

# **Instruction Manual**

## **Isolation Probe**

**SE-6000**

**SE-6011**

**CE**

**IWATSU ELECTRIC CO., LTD.**



# Introduction

- ◇ Thank you very much for your instrument purchase of our products.
- ◇ Use your instrument only after thoroughly reading this manual and understanding its contents. After reading this manual, keep it in a safe place for future reference.
- ◇ This manual consists of the following two volumes.
  - Instruction Manual: Precautions for handling, operation methods, functions, and specifications of this instrument
  - Remote Control Manual: Remote control methods and usable commands

## Cautions for safe use

Matters that must be observed for safe operation of this instrument and for prevention of injury to humans or damage to property are described as “ Warning” and “ Caution” in this manual. The warning and caution symbols are marked on the panel and are used to invoke careful handling.

### Explanations of “ Warning” and “ Caution” columns in this manual

 <b>Warning</b>	Incorrect operation or failure to heed warnings may cause death or serious injury.
 <b>Caution</b>	Incorrect operation or failure to heed cautions may cause an injury or damage to equipment.

### Explanation of the symbols on the panel

 Electric Shock	This symbol indicates that incorrect handling of this instrument may cause electrical shock. Read the instructions in Instruction Manual for how to protect yourself.
 Warning Symbol	This symbol is used in reference with the statements in Instruction Manual to protect the user against injury and to protect this instrument against damage.

## Cautions

- ◇ This manual may be modified without notice to accommodate improvements in performance and function.
- ◇ Reproduction of the contents of this manual, in part or whole, without previous consent is prohibited.
- ◇ For questions about this instrument, contact Iwatsu office or our sales distributors.

## History

- ◇ July 2016: Issue of the 1st edition

Read the following safety information. [Read the next page.]

## Warnings

- **To prevent electrical shock, never touch the probe cable if a circuit to be measured is connected to the Isolation Unit during measurement.**

For explanations of floating measurement, refer to “7.1 Precautions when using probes during floating measurement.”

- **Never touch the probe cable or BNC cable during measurement or voltage application. Even after measurement, turn off the power to the target to be measured, and be sure to discharge electrical charge by selecting either Method 1 or Method 2 below, whichever is safer. Never touch these parts until safety is confirmed (Isolation Unit).**

Touching the probe cable or BNC cable during measurement or voltage application may cause electrical shock, fire, or unit malfunction.

- Method 1: Discharge the electrical charge through the target to be measured by using a grounding rod, etc.
- Method 2: Discharge the electrical charge through the earth terminal inside the front insulation cover of the Isolation Unit by using a grounding rod, etc. Never touch any parts inside the Isolation Unit except the earth terminal.

- **This instrument is capable of floating measurement. Nevertheless, be aware of the relations among the input withstand voltage, measurement potential, and reference potential, and take into consideration the operating ratings of the outer sheath of the coaxial cable and ground leads (Isolation Unit).**

When performing floating measurement by using the voltage probe, the reference potential must not be raised to the input withstand voltage. The reference potential that can be used for floating is determined by the rated voltage of the outer sheath of the coaxial cable of the probe and GND leads.

Measurement without taking into consideration the relation among the input withstand voltage, measurement potential, and reference potential, and the operating ratings of the outer sheath of the coaxial cable and GND cable may cause an electrical shock, fire, or failure.

For details about the recommended probe and rated operating voltage of this instrument, and for examples of connection for floating measurement, refer to “7.1 Precautions when using probes during floating measurement.”

Read the following safety information. [Read the next page.]

## Warnings (cont'd)

### ● When exchanging the input signal or ending the operation after measurement, turn off the target to be measured, and be sure to discharge electrical charge by selecting either Method 1 or Method 2 below, whichever is safer.

Failure to do so may cause an electrical shock or instrument malfunction.

- Method 1: Discharge the electrical charge through the target to be measured by using a grounding rod, etc.
- Method 2: Discharge the electrical charge through the earth terminal inside the front insulation cover of the Isolation Unit by using a grounding rod, etc. Never touch any parts inside the Isolation Unit except the earth terminal. Take the following steps.
  - (1) Turn off the power to the circuit to be measured.
  - (2) Turn the POWER switch to standby.
  - (3) Open the insulation cover.
  - (4) Discharge through the earth terminal by using a grounding rod, etc.
  - (5) Disconnect the probe and measuring cable.

### ● If the red LED turns on when setting the battery pack to the battery charger, stop charging and do not use the battery pack.

If you continue using the battery pack, it may cause fire or unit malfunction.

