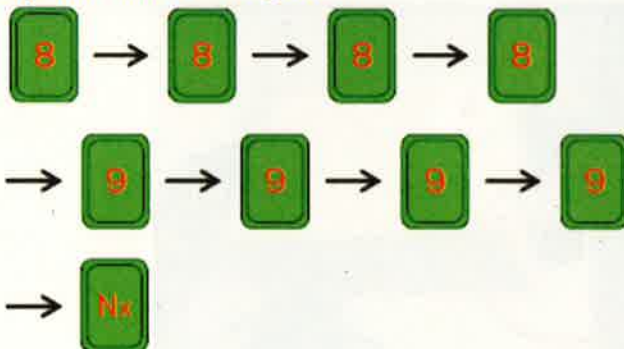


Touch the key.



#### 【Pass word】

Operate the following order.

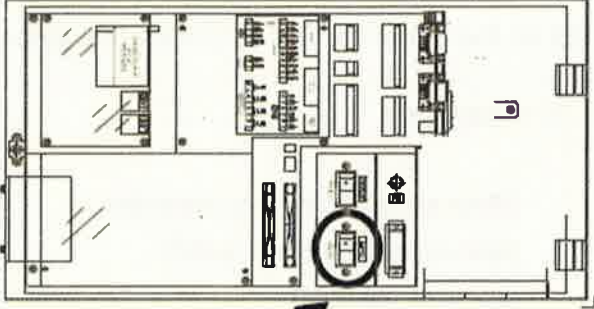


(Start over from the beginning if you make a mistake)

"Ready to turn off the power" can be displayed as shown on the right.

Internal of G210-P

"Battery" Turn off the power switch  
(arrow on the right)Battery  
• Battery



Battery switch

**One point !**  
G210-P equips with compact flash memory card. Recording waveform, earthquake information, parameter, operation log are stored in the memory. These files are stored by FAT 32 file system.  
The decided procedure should be shut down since the file system is broken.  
There is the file that is writing once every 10 minutes in the memory in order to extend the product life of the compact flash memory card. If the decided procedure is not performed, the data just before the shut down will be lost (max: 10 min).

\*\* Please follow the instruction (Appendix: Attachment 4 : P32,33)

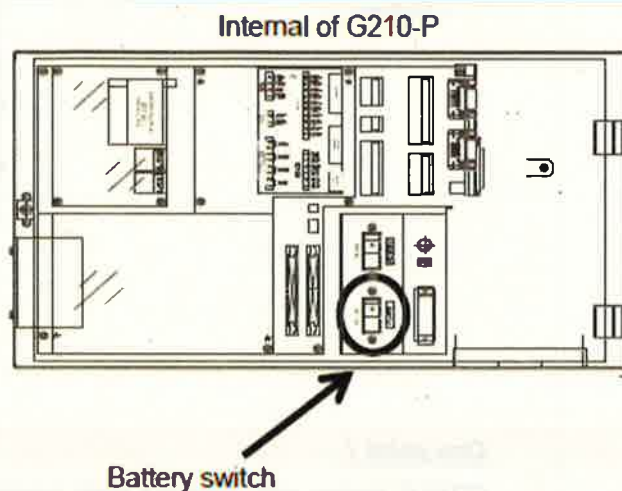
- Putting on the strong motion seismograph (G210-P, G210-S)

Put on the power for G210P (inside the waterproof box) following instruction below:

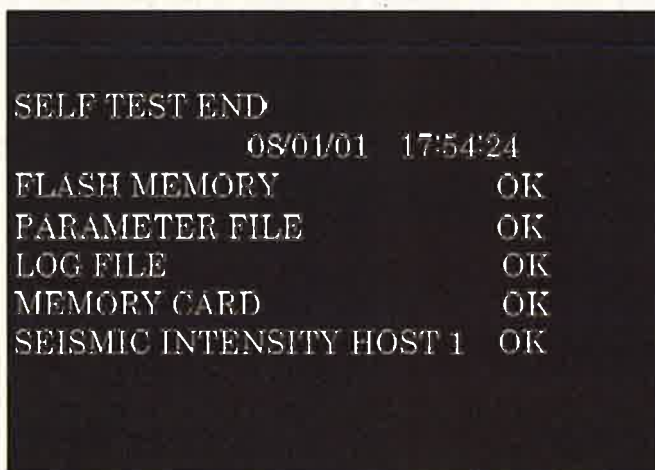
### 5.1 Power on

When all the cables are connected,  
please press the power switch  
(arrow on the right).

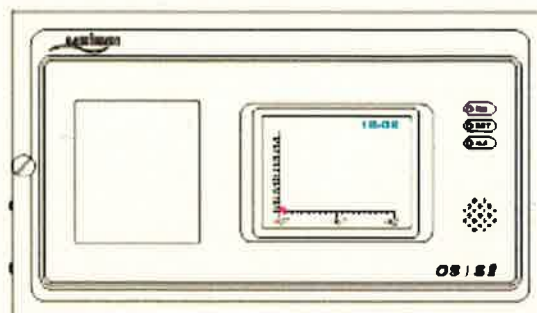
- Battery



Self-test will be done before the device gets up. It checks whether the device can performed normal processing of earthquake monitoring. The result is the following display.



In a few seconds after the test is over, RUN  
flashes. After a minutes, bar graph is displayed.  
It takes 2 minutes to power on.



\*\* Please follow the instruction (Appendix: Attachment 4 : P32,33)



## 5. Maintenance

This chapter indicates the maintenance time and item of each equipment and system for the Broadband site System in this Project.

### CAUTION

- For Detail, refer the each manual on Chapter 6 (Appendix).
- Replacement parts supply is not included in this project.

- Preventive maintenance menu

The major preventive maintenance menu is shown next page.

### CAUTION

When conducting corrective maintenance, please refer each manual on appendix.

- Weekly check list at each site (SAMPLE)

A sample of weekly check menu is shown after

Please refer the table next paper.

## Maintenance Menu



(Warning: This table indicates the main menu. When you conduct the maintenance, please refer the detail on the manual on appendix)

		Equipment		Normal menu		After disaster / whenever needed
		Weekly	Every 6month			
<i>indoor</i>						
Broadband Seismograph	Broadband seismograph (velocity meter)	120QA	Abnormality check	calibration SPD (serge protection device) check True north direction check(120QA)		
	Broadband strong motion seismograph (velocity meter)	TSM-1	Alarm check			
	Digitizer for velocity meters	G1019 GPS-Antenna G210-S G210-P GPS-Antenna				
Seismograph	Strong motion seismograph (accelerometer)					
	Digitizer for Strong motion seismograph (accelerometer)					
Satellite communication system	satellite modem	X3 (or X1)				
Power	Commercial power system	Rectifier Battery Charge controller assembly (Solar)				
	or Solar power battery system		Check voltage, status LED Check terminal connection Check liquid leak, expansion			SPD check
<i>outdoor</i>						
Satellite communication system	Satellite antenna	Antenna mount Cable	Physical damage check Creature or nest check	Tighten the loose bolts		SPD check
	Solar Power	Solar panel	Cleaning the surface Physical damage check Creature or nest check Environment check	Tighten the loose bolts		SPD check
(Designated site only)						
Wireless	Wireless communication system	Wifi equipment Structure	Physical damage check Creature or nest check	Tighten the loose bolts		



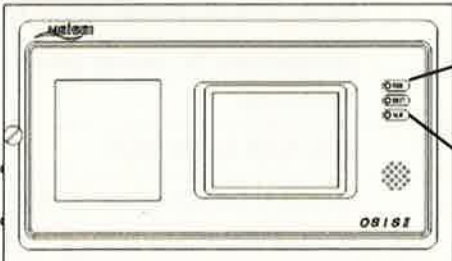


## 5.1 Normality check <Weekly, or when noticed the need>

- Weekly, or when you noticed the need,  
 Please check the status of the equipment.


Equipment	How to check the status
<b>Broadband seismograph</b>	
Broadband seismograph (velocity meter)	 <p>(You can't see the status of functioning by sensor itself. If you need to see the functioning status at your site, you need to connect PC to the digitizer and check the data .)</p>
Broadband strong motion seismograph (velocity meter)	
Digitizer for velocity meters	 <p>Usually the status is to be checked at HQ.                      When need to check the system log data at your site, it can be seen via PC. (Refer: Attachment 3 P63-)</p>

### Strong motion seismograph

strong motion seismograph (accelerometer) (sensor)	 <p>(You can't see the status of functioning by sensor itself. please check through the digitizer.)</p>
Digitizer for strong motion seismograph (accelerometer) (processor)	<p>1) Open the front door.</p>  <p>2) Check the LED light on G210-P</p> <p>◆Front panel LED :</p>  <ul style="list-style-type: none"> <li><input type="radio"/> RUN <b>Blink</b></li> <li><input type="radio"/> BATT <b>Light off</b></li> <li><input type="radio"/> ALM <b>Light off</b></li> </ul>



Satellite communication system

Equipment	How to check the status	
X1 Router (for Solar power site) 		
<b>Table 3-1. X1 Router Front Panel LED Indicators</b>		
LED Label	LED Color	Indicated X1 Status
RX	Off	Receiver is disabled or not configured.
	Solid Yellow	Downstream carrier is configured, but the demodulator is not locked.
	Slow Flashing Yellow	Downstream carrier is configured and the demodulator is locked. NCR is not locked.
	Solid Green	Downstream carrier is configured, demodulator and NCR are locked.
	Flashing Red	All LEDs simultaneously flashing red indicates a software exception or bad options file.
TX	Solid Yellow	Transmitter is disabled.
	Solid Green	Transmitter is enabled.
	Flashing Red	All LEDs simultaneously flashing red indicates a software exception or bad options file.
NET	Flashing Yellow	Demodulator is not locked on the Downstream carrier.
	Solid Yellow	Demodulator is locked on the Downstream carrier.
	2 Second Flashing Green	Demodulator is locked on the Downstream carrier. Network acquisition is in progress.
	1 Second Flashing Green	Demodulator and NCR are locked on the Downstream carrier. Network acquisition is in progress.
	Solid Green	Network is acquired. Link Layer is up.
POWER	Off	No or low DC power input to the X1.
	Solid Green	Acceptable DC power level to the X1 is detected.
	Solid Yellow	BUC/LNB power fail.
	Flashing Red	All LEDs simultaneously flashing red indicates a software exception or bad options file.

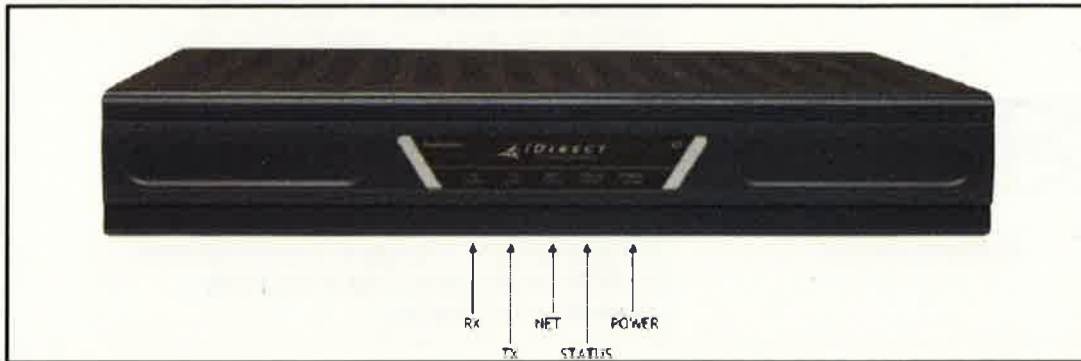


X3 Router (for Commercial power site)



### Front Panel LED Status Indicators

Once the IDU is powered up with the appropriate Options file, check the LEDs to ensure the IDU is functioning properly. The front panel indicators are shown in **Figure 18**.



**Figure 18. Front Panel Indicators**

#### 4.9.1 Front Panel Power and Network LED Status Indicators

For diagnostic purposes, the IDU chassis has five LED indicators located on the front panel.

- The Rx LED indicates the IDU receiver status.
- The Tx LED indicates the IDU transmitter status.
- The NET LED indicates the IDU network acquisition status.
- The STATUS LED indicates the IDU overall status.
- The POWER LED indicates whether the IDU is powered on or off.

The colors of the LEDs indicate the state of the IDU as defined in **Table 12**.

**Table 12. Front Panel LED Indicators**

LED Label	LED Color	Indicated Unit Status
PWR	OFF	The Satellite Router is powered Off or there is a power supply problem.
	GREEN	The Satellite Router is powered On.
NET	GREEN	The Satellite Router has been acquired into the network.
	FLASHING GREEN	The Satellite Router is attempting acquisition into the network.
	SOLID YELLOW	The downstream SCPC is locked.
	FLASHING YELLOW	The downstream SCPC is not locked.

**Table 12. Front Panel LED Indicators**

LED Label	LED Color	Indicated Unit Status
STATUS	OFF	The IDU is functioning properly.
	FLASHING GREEN	The unit is booting. DRAM test is in progress.
	RED	Indicates a serious fault or failure in the software, hardware, or configuration. May indicate that the DRAM test failed.
TX	GREEN	The IDU's transmitter is active.
RX	GREEN	The IDU is locked to the downstream and it is receiving data.
	FLASHING GREEN	The demodulator is locked to the downstream but HCR is not locked. Data is not being received by the modem.

● When Abnormality was found at the equipment...

Please check these...

- The power plug is not disconnected? Cables are properly connected?
- Are there any extraordinary situation around the equipment?
- As for the satellite modem, transponder on the satellite might be down.  
Please confirm the administrator at HQ.
- As for the solar power system, the power level will become lower due to the bad weather.

If the abnormality seems due to the equipment trouble...

- Record the abnormal situation. If possible, take photos.
- Report to the administrator.
- Please inform situation to the vender by the administrator.
- Also, please check the Chapter6 (manual for each equipment).

**CAUTION:**

Please do not open the housing of the equipment.

If housing of the equipment was opened, the warranty will expire even in the warranty period.

## 5.2 Physical damage check / Cleaning / Environment check / Creature or nest check < Weekly, or when you noticed the need >

Weekly, or when you noticed the need, please check the status of the equipment.

- Check of damaged
  - Check with eyes
- Cleaning of the surface for Solar Panel
  - Litter is removed promptly from the surface of Solar Panel.
  - If the Solar Panel dirty, wash with clear water and dry with soft cloth. Do not use of powder, detergent or abrasive products.

- Check the insect and worm nest inside / nearside the each equipment.
  - The creature and a nest are removed immediately.
  - Take measures so that a creature doesn't enter.



(This photo is just for a reference)

- Check of the surrounding tree will be the shadow over the solar panel or parabola antenna
  - Felling of the branches and leaves which become the shadow in a solar panel.



(This photo is just for a reference)

- Check the deterioration of sealing.
  - Sealing part (duct joint part, cable connecting part etc.) can be deteriorated. Please check and repair if needed.



(This photo is just for a reference)



## 5.3 Calibration

### 1) Broadband seismograph (Velocity meter) Nanometrics Trillium 120QA



Please conduct the alignment periodically in accordance with the instruction manual.

**NOTE:** For detail please also refer the Manual of 120QA (Appendix: Attachment 1-1 Chapter 13)

**CAUTION:** Do not attempt to move the product or disconnect connectors while the power switch is on to avoid damage or malfunction

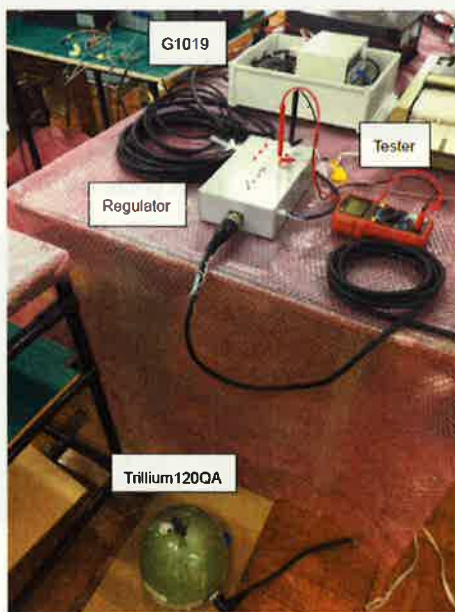
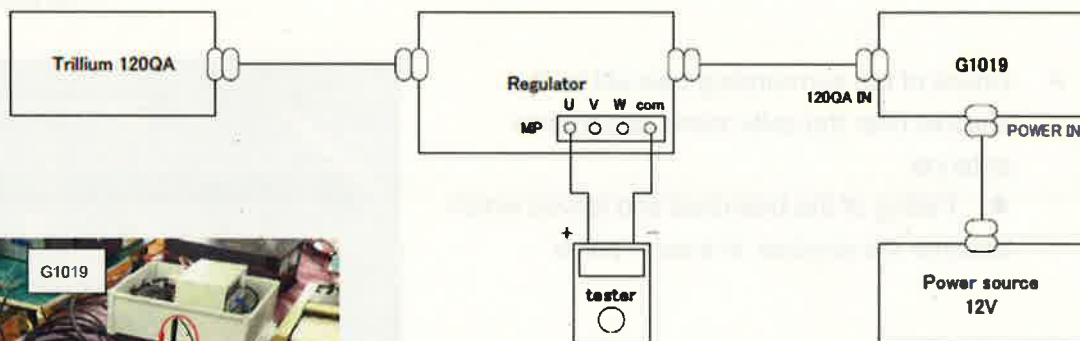
- True North is need to check periodically in accordance with user's policy.
- Centering and normality is need to be checked. The procedure are shown below:

#### Outline

Trillium 120QA regulator is an instrument for centering and checking the normality of the sensor. This manual shows how to operate. (refer to chapter 7 in "Trillium 120 Q / QA User Guide".) For basic usage, refer to "Trillium 120 Q / QA User Guide".

#### 1. System diagram

The following figure shows the system diagram.



## 2. Operating procedure

The procedure is described below.

- ① Turn on the G1019.
- ② Turn on "POW switch" Regulator
- ③ Turn on "MP switch" Regulator.

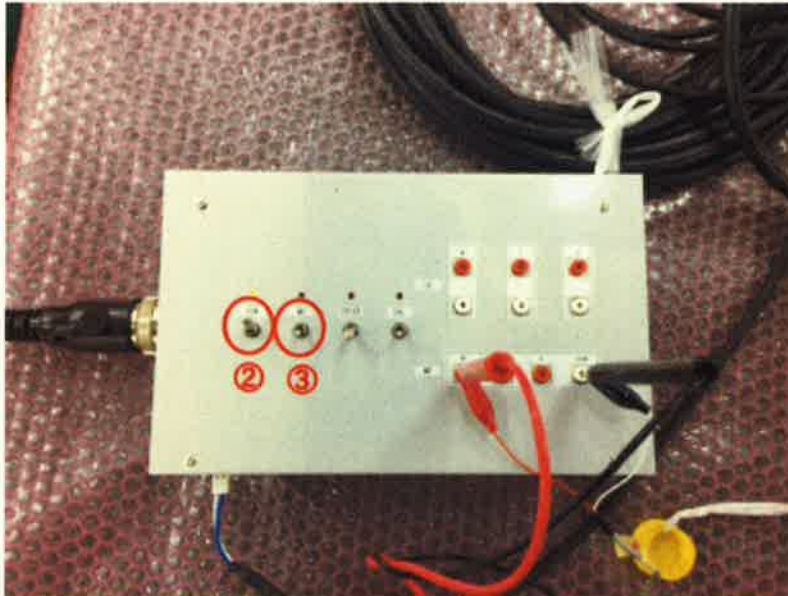


Fig3. Regulator

- ④ Using a tester, check that the output voltage is within  $\pm 0.35$  V.  
The adjustment is complete.  
Also check other components.



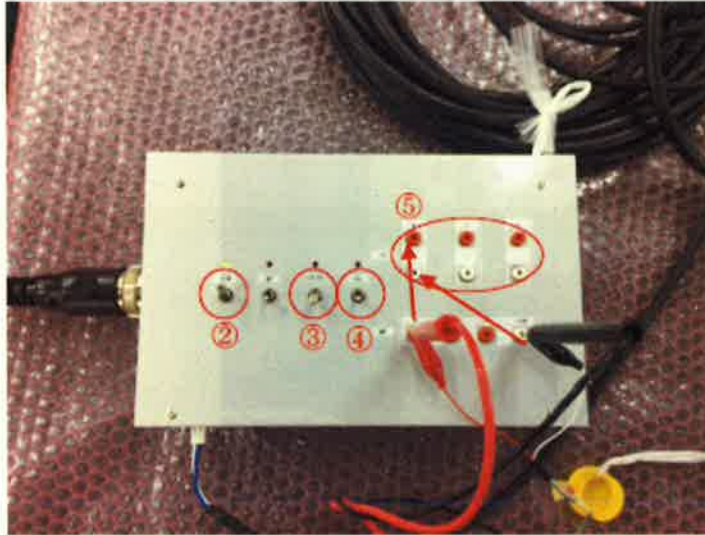
Fig4. Within  $\pm 0.35$ V by the tester



### 3. If you feel it is abnormal

Please try CAL signal input following procedure

- ① Turn on the G1019.
- ② Turn on "POW switch" Regulator
- ③ Turn on "CALEN switch" Regulator.
- ④ Turn on "CAL switch" Regulator



⑤ Using a tester, check that the output voltage. If it is abnormal, the voltage does not move. This is a simple check.



## 2) Broadband strong motion seismograph (velocity meter) Tokyo Keiki TSM-1

Please check the condition periodically in accordance with the instruction manual.

**CAUTION:** Do not attempt to move the product or disconnect connectors while the power switch is on to avoid damage or malfunction

### A) Check the Equipment Condition

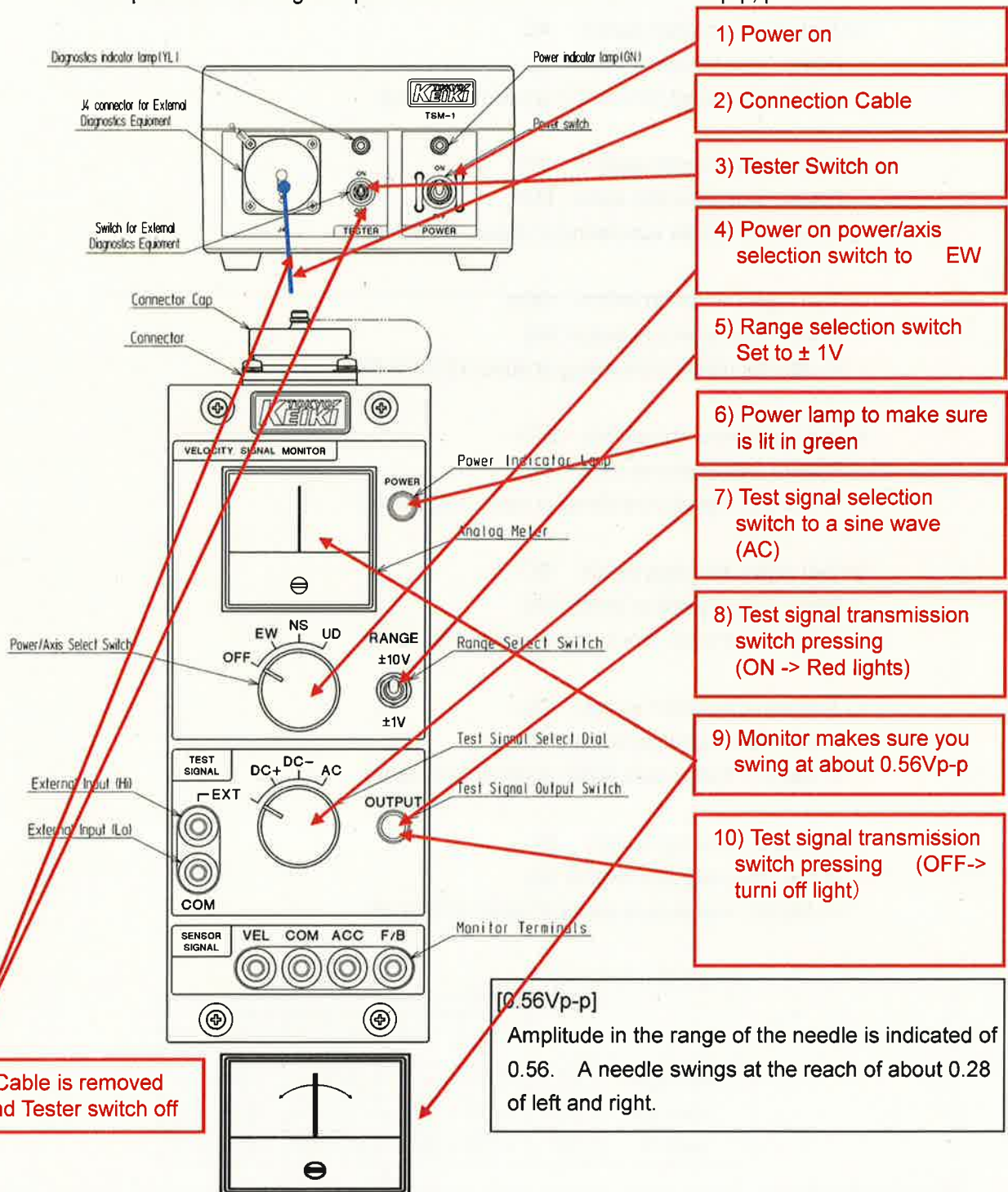
- Check the needle swing (about 0.5 Vp-p)

#### 1) Check of the Broadband Strong Motion Seismometer

The checking method of Broadband Strong Motion Seismometer with External Diagnostics Equipment.