Consult Iwatsu office or our sales distributors.

If the red LED blinks when setting the battery pack to the battery charger, calibration of the battery pack is necessary. Use the charging and calibration mode. (See 2.2.3)

### ● If smoke, abnormal odor, or abnormal sound emanates from this instrument, immediately take the following actions and disconnect the power cord from the receptacle.

#### Isolation Unit:

- (1) Turn off the power to the circuit to be measured.
- (2) Turn the POWER switch to standby.
- (3) Open the insulation cover.
- (4) Discharge through the earth terminal by using a grounding rod, etc.
- (5) Disconnect the probe and measuring cable.
- (6) Remove the battery pack.

#### Isolation Amplifier:

- (1) Turn off the power switch.
- (2) Disconnect the power plug from the receptacle.

Failure to do so may cause an electrical shock or fire. After taking the above actions, contact Iwatsu office or our sales distributors for repair. Never repair this instrument by yourself, doing so is dangerous.

Read the following safety information. [Read the next page.]



## Warnings (cont'd)

### ● Do not use this instrument near an explosive gas.

Using this instrument near an explosive gas may cause an explosion.

### ● Take care not to allow moisture to enter this instrument or allow this instrument to become wet.

Using this instrument while wet may cause an electrical shock or fire. If water or other foreign matter enters this instrument, after turning the power switch off (Isolation Amplifier: “●”, Isolation Unit: “standby” where the switch is turned to ☺ position), and disconnecting the power plug from the receptacle, contact Iwatsu office or our sales distributors for repair.

### ● Do not touch the power cord plug with wet hands.

Doing so may cause an electric shock.

### ● Do not place this instrument on an unstable foundation such as a shaky stand or incline.

Placing this instrument on an unstable foundation may lead to this instrument dropping or tipping over, which may cause an electric shock, injury, or fire. If this instrument has been dropped or its cover has been damaged, after turning the power switch off (Isolation Amplifier: “●”, Isolation Unit: “standby” where the switch is turned to ☺ position), and disconnecting the power plug from the receptacle, contact Iwatsu office or our sales distributors for repair.

### ● Do not allow any foreign matter such as metal or an inflammable substance to enter through the air vent or elsewhere.

Foreign matter may cause a fire, electrical shock, or malfunction of the unit. If any foreign matter enters, after turning the power switch off (Isolation Amplifier: “●”, Isolation Unit: “standby” where the switch is turned to ☺ position), and disconnecting the power plug from the receptacle, contact Iwatsu office or our sales distributors for repair.

### ● Use a 3-core power cord for the Isolation Amplifier.

Failure to use a 3-core power cord for the Isolation Amplifier may cause a fire, an electrical shock or malfunction of the unit.

- When supplying power from a 2-wire receptacle using a 3-core/2-core conversion adapter, be sure to connect the grounding terminal of the 3-core/2-core conversion adapter to the ground.
- When supplying power from a 3-wire receptacle using the provided 3-core power cord, the main unit is grounded by the grounding wire of the power cord.

Read the following safety information. [Read the next page.]



## Warnings (cont'd)

### ● Use this instrument with the rated power supply voltage. (Isolation Amplifier)

Use of this instrument with a voltage other than that specified may cause an electrical shock, fire, or power failure. The usable power supply voltage range is marked on the rear panel.

### ● Do not remove the insulation cover, cover, or panel.

There are high-voltage parts inside the cover and panel. Touching them may cause an electrical shock. Contact Iwatsu office or our sales distributors for inspection, calibration, or repair.

### ● When handling the power cord, strictly observe the following:

Failure to heed the following may cause an electrical shock, fire, or power failure. If the power cord has been damaged, contact Iwatsu office or our sales distributors for repair.

- Do not modify the power cord.
- Do not forcibly bend the power cord.
- Do not twist the power cord.
- Do not bundle the power cord.
- Do not pull the power cord.
- Do not heat the power cord.
- Do not get the power cord wet.
- Do not place heavy objects on the power cord.

### ● Do not modify or repair this instrument.

Modification or repair by the customer may cause an electric shock, fire, or malfunction. This instrument cannot be repaired by the customer. Do not repair this instrument by opening the cover. Contact Iwatsu office or our sales distributors for repair. Note that we cannot undertake the repair if the seal for tampering detection has been peeled off, the cover has been opened, or modification has been done.

### ● Insert the power plug to the receptacle securely after confirming that no dust is adhering. Check and clean the power plug and power adaptor once every six months or a year, disconnecting them from the receptacle.

Unclean power plugs may cause an electric shock, fire, or malfunction.