(CAUTION!: Do not input voltage more than  $\pm 10V$ )

If amplitude in the range amplitude of the needle is not 0.56 0.56Vp-p, please contact to NEC.



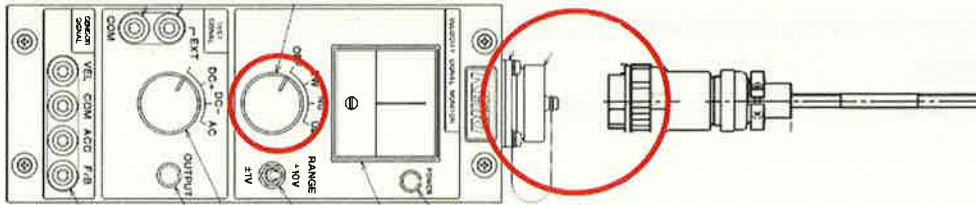
2) After the 1) Operation, check of the Broadband Strong Motion Seismometer.

- a) Test signal selection switch: AC  
Power / axis selection switch: EW  
=> Monitor makes sure swing at about 0.56Vp-p
- b) Test signal selection switch: AC  
Power / axis selection switch: NS  
=> Monitor makes sure swing at about 0.56Vp-p
- c) Test signal selection switch: AC  
Power / axis selection switch: UD  
=> Monitor makes sure swing at about 0.56Vp-p
- d) Test signal selection switch: DC+  
Power / axis selection switch: EW  
=> Monitor makes sure swing at about +0.28 to 0V
- e) Test signal selection switch: DC+  
Power / axis selection switch: NS  
=> Monitor makes sure swing at about +0.28 to 0V
- f) Test signal selection switch: DC+  
Power / axis selection switch: UD  
=> Monitor makes sure swing at about +0.28 to 0V
- g) Test signal selection switch: DC-  
Power / axis selection switch: EW  
=> Monitor makes sure swing at about -0.28 to 0V
- h) Test signal selection switch: DC-  
Power / axis selection switch: NS  
=> Monitor makes sure swing at about -0.28 to 0V
- i) Test signal selection switch: DC-  
Power / axis selection switch: UD  
=> Monitor makes sure swing at about -0.28 to 0V

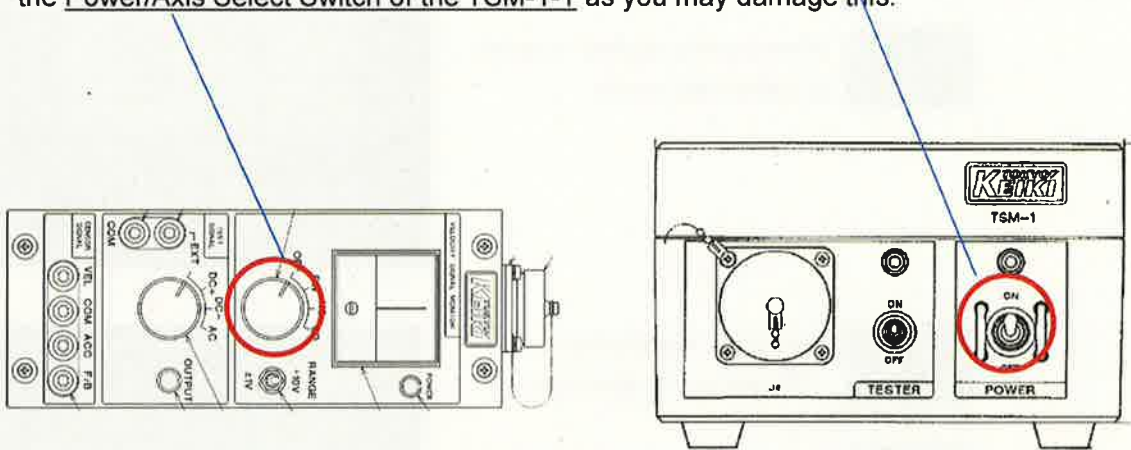
Normal Monitor value

		Power / axis selection switch:		
		EW	NS	UD
Test signal selection switch:	AC	0.56Vp-p	0.56Vp-p	0.56Vp-p
	DC+	+0.28 to 0V	+0.28 to 0V	+0.28 to 0V
	DC-	+0.28 to 0V	+0.28 to 0V	+0.28 to 0V

**CAUTION:** Do not attach or detach connectors while the switch for external diagnostic equipment (TSM-1-D) of the signal distributor is ON to prevent damaging this equipment.



**CAUTION:** Do not turn off the switch for external diagnostic equipment of the TSM-1-D before turning off the Power/Axis Select Switch of the TSM-1-T as you may damage this.





## 5.4 System test function

Digitizer for strong motion seismograph (accelerometer) (processor) [G210-P] has system-checking function.

Periodical checking is recommended.

### G210

#### 6.6 System test

Sensor test, operation test of alert contact output and volume check are can be operated.



When the key touched, it moves to system test screen.



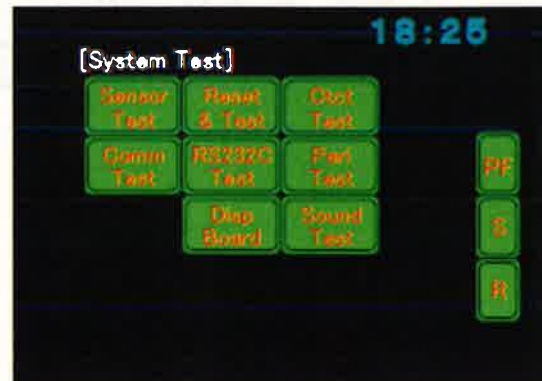
Sensor test is performed.  
 (Please refer to item 6.6.1)



Self test and reset are performed.  
 (Please refer to item 6.6.2)



Operation check of contact output is performed.  
 (Please refer to item 6.6.3)



Host communication test is performed.  
 (Please refer to item 6.6.4)

#### 【System test screen】



No use.



Regular test settings are performed.  
 (Please refer to item 6.6.5)



No use.



When the key is touched, it rings buzzer.  
 (Please refer to item 6.6.6)



6.6.1 Sensor test

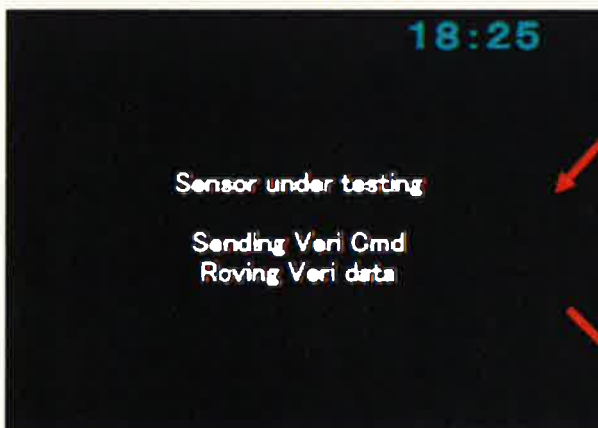
It is a function to know the output state of accelerometer in the sensor and horizontal state.

**Sensor Test** The key is touched and moves to operation screen.

※ After performing sensor test, earthquake measurement function is stopped for nearly 3 minutes. If an earthquake occurs in this time, it cannot be detected. Please fully understand the contents and operate.

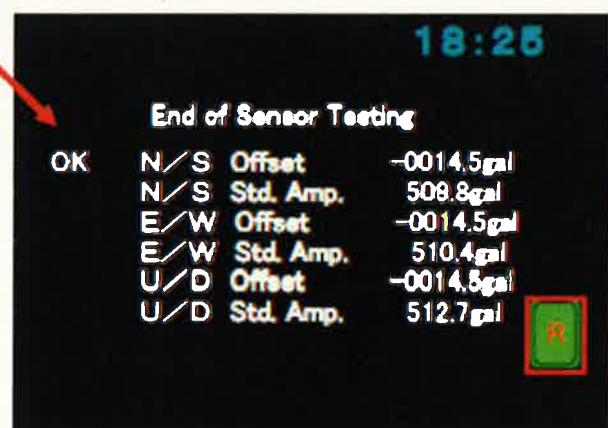
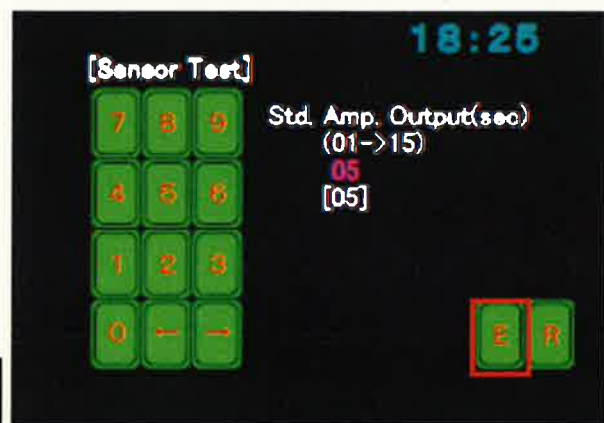
The setting of "standard amplitude output time" should not be changed. Please keep "05".

**E** Press it to start.  
 (Earthquake occurring = cannot be performed while triggering.)



**R** It returns with the key.

【System test screen】



**One point !**

If an error occurs as a result of the test and an error occurs in the retest, there are the following possibilities. Please check it immediately.

- The level of the sensor is not maintained.
- The accelerometer doesn't work.

If the error cannot be confirmed on the appearance, please ask us for repair. (Compensation)

Guarantee or repair may not be possible if it is disassembled by users. Please be careful.

### 6.6.2 Reset / Test

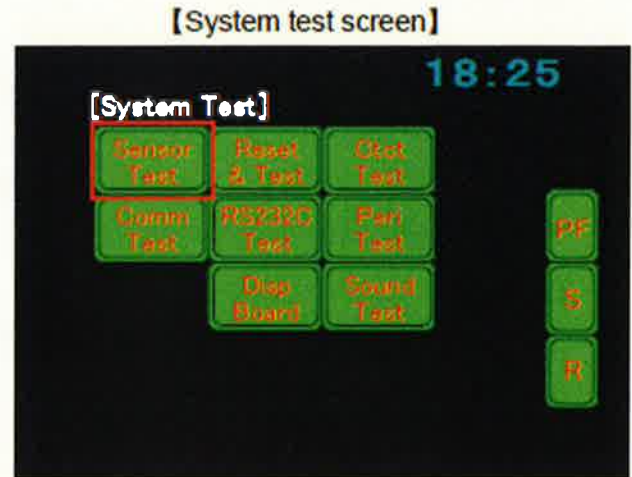
Set operation of G210-P is performed.