### ● Do not let a metallic object touch the power plug pins.

A metallic object contacting the power plug may cause an electric shock, fire, or malfunction.

### ● Do not connect two or more plugs to one receptacle.

Doing so may cause a fire or cause the plugs to overheat.

Read the following safety information. [Read the next page.]



## Warnings (cont'd)

- **Do not place a container with water or chemicals inside, or a small metallic object directly on or nearby this instrument.**

If such liquid or metallic object spills over or enters into this instrument, an electric shock, fire, or malfunction may result. If water, chemicals, or a metallic object enters inside, after turning the power switch off (Isolation Amplifier: “●”, Isolation Unit: “standby” where the switch is turned to ⏏ position), and disconnecting the power plug of the Isolation Amplifier from the receptacle, contact Iwatsu office or our sales distributors for repair.

- **Do not place this instrument where it may be subject to vibration or shock.**

If this instrument drops or tips over, injury or malfunction may result.

- **Dropping of this instrument may cause injury to the human body or damage to objects.**

When carrying this instrument, disconnect the target to be measured, probes, and cables, and hold the handle and handgrip tightly to prevent dropping.

- **If lightning occurs in the area nearby, turn the power switch off, and disconnect the power plug of the Isolation Amplifier from the receptacle.**

A lightning strike may cause an electric shock, fire, or malfunction.

- **Do not use this instrument if it has failed.**

Continuing to use a failed instrument due to dropping, etc., may cause an electric shock or fire.

In case of failure, after turning the power switch off (Isolation Amplifier: “●”, Isolation Unit: “standby” where the switch is turned to ⏏ position), and disconnecting the power plug of the Isolation Amplifier from the receptacle, contact Iwatsu office or our sales distributors for repair.

- **Do not use excluding the accessory of our specification.**

- **Be sure to use the battery of our specification.**

- **Ahead of the use, confirm neither probe nor cables connected with SE-6011 are damaged.**

Read the following safety information. [Read the next page.]

## **Cautions**

● **Be sure to use a 3-core power cord suitable for the supply voltage.**

The use of a power cord that is not suitable for the supply voltage may cause fire. Also, the use of a 2-core power cord may cause an electrical shock.

Unless specified otherwise at the time of purchase, a power cord rated for 100V system (90V to 132V) is provided. If the supply voltage is 200V system (180V to 250V), use the optional 200V 3-core power cord (rating: 250V) designated by IWATSU.

● **Place this instrument properly so that power cord can be easily unplugged.**

If this instrument becomes in a dangerous condition, power supply should be shut down immediately. Do not place this instrument in a place where the power cord cannot be readily unplugged.

● **When disconnecting the power cord from the receptacle, pull it by holding the power plug.**

Pulling by the power cord may damage the cord and may cause an electrical shock or fire.

● **Do not use the power cord supplied with this instrument for any other electric equipment.**

The power cord supplied with this instrument must not be used with any other electric equipment, according to the Japanese law for electrical instrument safety.

● **Do not use a damaged power cord, cable, or adaptor.**

Using a damaged power cord, cable, or adaptor may cause an electric shock, fire, or malfunction.

● **Do not place anything on this instrument.**

Placing an object on this instrument may cause an electric shock, fire, or malfunction.

● **Do not place anything in the vicinity of the air vent of this instrument.**

Placing an object in the vicinity of the air vent may cause internal heat generation, causing fire or malfunction.

● **Provide sufficient space behind the rear panel and on both sides of this instrument.**

Note that the temperature may rise if this instrument is mounted in a rack or on another measuring instrument, resulting in faulty operation or performance.

● **Do not place this instrument in an atmosphere containing a high degree of moisture (e.g., bathroom) or dust.**

Placing this instrument in an atmosphere containing a high degree of moisture, where dew condensation is possible, or dust may cause an electric shock, fire, or malfunction.

● **When probes, measuring cables, or the like are connected to this instrument, do not let this instrument tip over by pulling them.**

If this instrument tips over, an electric shock, injury, or fire may result.

● **Do not place this instrument in a place exposed to direct sunlight or subject to high degree of moisture.**

If this instrument is exposed to direct sunlight, the temperature inside this instrument may rise, causing a fire.

● **Do not use this instrument by method of no regulations with this instruction manual.**

If not, protection means does not function.

Read the following safety information. [Read the next page.]

## **Cautions** (cont'd)

● **Always use this instrument only within the rated operating environment range.**

Operation or storage of this instrument out of the rated environment range may cause malfunction. The environment range in which this instrument may be used is as follows:

<Isolation Amplifier SE-6000>

- Installation: Indoor use only
- Operating temperature: 0°C to +40°C
- Operating humidity: below the moisture amount of 5 to 80%RH  
(30°C or less, no dew condensation)
- Operating altitude: 2000m

<Isolation Unit SE-6011>

- Installation: Indoor use only
- Operating temperature: -15°C to +50°C
- Operating humidity: below the moisture amount of 5 to 80%RH  
(30°C or less, no dew condensation)
- Operating altitude: 2000m

● **When this instrument is not used for a long time, disconnect the power plug from the receptacle.**

● **When transporting this instrument, be sure to use the original packing material that came with this instrument or other packing material that is of equal or superior quality.**

Large vibrations or shocks applied to this instrument during transportation may cause a power failure or a fire. If no appropriate packing material or cushion material is available, contact Iwatsu office or our sales distributors. When using a carrier, label "precision machine" on each face of the packing box.

● **For your safety, disconnect the power plug from the receptacle before maintenance. In addition, wipe off with a dry cloth when water droplets are attached.**

Cleaning without disconnecting the power plug from the receptacle or using with water droplets may cause an electric shock or malfunction.

● **Do not use for a prolonged period without cleaning the inside.**

If you use this instrument for a prolonged period without cleaning dust inside, fire or malfunction may result. We recommend to order Iwatsu office or our sales distributors for inside cleaning together with periodical inspection and calibration once a year or so.

● **Do not apply a voltage higher than that rated to the input terminals of the Isolation Unit.**

Applying a voltage (including the transient overvoltage) exceeding the rating could cause a failure. The maximum voltages that can be applied are as follows:

- Between BNC center contact and BNC shell: 400Vpeak
- Between BNC shell (casing) and earth: 1kVpeak

● **When inserting the optical fiber cable into the Isolation Amplifier or Isolation Unit, remove the protective cap, hold the connector (blue) on the optical fiber cable side, and insert until it clicks into place.**

When inserting the connector, insert straight.

A cap is attached to the optical fiber cable to protect the edge of the optical fiber cable (from damage and dust). Do not lose the cap. Store the optical fiber cable with the cap attached.

● **Do not forcibly pull the optical fiber cable.**

The optical fiber may be damaged.

Read the following safety information.

## **Cautions** (cont'd)

- **Do not forcibly bend the optical fiber cable.**

Minimum bending radius of the cable is 15mm. Bending the cable further may damage it.

- **When disconnecting the optical fiber cable from the Isolation Amplifier or Isolation Unit, pull the plug while pushing the lock lever (upper side of plug) of the connector plug (blue part).**

- **The Isolation Unit and Isolation Amplifier use an optical transceiver classified as semiconductor laser Class 1. If the protective cap of optical fiber is removed or the optical fiber is disconnected from this instrument during operation, invisible laser light will be emitted outwardly. Do not look at the emitted light directly or through lenses.**

Semiconductor laser Class 1 is supposed to be not harmful to human eyes, but we recommend not looking directly at the emitted laser light. When an optical fiber cable is not used, put the protective cap on.

- **Be sure to detach the battery from the isolation unit when there is no schedule for use in the transportation of the isolation unit (By aircraft, ship, and car, etc.) and keeping, etc.**

The packing work and unexpected reason may cause the POWER switch to turn on. Leaving the POWER switch on may cause the battery to become an overelectrical discharge and not to be able to be used.

- **Do not transport the battery pack when it is fully charged.**

**When you airlift the battery pack, please confirm the level indicator of the battery is 1(■).**

**When you transport the battery pack by other way, please confirm the level indicator of the battery is 2(■■) or 3(■■■).**

If the level indicator is not in the range of the above-mentioned, please charge or discharge the battery pack.

Before transporting the battery pack by air or sea, sufficiently check with your transportation agency.

- **Do not short-circuit the battery pack.**

- **Do not soak the battery pack in water.**

- **Do not disassemble or modify the battery pack.**

- **Do not expose the battery pack to heat or flame.**

- **Do not apply a shock or vibration to the battery pack.**

- **Keep the battery packs out of the reach of children.**

- **If operation of a battery pack seems abnormal, stop using it.**

- **Charge the battery pack by the specified method (see 2.2.3).**

- **Do not use the battery pack for any purpose other than as intended with this system.**

- **Store the battery pack in a dry, ventilated, and cool location.**

- **Do not store the battery pack for a prolonged period with a full charged.**

Doing so may shorten the battery pack life.