The key is touched and it moves to operation screen.

※Sensor cannot be reset.

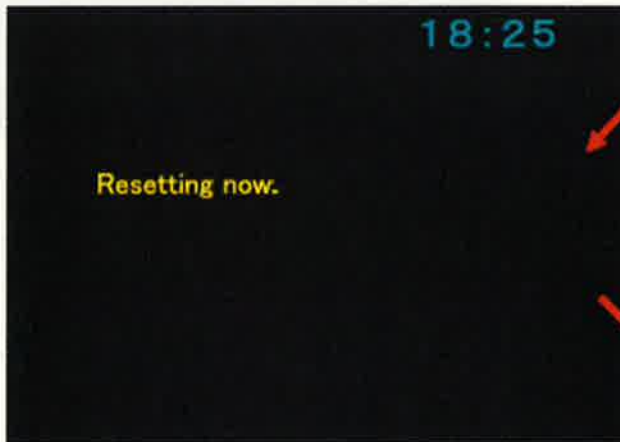
(It is necessary for sensor to shut down (refer to item 5.2) and power on.



Self test type is selected with the key.

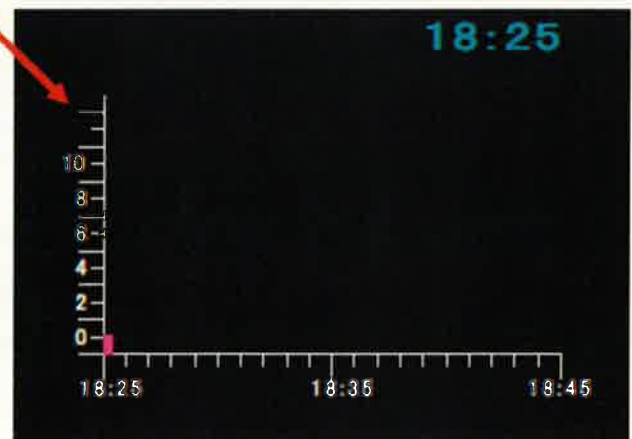


Press the key to start.



"Resetting now" is displayed for 10 to 30sec

When measurement graph screen is displayed as shown on the right, the reset is completed.



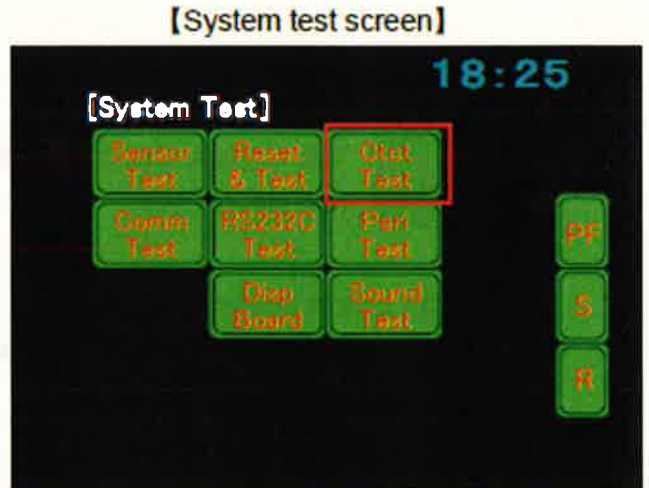
### 6.6.3 Contact output test

It can be test the set alert output in item 6.5.2,



The key is touched and it moves to operation screen.

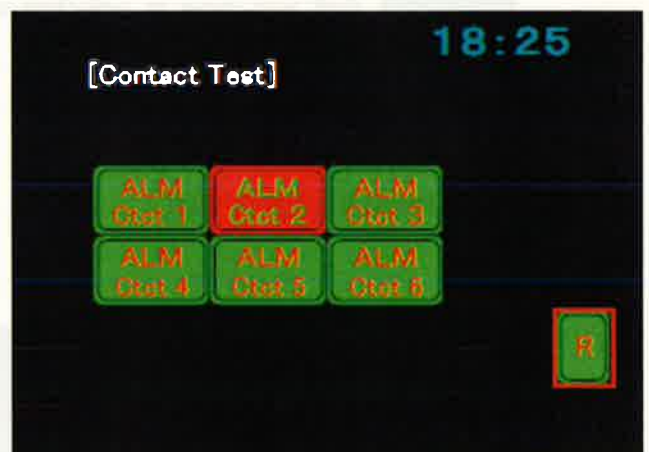
※ Actually, output point is made. Please pay sufficient attention during operation.



Please touch the ALM button to be tested. It turns red during makeup. It touched again to return to green.



It returns previous screen with the key.



Setting No.	Role	Remarks
ALM 1	Alert contact output 1	
ALM 2	Alert contact output 2	
ALM 3	Alert contact output 3	
ALM 4	Alert contact output 4	No use. (Test only possible)
ALM 5	Status output 1	No use. (Test only possible)
ALM 6	Status output 2	No use. (Test only possible)
No use		
No use		



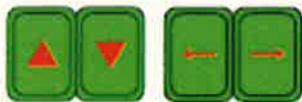
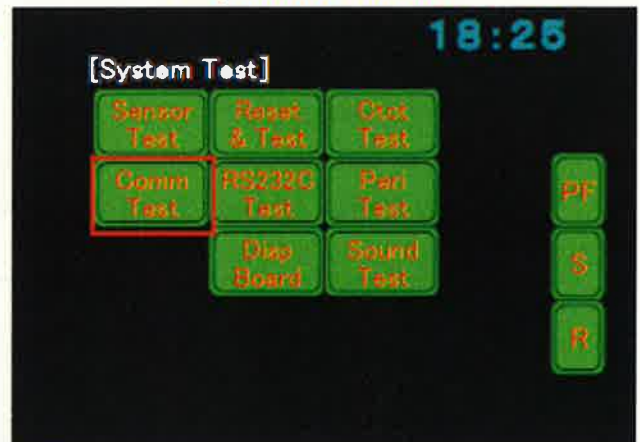
### 6.6.4 Communication test

This is a function to specify the time to send about the test telegram to the host. It is the same function as the manual seismic intensity telegram transmission of "Manual telegram". However, when seismic intensity information is sent, The host device can be recognized "Test telegram" since the test flag is always added. And also, it is possible to send status telegram.



The key is touched and it moves to details input screen.

【System test screen】



The items are selected with the key.

(Transmission start date is set with numeric keypad.)



It is determined with the key.  
 (It is sent at the transmission start date.)



After determination of transmission setting, when it needs to cancel, it is touched.  
 (After canceling, the transmission start date becomes " \* ")



It returns previous screen the key.





◆ Communication line type

Host line : Test telegram is transmitted via ground line.

"Normal" is no use.

◆ Test transmission starting date.

Transmission date of test telegram is specified.

After transmission, it is sent at the set time every day.

If it is not necessary to communicate regularly, please cancel the settings with **Cancel** key.

◆ Transmission seismic intensity

This is effective when transmission telegram is used as "seismic intensity" and seismic intensity value is input. (please refer to the following)

MMIS	MMI
I	0.5 ~ <1.5
II	1.0 ~ <2.5
III	2.5 ~ <3.5
IV	3.5 ~ <4.5
V	4.5 ~ <5.5
VI	5.5 ~ <6.5
VII	6.5 ~ <7.5
VIII	7.5 ~ <8.5
IX	8.5 ~ <9.5
X	9.5 ~ <10.5
XI	10.5 ~ <11.5
XII	11.5 ~

◆ Transmission telegram

Seismic intensity : The setting seismic intensity is transmitted.

Status : Information on whether error has occurred in the equipment is transmitted.

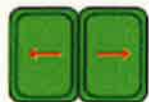
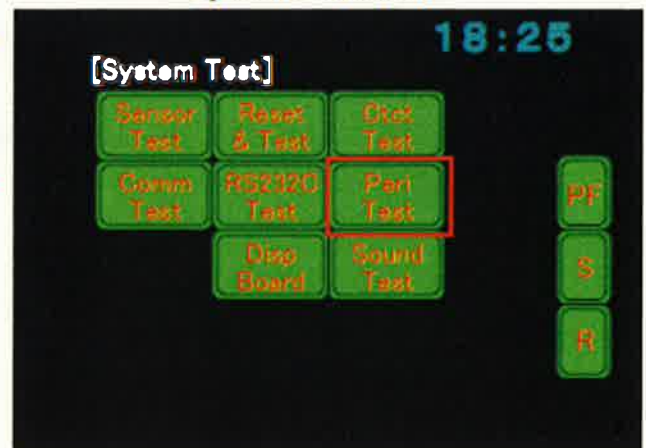
### 6.6.5 Regular sensor test

Real time observation data for the display that is uploaded per 10sec is tested it out.



The key is touched and it moves to operation screen.

【System test screen】

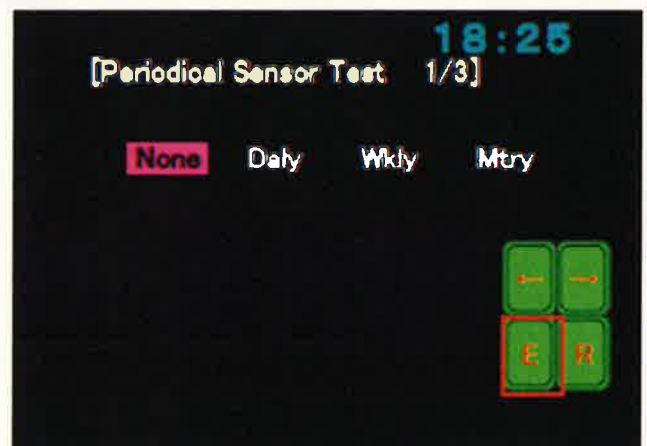


It is selected with the key.



It is determined with the key.

- ◆Daily : It moves to the screen that the time is set.
- ◆Weekly : It moves to the screen that the day of the week/time are set.
- ◆Monthly : It moves to the screen that date/time are set.



※After regular sensor test, earthquake measurement function is stopped for nearly 3 minutes. It cannot observe while stopped. Please fully understand the contents and operate.

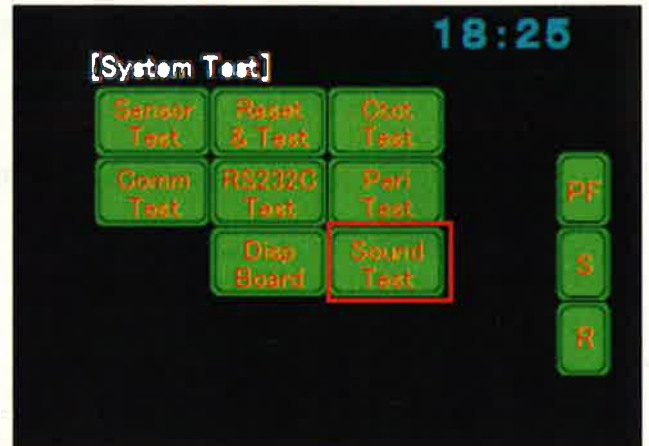
### 6.6.6 Volume check

The volume of internal speaker can be adjusted.



When the key is touched, the buzzer can be ring.

【System test screen】



(Self-checking for G210 is described at ATTACHMENT 4 Page 85-93)

## 5.5 Arrester

Some of the equipment obtain arresters.

When arresters were damaged, they need to be replaced.

(\* Spare parts are not prepared by this project)

### (1) Arrester for seismometers

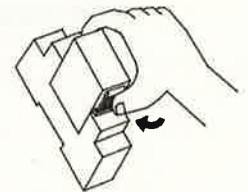
#### ● Parts table

No	Equipment	Replacement parts	Quantity for each	When to replace
1	G1019	SG-HS24S	2	Every 5-10 years or damaged
2	G210	ZP-H2-H1	3	Every 10 years or damaged
3	G210	CN226-24A	2	LED on the arrester turned off

#### ● Replace

##### (1) SG-HS24S

The SPD plug is base locked by the retaining mechanism. When pulling out the plug from the base, please pull out while pressing the "plug disengagement prevention knob" with your thumb



##### (2) ZP-H2-H1

Please remove the SPD plug from the base.