Confirm that the level indicator of the battery pack shows level 2 (■■) or level 3 (■■■). If the level indicator is not within this range, charge or discharge the battery pack before putting it into storage.

- **Be sure to charge the battery pack once every six months or so, because over discharging will make the battery pack unusable.**

To avoid over discharge, it is recommended that you keep the level indicator of battery pack at level 2 (■■) or level 3 (■■■).

- **This instrument uses a dedicated battery pack. Replacing the battery pack with an incorrect type poses a risk of explosion. When the service life of a battery pack has ended, be sure to purchase the correct new battery pack from IWATSU.**

# Checking packed materials

When receiving this instrument, confirm the type and number of the instrument, and check the main unit and accessories while referring to the following “Components.” (For unpacking, see next page.) If there is a missing item or an item damaged during transportation, immediately contact Iwatsu office or our sales distributors.

## Components

### ◆ Isolation Amplifier SE-6000

- Main unit .....1
- <Accessories>
  - Power cord .....1
  - Cord strap.....1
  - CD (with PDF data of Instruction Manual) .....1
  - User's Guide.....1

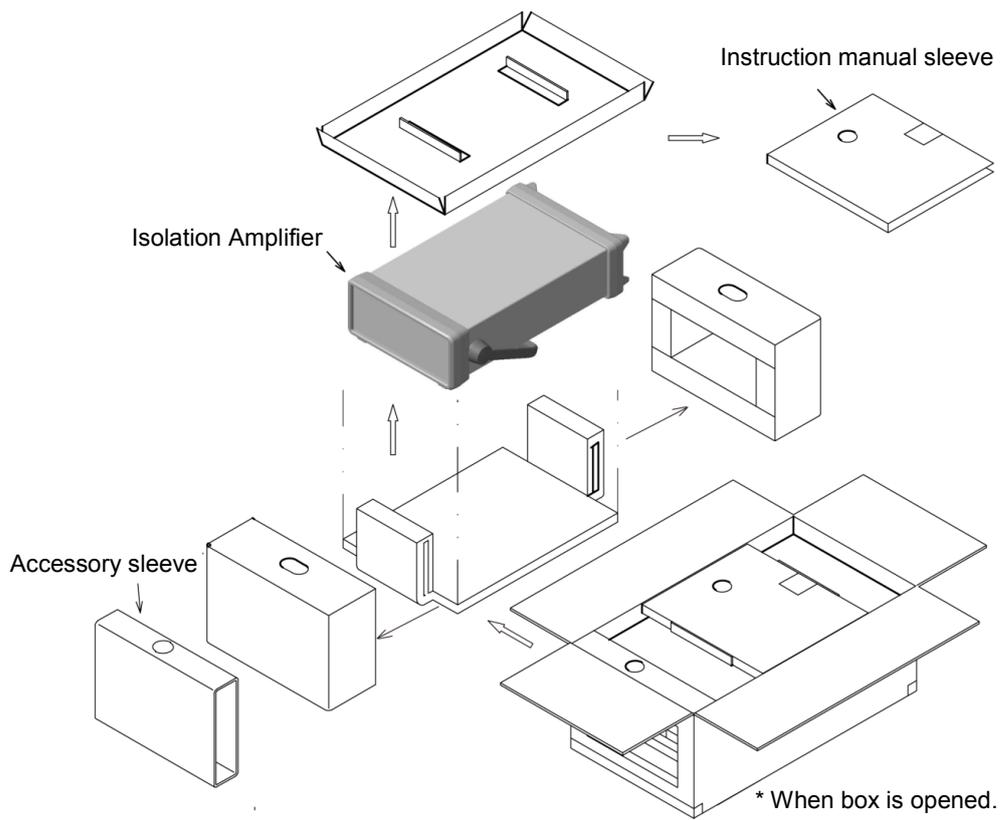
### ◆ Isolation Unit SE-6011

- Main unit .....1
- <Accessories>
  - User's Guide.....1

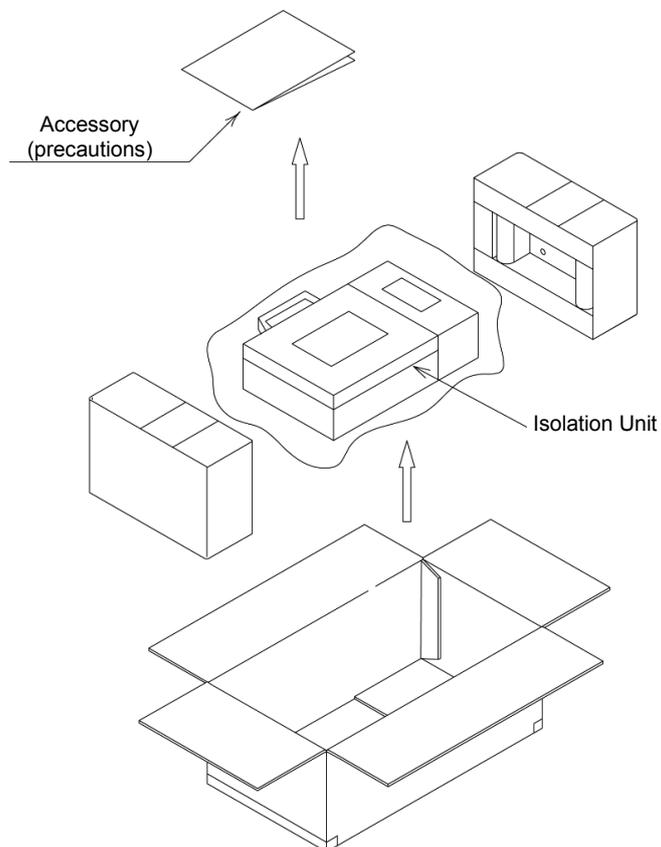
### ◆ Optical fiber cable

- SE-605 (3m)
- SE-606 (10m)
- SE-607 (50m)

## Unpacking (Isolation Amplifier SE-6000)



## Unpacking (Isolation Unit SE-6011)



## Management of instrument

When disposing of this instrument, it must be recycled or disposed of properly in accordance with local laws or regulations. When disposing of it, request a recycling company to dispose of it in accordance with local laws or regulations.