\* Even if you remove the main body of the arrester, the signal circuit will not be opened.

##### (3) CN226-24A

Please remove the SPD plug from the base.

\* Even if you remove the main body of the arrester, the signal circuit will not be opened.

### (2) Arrester for satellite modems

#### ● Parts table

No	Equipment	Replacement parts	Quantity for each	When to replace
1	X3 (commercial power site)	OBVW-F/75C	2	When damaged
2	X1 (solar power site)	OBVW-F/75C	2	When damaged



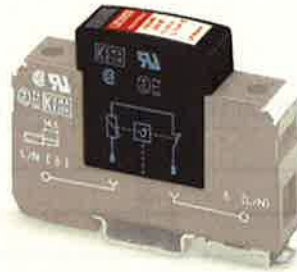


(sample photo)

### (3) Arrester for Power system

● Parts table

No	Equipment	Replacement parts	Quantity for each	When to replace
1	Rectifier	VAL-MS 230 ST	1	When displayed "Defect"
		F-MS 12 ST	1	



**CAUTION**

- Before the plug of arrester is removed. Must be power off for your safety.
- As it involves risk and danger, refer each manual attached before replace or maintenance.

### 5.6 Battery

Commercial power system and solar power system obtain Batteries. They need to be exchanged periodically. (They withstand up to 3 years provided the temperature is kept at around 30 degree Celsius.)

Preferably every 3 months there should be a discharge and re-charge of the battery.



**CAUTION**

- As it involves risk and danger, refer each manual attached before replace or maintenance.



## 5.7 Other equipment Maintenance and troubleshooting (Digest)

### 5.7.1 Satellite communication system



- 1) X-3 Router (for commercial power sites)

\*\* This is the digest of the manuals. For detail, please refer to it.

#### *Maintaining the Remote*

### 4.10 Maintaining the Remote

The IDU requires basic maintenance to keep it running efficiently and to prolong its life. However, the only maintenance you need to perform on the unit, without explicit directions from iDirect Technologies, is to maintain the temperature of the IDU and keep its external areas free from dust or dirt.

**Note:** *There are no user-serviceable parts within the iDirect Evolution X3 Satellite Router. Do not attempt to repair/replace a malfunctioning or defective component/module. Doing so may void the warranty.*

#### 4.10.1 Temperature Control

The IDU has a built-in temperature sensor. The temperature sensor measures the actual circuit board temperature. If the board temperature exceeds a defined threshold, the IDU alerts the IMS about the high temperature condition. See Chapter 3, *Specifications*, for the proper temperature range.

Various conditions can cause the IDU chassis to have an elevated internal temperature, such as:

- Objects blocking the enclosure vents
- Dust accumulated on the enclosure or the vents
- Ambient temperature elevated beyond the specified limits

#### 4.10.2 Dust Removal

A dusty environment requires frequent maintenance. With the unit powered down, use a slightly damp cloth with the excess moisture wrung out (not a saturated, dripping-wet cloth) to wipe away the dust that collects on the outside of the enclosure.

Vacuum the dust off the enclosure vents. Vacuum the circuit board through the enclosure vents, if possible.

2) X-1 Router (for solar sites)



\*\* This is the digest of the manuals. For detail, please refer to it.

## 6 Maintenance and Troubleshooting

This chapter describes maintenance procedures necessary for ensuring the correct functioning of the X1 Router at a VSAT location.

This chapter contains the following sections:

- Section 6.1, *Safety Guidelines to Observe During Servicing* on page 49
- Section 6.2, *Maintaining the X1 Router* on page 50
- Section 6.3, *Maintaining the X1 Outdoor Router* on page 51
- Section 6.4, *Troubleshooting* on page 52
- Section 6.5, *Repacking the X1 Router* on page 52

### 6.1 Safety Guidelines to Observe During Servicing

When an X1 Router requires service, observe the safety guidelines in this section:

- Always remove or disconnect ALL power connections before installing or removing a chassis
- Keep the staging area clear and free of dust during and after installation
- Keep tools, X1 Router components, and shipping boxes away from walkway area
- Do not overload wall outlets, extension cords, or integral convenience receptacles as this can result in a risk of fire or electrical shock
- Cables – Never use any other RF cable than what is supplied or recommended by iDirect
- Cleaning – Do not use liquid cleaners or aerosol cleaners; use a cloth for wiping up dust

#### 6.1.1 Servicing



**WARNING:** This unit is not serviceable. Return unit to provider for all servicing issues.

**ATTENTION:** Cette unité n'est pas réparable sur site. Renvoyer au fournisseur pour tout réparation.

Do not attempt to service the X1 Router internal assemblies, as opening and removing covers may expose personnel to dangerous voltages or other hazards. There are no user serviceable parts inside. Opening the X1 Router or Power Module will void the warranty. Refer all servicing to qualified service personnel.

*Maintaining the X1 Router*

### 6.1.2 Conditions Requiring Service

Unplug the X1 Router from the power source and refer servicing to qualified service personnel under the following conditions:

- When the power supply cord or plug is damaged
- If the X1 Router does not operate normally when following the operating instructions
- If the X1 Router has been dropped or if the chassis has been damaged
- When the X1 Router exhibits a distinct change in performance

## 6.2 Maintaining the X1 Router

The X1 Router requires basic maintenance to keep it running efficiently and to prolong its life.

Typically, the only maintenance needed to be performed on the unit, without explicit directions from iDirect, is to maintain the temperature of the X1 Router and keep its external areas free from dust or dirt. There are no user-serviceable parts within the X1 Outdoor Router. Do not attempt to repair/replace a malfunctioning or defective component/module. Doing so may void the warranty.



**CAUTION:** This unit is not serviceable. Return unit to provider for all servicing issues.

**ATTENTION:** Cette unité n'est pas réparable sur site. Renvoyer au fournisseur pour tout réparation.

### 6.2.1 Temperature Control

The X1 Router has a built-in temperature sensor. The temperature sensor measures the actual circuit board temperature. If the board temperature exceeds a defined threshold, the X1 Router alerts the HMS about the high temperature condition. See Table 2-1 on page 3, for the proper temperature range.

Various conditions can cause the satellite router chassis to have an elevated internal temperature, such as:

- Objects blocking the enclosure vents
- Dust accumulated on the enclosure or the vent
- Ambient temperature elevated beyond the specified limits

### 6.2.2 Dust Removal

A dusty environment requires frequent maintenance. With the unit powered down, use a slightly damp cloth with the excess moisture wrung out (not a saturated, dripping-wet cloth) to wipe away the dust that collects on the outside of the enclosure. Do not use liquid cleaners or aerosol cleaners. Use a cloth for wiping up dust.

### 6.2.3 90 Day Regular Maintenance

The X1 Router should have the following procedures performed every 90 days:

- Make sure that no objects are blocking the core protective vents
- If there are objects blocking the core protective vents, remove them safely, so, there is approximately least 6 inches (12 cm) clearance
- Make sure that the ambient temperature remains within the specified limit



## 6.4 Troubleshooting

Table 6-1 describes the most common X1 Router troubleshooting events and actions to take. Consult with the iDirect TAC when considering a reset. Reset functions are described in Appendix F, *X1 Reset* on page 73.

Table 6-1. Troubleshooting Events and Actions to Take

Event	Action
Router not functioning	Check status LEDs. Compare LEDs to Table 3-1, <i>X1 Router Front Panel LED Indicators</i> on page 13
POWER LED OFF (No power)	<ul style="list-style-type: none"> <li>Verify power connection</li> <li>Test power to determine if there is power to the power module</li> </ul>
POWER LED ON and not functioning	Test power Check other status LEDs. Compare LEDs to Table 3-1, <i>X1 Router Front Panel LED Indicators</i> on page 13.
Lost or forgot IP address of router and/or DHCP* (DHCP server) is disabled Dynamic Host Configuration Protocol	<ul style="list-style-type: none"> <li>Perform a Level 1 reset (Boot into Recovery mode) so that the X1 Router will have a known IP address of the default: 192.168.0.1</li> <li>Retrieve the options file (which will list the router's current IP address) and write down the current IP address</li> <li>Reboot with a Level 0 reset, and connect with the current IP address</li> <li>See Appendix F, <i>X1 Reset</i> on page 73 for more information on Reset</li> </ul>
Router cannot be accessed by Web iSite	<ul style="list-style-type: none"> <li>Router may have a bad options file, settings, or software package</li> <li>Perform a Level 1 reset (Boot [into Recovery mode]) and manually load the correct options file and the new software package that is appropriate</li> <li>Reboot with a Level 0 reset to see if the issue is fixed</li> <li>See Appendix F, <i>X1 Reset</i> on page 73 for more information on Reset</li> </ul>

### 3) 1.8 Meter Rx/Tx Antenna System

\*\* This is the digest of the manuals. For detail, please refer to it.



#### PERIODIC INSPECTION & MAINTENANCE

To ensure peak performance of the antenna system and to maintain validity of the warranty, the user should perform a periodic inspection every 6 months or following any severe weather event, As a minimum the following items should be inspected.

##### 1. **INSTALLATION MOUNT**

Check for loose hardware - tighten if necessary.  
Check integrity of anchor bolts or hardware securing mount to the building or foundations  
Check ballast of Non-Penetrating Roof Mounts - cracked or broken blocks must be replaced.  
Check hardware and structural members for signs of corrosion - repair or replace as needed

##### 2. **ANTENNA BACK STRUCTURE OR AZ/EL MOUNT**

Check for loose hardware - tighten if necessary.  
Check for signs of structural damage such as bending or cracking  
Check hardware and structural members for signs of corrosion - repair or replace as needed

##### 3. **REFLECTOR**

Check integrity of bolts securing reflector to back structure or az/el mount. Tighten any loose hardware.  
Check for signs of damage such as cracking. Inspect reflector face for impact damage.  
Check hardware for signs of corrosion - repair or replace as needed.

##### 4. **FEED SUPPORT STRUCTURE**

Check for loose hardware - tighten if necessary.  
Check for signs of structural damage such as bending. Check hardware and structural members for signs of corrosion - repair or replace as needed

##### 5. **FEED & RF COMPONENTS**

Check for loose hardware - tighten if necessary.  
Check hardware for signs of corrosion - repair or replace as needed.  
Check feed lens or window for damage or signs of leaking. Check waveguide connections between feed and RF electronics

##### 6. **ELECTRICAL**

Check for loose cables and connectors - tighten if necessary  
Check for tight grounding connections  
Check cables for weathering or cracks





## 5.7.2 Commercial power system

### Commercial Power System for BBS

1. RIN#4P8BL+12V#1612
2. RIN#4P8BL+12V#1612(SL)

\*\* This is the digest of the manuals. For detail, please refer to it.

#### **4. MAINTENANCE**

In addition to being the standard operating and troubleshooting procedures that must be put into action, SOP also functions as a work evaluation in terms of the operation of the SPS (battery) cabinet conducted by all workers and to properly handle work-related problems. Furthermore, SOP also has an important role in creating an efficient, effective, and consistent standardization of work in handling the device's problems.

Due to the importance of SOP, every kind of operation has its own SOP intended to avoid possible irregularities in the troubleshooting procedures and to update the engineers' knowledge. Therefore, SOP becomes a vital instrument to push every engineer and executor to perform their tasks efficiently and enable them to easily monitor their work product so that their tasks will be more structured.

#### **4.1 MAINTENANCE PROCEDURE OF HARIFF POWER SYSTEM**

##### **1. Introduction**

Maintenance is intended to help maintain the installed Hariff Power System Devices. Maintenance will help tackle problems early on.

##### **2. Reference**

Rectifier installation and Hariff Power System battery manuals.

##### **3. Maintenance Procedures**

Maintenance procedure is developed as a reference in implementing the observation and maintenance of Hariff Power System that has been operating in the field that is already operating in the field. In practice, maintenance is expected to anticipate things that may affect the device's system, including:

- Anticipation of malfunctions,
- Visual check of the battery condition,
- Measure of the battery backup time,
- Early detection of malfunctions,
- Replacement of damaged unit

The preparation before conducting maintenance include:

- a. Every technician removes all metal-containing jewelry (rings, watches, etc.).
- b. Letter of assignment is ready.
- c. Permit to conduct maintenance on SPS cabinet acknowledged by the customer is ready.
- d. List of tools required in maintenance.

<b>NO</b>	<b>TOOLS</b>	<b>PROTECTIVEGEAR</b>
1.	Dummy Load (12V, 250A)	Helmet
3.	Ampere pliers	Safety shoes
4.	Temperature meter	Goggles
5.	Combination spanner (1 set)	Isolated gloves
6.	Multimeter/AVO meter	
8.	Large/medium plus (+) screwdriver (No:2, 6.4 x 150mm, No:1, 4 x 150mm)	
9.	Large/medium minus (-) screwdriver(2x150mm), (4x150mm)	
10,	Trimmer screwdriver	
11	Camera	
12	Clean cloth	
13	Maintenance Form	
14	Brush	
15	Electrical tape	

#### **4.2 Indoor Visual Check of Hariff Power System Device**

- a. Fill in the visual check observation form under HPS Maintenance Form.
- b. Check the robustness of the self-supporting/mounting surface of the SPS battery cabinet. Check the tightness of the locking bolts on the self-supporting surface to the floor. Fill the maintenance form accordingly.
- c. Check the wiring and tightness of the cable interconnection to the installed ACPDB/KWH meter. Check the AC distribution and make sure that the AC cable interconnection from the electricity is connected well to the MCB. Then, check the condition of the arrester and note the color indication of the arrester status. Fill the maintenance form accordingly.
- d. Check the DC distribution section and make sure the interconnection of the cable from the device/load to the MCB terminal is well connected. Then, note the load MCB that is connected to the device. Fill the maintenance form accordingly.
- e. Check the LED indicator and make sure it works properly. Fill the maintenance form accordingly.
- f. Check the cable connections on the battery block terminals. Make sure that the cabling connection of the battery terminals is strong and then take note of the physical condition of the battery. Make sure the battery condition is dry and clean. Perform battery block cleaning with a damp cloth. Fill the maintenance form accordingly
- g. Record the PN and SN of the rectifier system. Fill the maintenance form accordingly.
- h. Note the SN of the battery. Fill the maintenance form accordingly

#### **4.3 Functional Check of Hariff Power System**

##### **Rectifier Measurement**

- a. Input the AC.
- b. Measure the voltage and current that feed the rectifier
- c. Put out the DC rectifier.
- d. Measure the voltage and current coming out of the rectifier.



**Figure 1. The measurement of Phase Voltage**



**Figure 2. Voltage Measurement of Rectifier Output for Battery and Load**

### **Battery Testing**

To test the battery, there are several things to do and prepare, they are:

❖ Prepare dummy load current simulation, jumper cable to connect to the existing battery, mobile rectifier, and backup battery. The procedures are:

- 1) Prepare the dummy load rectifier simulation to test the battery capacity.
- 2) Prepare the jumper cable on the dummy load (+) and (-) to connect it to the battery pole (+) and (-) on the battery bank that will be tested.

❖ Record all batteries that will be tested for their capacity. Record the followings:

- 1) Record the brand, type, and capacity of battery.
- 2) Record the number of blocks or banks.
- 3) Specify the discharge current of the load on the load discharge constant current table based on the brand, type, and capacity of the installed battery at the end voltage of 1.8 VPC and 1-hour load discharge time. For Maxlife FGB12-100, the load discharge constant current is 63.1 A.
- 4) Make sure that the battery for which the capacity will be tested is fully charged.

### **Battery Temperature Measurement**

Check the temperature of each battery block by attaching the temperature meter on the battery container. Record the result of the measurement on the Maintenance Form.

❖ Procedures of Battery Capacity Test

#### **a. Battery test per block**

- 1) Turn off the rectifier battery MCB connected to the battery bank/block and remove the connector of both ends of the battery polarity cable and isolate them.
- 2) Measure and record the open circuit voltage of the battery bank and the voltage of each existing battery block. After that, connect the existing battery bank to the dummy load. Give a load current simulation according to the characteristics table of the load discharge constant current for an hour. Assume that, for an hour of load discharge with the constant current, the battery is 100% charged (full). As an example, for a 1-hour load discharge time recorded every 10 minutes, the record is: the initial battery condition after being weighed down by a dummy load (0 minute), 10 minutes, 20 minutes, and so on until minute 60 (1 hour).
- 3) Measure the voltage of the initial condition when the battery is in an open circuit condition. Then, record every X minute rise constantly for an hour to each battery block and bank and record the discharge current of the battery.





**Figure 3. Voltage Measurement on Battery**

- 4) After the load discharge of the battery is done for an hour, remove the cable connector on the dummy load and charge the battery by reconnecting it to the rectifier system. Charge with boost voltage for an hour.
- 5) Record the result of the load discharge on the Load Discharge Form under the Capacity Record Sheet.

#### **4.4 Separation and Replacement of Battery Blocks with the Following Characteristics:**

- a. The difference of temperature of each battery block is no higher than 5°C. If the temperature is higher, it could cause damage. Give a mark if there is any indication of damage and give a recommendation to replace the damaged battery.
- b. The test result of the voltage measurement of battery block for load discharge of 63.1A for an hour cannot be less than 10.8 VDC. If the result is less than 10.8 VDC, it could cause damage to the battery block. Give a mark if there is any indication of damage and give a recommendation to replace the damaged battery.

## **5. PROCEDURES OF TROUBLESHOOTING**

### **5.1 Rectifier Module**

If there is no voltage in the DC distribution terminal of 12VDC, check the power system (rectifier) with the following steps:

- Check whether the physical rectifier system is on or off.
- Make sure that the load distribution MCBs (load 1 and load 2) are on.
- Make sure that the AC distribution rectifier MCB 1, 2, 3 are on.
- Make sure that the AC input MCB is on.
- Measure the AC voltage (electricity) on AC Input MCB.

If the above steps have been done and there is no 12VDC voltage on the voltage conditions on the DC distribution, then replace the rectifier module.

**Procedures for the replacement of the rectifier module are as follows:**

- Turn off MCB on damaged rectifier module on power system (rectifier). (AC input MCB, AC distribution MCB).

- Disconnect AC cable, compensation temperature, output load cable, and battery output cable on rectifier.
- Remove the damaged rectifier and replace it with a new rectifier.
- Replace the AC cable, compensation temperature, output load cable, and battery output cable.
- Restart MCB AC input and MCB AC input rectifier.

### **5.2 Inverter Module**

If there is no voltage of 220VAC on the AC outlet AC distribution 220V, check the power system (rectifier) with the following steps:

- Make sure that the AC distribution 220VAC MCB is on.
- Make sure that the MCB inverter on the load distribution is on.
- Check the light on the inverter. If there is an alarm turned on, reset the inverter by turning off the MCB on the inverter. If the light is still on after resetting the alarm, then replace the inverter with a new one.

### **5.3 Battery**

If a battery cannot provide backup when the charge controller is off, check the battery with the following procedures:

- Make sure that the battery bank MCB 1 to 7 are on.
- Measure the battery voltage for each block. If the battery voltage is dropped or damaged (under 10.8VDC), charge or replace the battery.

### 5.7.3 Solar power battery system

#### Solar Power battery System for BBS

1. SPS#SLV-8PV1800AH-01(SL)

\*\* This is the digest of the manuals. For detail, please refer to it.

#### 4. MAINTENANCE

In addition to being the standard operating and troubleshooting procedures that must be put into action, SOP also functions as a work evaluation in terms of the operation of the SPS (battery) cabinet conducted by all workers and to properly handle work-related problems. Furthermore, SOP also has an important role in creating an efficient, effective, and consistent standardization of work in handling the device's problems.

Due to the importance of SOP, every kind of operation has its own SOP intended to avoid possible irregularities in the troubleshooting procedures and to update the engineers' knowledge. Therefore, SOP becomes a vital instrument to push every engineer and executor to perform their tasks efficiently and enable them to easily monitor their work product so that their tasks will be more structured.

##### 4.1 PROCEDURES OF SPS CABINET MAINTENANCE

###### 1. Introduction

Maintenance is intended to help maintain the SPS cabinet that has been installed. Maintenance will help tackle problems early on.

###### 2. Reference

Rectifier installation and Hariff Power System battery manuals.

###### 3. Maintenance Procedures

Maintenance procedure is developed as a reference in implementing the observation and maintenance of SPS (battery) cabinet that is already operating in the field. In practice, maintenance is expected to anticipate things that may affect the device's system, including:

- Anticipation of malfunctions
- Visual check of the battery condition
- Measure of the battery backup time
- Early detection of malfunctions
- Replacement of damaged unit

The preparation before conducting maintenance includes:

- a. Every technician removes all metal-containing jewelry (rings, watches, etc.)
- b. Letter of assignment is ready.
- c. Permit to conduct maintenance on SPS cabinet acknowledged by the customer is ready.
- d. List of tools required in maintenance:

NO	TOOLS	PROTECTIVE GEAR
1.	Dummy Load (24V, 50-250A)	Head protector/helmet
3.	Ampere pliers	Safety shoes
4.	Temperature meter	Goggles
5.	1 Set of combination spanner	Isolated gloves
6.	Multimeter/AVO meter	
8.	Screwdriver plus (+) large/medium (No:2, 6,4 x 150mm, No:1, 4 x 150mm)	
9.	Screwdriver minus (-) large/medium (2x150mm), (4x150mm)	
10.	Trimer screwdriver	
11.	Camera	
12.	Portable Genset	
13.	Rectifier mobile	
14.	AC bar jumper	
15.	Clean cloth	
16.	Form Maintenance	
17.	Brush	
18.	Electrical Tape	

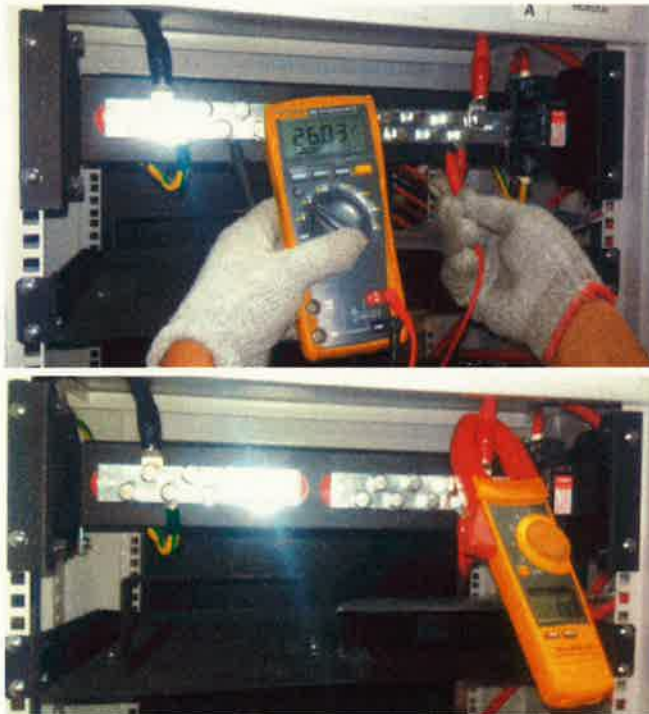
#### **4.2 Indoor Visual Check of Hariff Power System Device**

- a. Fill in the visual check observation form under HPS Maintenance Form.
- b. Check the robustness of the self-supporting/mounting surface of the SPS battery cabinet. Check the tightness of the locking bolts on the self-supporting surface to the floor. Fill the maintenance form accordingly.
- c. Check the wiring and tightness of the cable interconnection to the installed DC distribution subrack. Check the DC distribution and make sure that the DC cable interconnection from the charge controller is well connected to the MCB/fuse. Fill the maintenance form accordingly.
- d. Check the arrester condition by paying attention to the color indication of the arrester status. Fill the maintenance form accordingly.
- e. Check the cable connection on the battery block terminal. Make sure that the cable connection on the battery terminal is strong. Pay attention to the physical condition of the battery, make sure that it is dry and clean. Clean the battery block using damp cloth. Fill the maintenance form accordingly.
- f. Record the Part Number and Serial Number of the battery cabinet. Fill the maintenance form accordingly.