## Repair and sending instrument to be repaired

If a failure occurs, send this instrument to Iwatsu office or our sales distributors. Malfunctions that occur during the warranty period due to our responsibility will be repaired by us free of charge.

When sending an instrument to be repaired, clearly write the instrument name, serial number (in the label on the rear of this instrument), description of the failure, and the name, division, and telephone number of the responsible person.

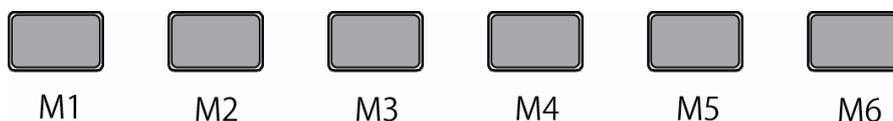
## How to read Instruction Manual

- This instrument consists of an Isolation Amplifier, Isolation Unit, battery pack, and optical fiber cable. Unless noted otherwise, explanation of the functions written in this document refers to the system as a whole. In the explanation of each unit, the name of the unit is indicated; i.e., Isolation Amplifier, Isolation Unit, battery pack, or optical fiber cable.

- Operation keys described in each section are shown as the example below.

Example:  key is shown as [SYSTEM] key.

- For explanation of operation procedures, menu keys at the bottom of the LCD screen are named M1 to M6 as shown below.



- n in "CHn" is from 1 to 4, which shows the channel number of CH1 to CH4, respectively.
- Examples of Caution! and Memo!

◇Example of **Caution!**

### Caution!

Dew condensation may occur due to sudden change in temperature if you move this instrument to another place with different temperature or humidity.  
If you need to move this instrument, avoid sudden change in temperature by taking time to move.

◇Example of **Memo!**

### Memo!

Two battery packs can be installed to one Isolation Unit, but it can be operated with only one battery pack.

## Firmware version update

For firmware version update, contact our salesperson or visit our web page (<http://www.iti.iwatsu.co.jp>).  
See "4.4.1 MISC/FIRMWARE UPDATE menu" for updating procedures.