#### **4.3 Functional Check of SPS Cabinet**

##### **Battery Measurement**

- a. InputDC.
- b. Measure the voltage and current of the charge controller.
- c. Measure the voltage and current out of the battery.



**Figure 1. Measurement of DC Voltage and Current**



### **Battery Test**

To test the battery, there are several things to do and prepare, they are:

- ❖ Prepare dummy load current simulation, jumper cable to connect to the existing battery, mobile rectifier, and backup battery. The procedures are:
  - 1) Prepare the dummy load rectifier simulation to test the battery capacity.
  - 2) Prepare the jumper cable on the dummy load (+) and (-) to connect it to the battery pole (+) and (-) on the battery bank that will be tested.
- ❖ Record all batteries that will be tested for their capacity. Record the followings:
  - 1) Record the brand, type, and battery capacity.
  - 2) Record the number of blocks or banks.
  - 3) Specify the discharge current of the load on the load discharge constant current table based on the brand, type, and capacity of the installed battery at the end voltage of 1.8 VPC and 1-hour load discharge time. For Maxlife FGB12-100, the load discharge constant current is 63.1 A.
  - 4) Make sure that the battery for which the capacity will be tested is fully charged.

#### ❖ Battery Temperature Measurement

Check the temperature of each battery block by attaching the temperature meter on the battery container.  
Record the result of the measurement on the Maintenance Form.

#### ❖ Procedures of Battery Capacity Test

##### a. Battery test per block

- 1) Turn off the battery MCB (if using MCB) connected to the battery bank/block and remove the connector of both ends of the battery polarity cable and isolate them.
- 2) Test the existing battery on the SPS cabinet. Measure and record the open circuit voltage of the battery bank and the voltage of each existing battery block. After that, connect the existing battery bank to the dummy load. Give a load current simulation according to the characteristics table of the load discharge constant current for an hour. Assume that, for an hour of load discharge with the constant current, the battery is 100% charged (full). As an example, for a 1-hour load discharge time recorded every 10 minutes, the record is: the initial battery condition after being weighed down by a dummy load (0 minute), 10 minutes, 20 minutes, and so on until minute 60 (1 hour).
- 3) Measure the voltage of the initial condition when the battery is in an open circuit condition. Then, record every X minute rise constantly for an hour to each battery block and bank and record the discharge current of the battery.



**Figure 2. Voltage Measurement on Battery per Bank**

- 4) After the load discharge of the battery is done for an hour, remove the cable connector on the dummy load and charge the battery by reconnecting it to the rectifier system. Charge with boost voltage for an hour.
- 5) Record the result of the load discharge on the Load Discharge Form under the Capacity Record Sheet.

#### **4.4 Separation and Replacement of Battery Block with the Following Characteristics:**

- a. The difference of temperature of each battery block is no higher than 5°C. If the temperature is higher, it could cause damage. Give a mark if there is any indication of damage and give a recommendation to replace the damaged battery.
- b. The test result of the voltage measurement of battery block for load discharge of 63.1A for an hour cannot be less than 10.8VDC. If the result is less than 10.8VDC, it could cause damage to the battery block. Give a mark if there is any indication of damage and give a recommendation to replace the damaged battery.



**Figure 3. Measurement on Per Block Battery**

## **5. PROCEDURES OF TROUBLESHOOTING**

### **5.1 Battery**

If a battery cannot provide backup when the charge controller is off, check the battery with the following procedures:

- Make sure that the battery bank MCB/fuse on the charge controller is on
- Measure the battery voltage for each block. If the battery voltage is dropped or damaged (under 10.8 VDC), charge or replace the battery.



## 5.7.4 Solar Power system

### 1. Monthly maintenance

#### (1) Solar Panel

##### A) Check of damaged

- Check with eyes  
If the surface of the panel was cracked or broken, it may need to be replaced, depending on the situation.
- When the status LED is Blue of Solar Charger even If Solar Panel was damaged, keep the condition, no change Solar Panel.



- When the status LED is no light of Solar Charger even If Solar Panel was not damaged, the Solar Panel shall be replaced.
- When the Solar Panel is failed to function, the Solar Panel shall be replaced.

##### B) Cleaning of the surface for Solar Panel

- Litter is removed promptly from the surface of Solar Panel.
- If the Solar Panel dirty, wash with clear water and dry with soft cloth. Do not use of powder, detergent or abrasive products.



(Picture is just for reference)

##### C) Check of the surrounding tree will be the shadow over the solar panel

- Felling of the branches and leaves which become the shadow in a solar panel.



(Picture is just for reference)



## 2. Every 6 months Maintenance

### (1) Solar Panel, Junction Box, Charge Controller Assembly.

#### A) Check the cabling

- Check cabling whether any damage or not. If the cable damaged, replace cable or cut damage portion and connect new cable.
- When it's the exclusive cable which isn't marketed, make a contact to NEC.

#### B) Check the Bolt

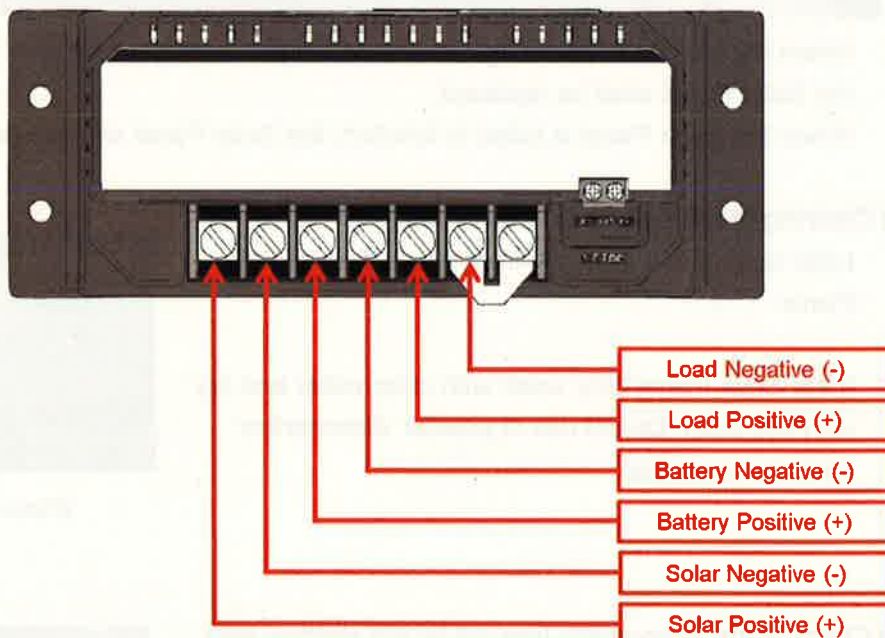
- Check the Mount structure tightens for each bolt connection. If the connection is loose, re-tighten by the correct tools.
- Use a special tool for the round lock nut.

### (2) Charge Controller

#### A) Check the Voltage

- Attach the each to measurement terminal of Multi-meter to plus and minus terminal of charge controller and check the following voltage. If the result is out of voltage, check of the each equipment.

LOAD output Voltage (V)	23.0V – 28.6V
Battery Voltage (V)	23.0V – 28.6V
Array Open Circuit (Solar) Voltage (V)	30V- 50V



B) Check the Status LED

- Check the following Status LED pattern

Color	Indication	Operating State
None	Off (with heartbeat <sup>1</sup> )	Night
Green	On Solid (with heartbeat <sup>2</sup> )	Charging
Red	Flashing	Error
Red	On Solid (with heartbeat <sup>2</sup> )	Critical Error

<sup>1</sup> heartbeat indication flickers the Status LED on briefly every 5 seconds

<sup>2</sup> heartbeat indication flickers the Status LED off briefly every 5 seconds

Status LED Error Indications

- PV High Voltage Disconnect Flashing Red
  - RTS Shorted Flashing Red
  - RTS Disconnected Flashing Red
  - Damaged local temp. Sensor Solid Red \*1
  - Damaged heat sink temp. Sensor Solid Red \*1
  - Damaged input MOSFETs Solid Red \*1
  - Firmware Error Solid Red \*1
- \*1 - Heartbeat indication flickers the Status LED off briefly every 5 seconds

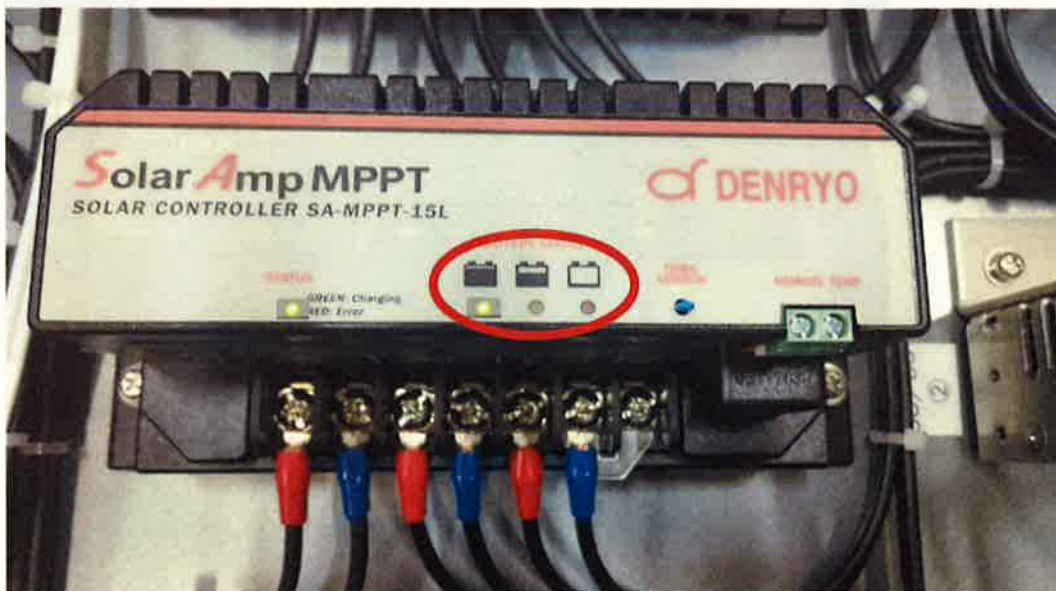


- Check the following Battery LED pattern

SOC LED	Indication	Battery Status	Load Status
Green	Fast Flashing (2 Flashes / sec)	Equalize Charge	Load On
Green	Med. Flashing (1 Flash / sec)	Absorption Charge	Load On
Green	Slow Flashing (1 Flash / 2 sec)	Float Charge	Load On
Green	On solid	Nearly Full	Load On
Yellow	On solid	Half Full	Load On
Red	Flashing (1 Flash / sec)	Battery Low	LVD Warning (Load On)
Red	On solid (Load Off)	Battery Empty	LVD

Battery Status LED Error Indications

- Load High Voltage Disconnect R-G Sequencing
- High Temperature Disconnect R-Y Sequencing
- Remote Temp. Sensor Error Y/R - G/Y Sequencing
- External Wiring Error G/R-Y Sequencing
- Load Overcurrent Y/R-G Sequencing
- Load Short Circuit G/R-Y Sequencing
- Custom Set Points Update G/Y/R Flashing
- Self-test Error R-Y-G Sequencing



### (3) Battery

#### A) Check item every 6-month

- Check the terminal connection. If terminal connection is loose, re-tighten the terminal using correct screw driver.
- Check the shape of the each battery if there is any abnormal expansion.
- Check the terminal corrosion. If the terminal is corroded, wipe by the dried cloth.
- Check no liquid spill. If the liquid is spilled, wipe by the dried cloth.