# **Instruction Manual**



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# Contents

Introduction .....	i
Cautions for safe use .....	i
Warnings .....	ii
Cautions .....	vii
Checking packed materials .....	x
Components .....	x
Unpacking (Isolation Amplifier SE-6000) .....	xi
Unpacking (Isolation Unit SE-6011) .....	xi
Management of instrument .....	xii
Repair and sending instrument to be repaired .....	xii
How to read Instruction Manual .....	xii
Firmware version update .....	xii
<b>Chapter 1 Overview .....</b>	<b>1-1</b>
1.1 Applications .....	1-2
1.2 Characteristics .....	1-2
1.3 System configuration and overview (functions) .....	1-3
1.4 Options/Accessories .....	1-4
<b>Chapter 2 Exterior features and basic operations .....</b>	<b>2-1</b>
2.1 Exterior features of Isolation Amplifier (SE-6000) and its overview .....	2-2
2.1.1 Exterior features of front panel and its overview .....	2-2
2.1.2 Exterior features of rear panel and its overview .....	2-5
2.2 Exterior features of Isolation Unit (SE-6011), related parts, and overview .....	2-6
2.2.1 Exterior features of front panel and its overview .....	2-6
2.2.2 Battery pack .....	2-8
2.2.3 Charging battery pack .....	2-13
2.2.4 Insulation cover .....	2-15
2.2.5 Protection function for temperature (Overheat prevention) .....	2-16
2.3 Screen layout and basics of menus .....	2-17
2.3.1 Screen layout .....	2-17
2.3.2 Basics of menus .....	2-19
<b>Chapter 3 Installation and preparations .....</b>	<b>3-1</b>
3.1 Precautions for installation .....	3-2
3.1.1 Installation conditions .....	3-2
3.1.2 Installation states .....	3-3

---

3.1.3	Power cord connection/power on (Isolation Amplifier SE-6000).....	3-5
3.2	Connection of instruments.....	3-6
3.3	System startup .....	3-7
<b>Chapter 4</b>	<b>Function setting.....</b>	<b>4-1</b>
4.1	CH menu .....	4-2
4.1.1	RANGE.....	4-4
4.1.2	BANDWIDTH .....	4-9
4.2	SAVE menu.....	4-10
4.3	RECALL menu .....	4-13
4.4	SYSTEM menu.....	4-16
4.4.1	MISC/FIRMWARE UPDATE menu.....	4-18
4.4.2	ABOUT menu.....	4-21
<b>Chapter 5</b>	<b>Daily check and calibration .....</b>	<b>5-1</b>
5.1	Daily maintenance.....	5-2
5.2	Maintenance.....	5-2
5.3	Calibration .....	5-2
5.3.1	Regular calibration .....	5-2
5.3.2	SELF CALIBRATION menu .....	5-3
5.4	Repair and sending product for repair.....	5-6
5.5	Storage and transportation.....	5-6
<b>Chapter 6</b>	<b>Specifications .....</b>	<b>6-1</b>
6.1	Specifications .....	6-2
6.1.1	Isolation Unit (SE-6011).....	6-2
6.1.2	Isolation Amplifier (SE-6000) .....	6-4
6.1.3	Options.....	6-5
6.2	Compliance.....	6-6
6.3	Appearance .....	6-7
6.3.1	Isolation Unit (SE-6011).....	6-7
6.3.2	Isolation Amplifier (SE-6000) .....	6-8
<b>Chapter 7</b>	<b>Measurements .....</b>	<b>7-1</b>
7.1	Precautions when using probes during floating measurement .....	7-2
7.2	Message display.....	7-4

## Product Warranty

# 1 234567

## Chapter 1 Overview

### 1.1 Applications

This Isolation Probe (referred to as “this instrument” hereinafter) has been developed for the applications exemplified as follows.

- For the analysis of generating mechanism for the failure parts of power plants, large industrial machineries, etc.
- For developing new technologies of power electronics instruments, measurement of high voltage such as railroad applications, remote control and measurement, etc.

### 1.2 Characteristics

This instrument is a system consisting of an Isolation Amplifier (SE-6000), Isolation Unit (SE-6011), battery pack, and optical fiber cable (see 1.3). Characteristics of this system will be explained below.

#### (1) Wide bandwidth

It has a bandwidth of 30MHz, and can be used with such digital oscilloscopes as our ViewGo II series.

#### (2) High voltage measurements

High voltage measurement can be carried out safely, because the Isolation Unit (measurement unit) and Isolation Amplifier (operation unit) are electrically isolated by optical fiber cable.