### 3. Check after the natural and human disaster

Check for just after the natural disaster (typhoon, heavy rain, flood, whirlwind, landslide, thunderbolt, eruption, etc.) and human disaster (fire, vibration, land subsidence, traffic accident, etc.) for equipment damage.

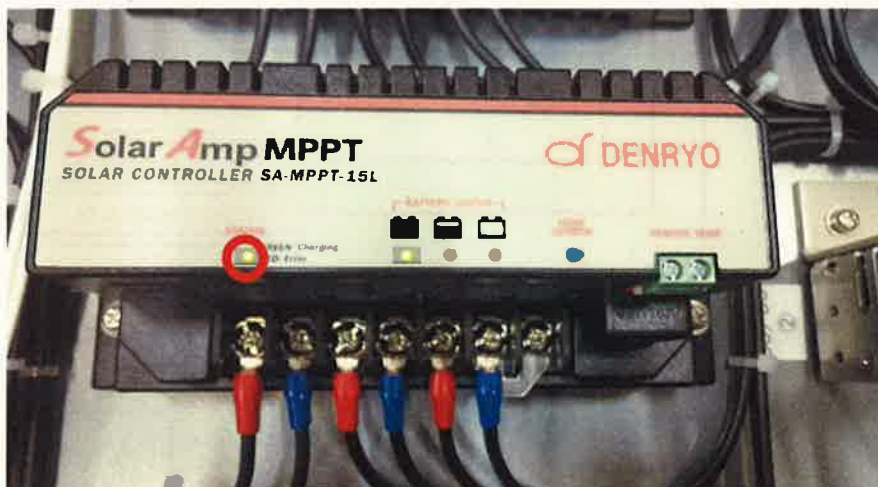
#### (1) Solar panel, Junction box, charge controller, etc.

- Check with eyes external.

#### (2) Solar Panel

##### A) Check of damaged

- When the status LED is Green of Solar Charger even If Solar Panel was damaged, keep the condition, no change Solar Panel.



- When the status LED is no light of Solar Charger even If Solar Panel was not damaged, the Solar Panel shall be replaced.
- When the Solar Panel is failed to function, the Solar Panel shall be replaced.

##### B) Cleaning of the surface for Solar Panel

- Litter is removed promptly from the surface of Solar Panel.
- If the Solar Panel is dirty, wash with clear water and dry with soft cloth. Do not use of powder, detergent or abrasive products.



(5) Equipment Enclosure

A) Cleaning of the inside for Equipment Enclosure

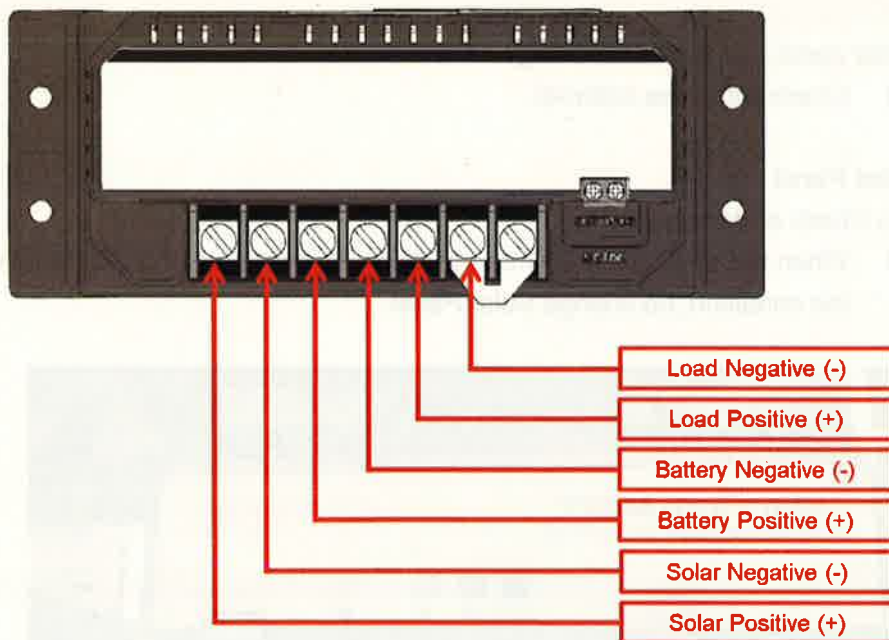
- If the inside of the Equipment Enclosure becomes soggy, it's wiped up by dried cloth for each material in the Equipment Enclosure.

(6) Charge Controller (Solar Charger)

A) Check the Voltage

- Attach the each to measurement terminal of Multi-meter to plus and minus terminal of charge controller and check the following voltage. If the result is out of voltage, check of the each equipment.

LOAD output Voltage (V)	23.0V – 28.6V
Battery Voltage (V)	23.0V – 28.6V
Array Open Circuit (Solar) Voltage (V)	30V- 50V



B) Check the Status LED

- Check the following Status LED pattern

Color	Indication	Operating State
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Red	Flashing	Error
Red	On Solid (with heartbeat <sup>2</sup> )	Critical Error

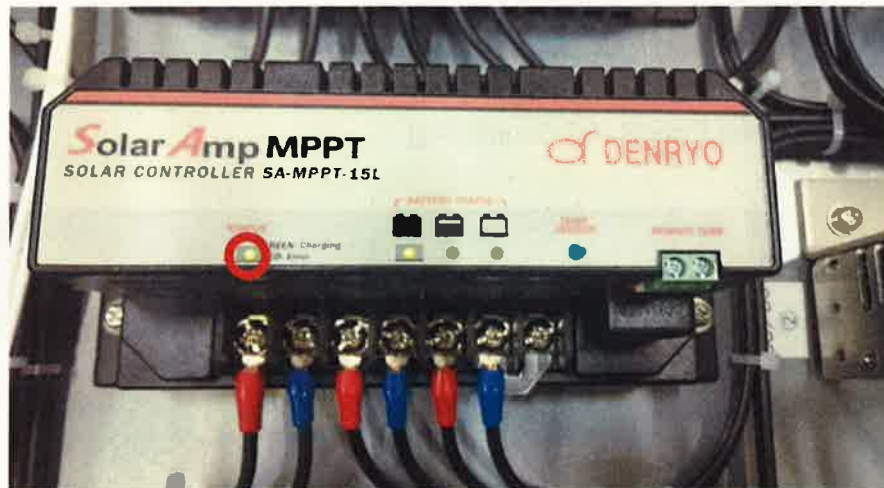
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Status LED Error Indications

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- RTS Shorted Flashing Red
- RTS Disconnected Flashing Red
- Damaged local temp. Sensor Solid Red \*1
- Damaged heat sink temp. Sensor Solid Red \*1
- Damaged input MOSFETs Solid Red \*1
- Firmware Error Solid Red \*1

\*1 - Heartbeat indication flickers the Status LED off briefly every 5 seconds

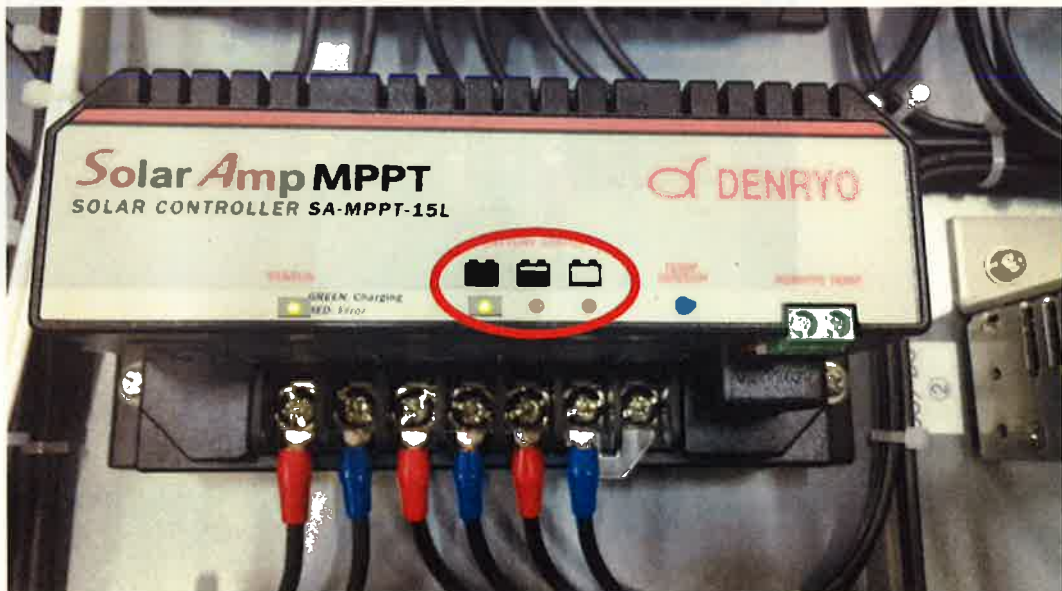


● Check the following Battery LED pattern

SOC LED	Indication	Battery Status	Load Status
Green	Fast Flashing (2 Flashes / sec)	Equalize Charge	Load On
Green	Med. Flashing (1 Flash / sec)	Absorption Charge	Load On
Green	Slow Flashing (1 Flash / 2 sec)	Float Charge	Load On
Green	On solid	Nearly Full	Load On
Yellow	On solid	Half Full	Load On
Red	Flashing (1 Flash / sec)	Battery Low	LVD Warning (Load On)
Red	On solid (Load Off)	Battery Empty	LVD

Battery Status LED Error Indications

- Load High Voltage Disconnect R-G Sequencing
- High Temperature Disconnect R-Y Sequencing
- Remote Temp. Sensor Error Y/R - G/Y Sequencing
- External Wiring Error G/R-Y Sequencing
- Load Overcurrent Y/R-G Sequencing
- Load Short Circuit G/R-Y Sequencing
- Custom Set Points Update G/Y/R Flashing
- Self-test Error R-Y-G Sequencing



(7) Arrester

A) Check of Damaged

- When the circuit didn't connect (for example, the earthquake intensity data is not transfer to server or, Status LED is became to red...etc.) after thunderbolt, a plug of the arrester is removed.
- If the circuit connects after the removed the plug of arrester, the plug is replace, because the plug of arrester had damaged.
- Before the plug of arrester is removed. Must be power off for your safety.





#### 4. Precautions to observe when performing connection and disconnection of the equipment

To avoid the damage of the equipment during the installation work and replacement work, refer to the following precautions.

- An electrical engineering work is required to have the licensed electrician or the engineer who has enough knowledge to manage the equipment installation work.
- To connect the battery cable is at the end of the connection work.
- To disconnect the battery cable is at the beginning of disconnection work.
- To avoid the short circuit, provide excellent electrical insulation.
- Be careful not to short-circuit. Solar panel supplies the power already.
- Be careful not to short-circuit. Battery supplies the power.
- Make sure that the connection of terminal of all equipment is correct, especially polarity.
- The order of connecting the solar panel cable to the terminal block is from positive terminal, then negative terminal.
- The order of connecting the battery cable to the terminal block is from positive terminal, then negative terminal.
- The order of disconnecting the battery cable from the terminal block is from negative terminal, then positive terminal.
- The order of disconnecting the solar panel cable from the terminal block is from negative terminal, then positive terminal.

#### 5. Confirmation of environment around the site

Check for the environmental change around the site by which observation activity is affected.

##### (1) Solar Panel

###### A) Check of the plan for Construction project around the site

- Whether a solar panel will be the shadow will ask a relevant company for opinions.
- When an observation is affected, We will consider relocation.

## 6. Appendix

### Detail Procedure

Attachment-1 Broadband seismograph (velocity meter)

Attachment-2 Broadband strong motion seismograph (velocity meter)

Attachment-3 Digitizer for velocity meters

Attachment-4 Strong motion seismograph (accelerometer) (sensor) and

Digitizer for strong motion seismograph (accelerometer) (processor)

Attachment-5 Satellite communication system

Attachment-6 Commercial power system and

Solar power system

Attachment-7 Wireless communication system

Attachment-8 Storage box

Attachment-9 External Diagnostics Equipment