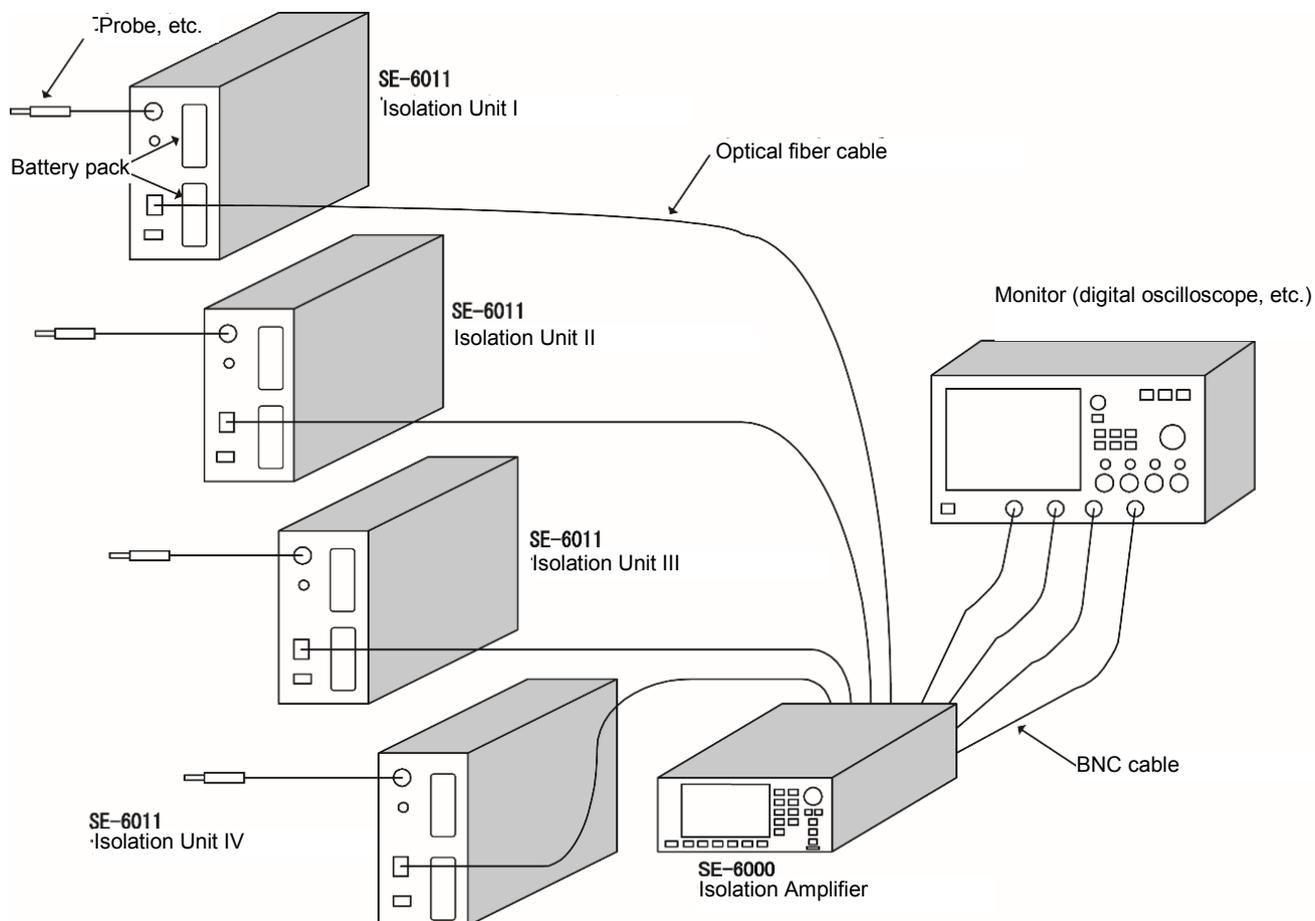
Additionally, measurements with low common mode noise, thereby obtaining data with small distortion, can be performed because the Isolation Unit is driven by the battery pack.

#### (3) Measurements from a distance

Measurements from a distant place (50m with optical fiber SE-607) are possible, because the Isolation Amplifier and Isolation Unit are connected by optical fiber cable.

### 1.3 System configuration and overview (functions)

This instrument is a system where the Isolation Amplifier (SE-6000) and Isolation Unit (SE-6011) are connected by optical fiber cable. (See Figure 1.1)



\* Monitor (oscilloscope etc.), probes, and BNC cables shown above are not attached to this instrument as standard.

**Figure 1.1 System image of this instrument**

A measurement signal is captured by such device as a probe which is connected to the Isolation Unit. The captured analog signal is digitized and converted to an optical signal by E/O conversion within the Isolation Unit. The converted digital optical signal is then transmitted by optical fiber cable to the input of the Isolation Amplifier.

This optical digital signal will be converted back to an electrical signal in the Isolation Amplifier by O/E conversion, and the signal is further converted back to an analog signal which will be output to monitors such as oscilloscopes.

The Isolation Amplifier has a screen for setting and monitoring to control Isolation Units remotely. Ranges, offsets, etc., of Isolation Units are configured with a menu screen, and then control commands are sent through optical fiber cable for the control of each Isolation Unit.

These functions of this system enable you to measure high voltage signals, etc., safely and precisely.

### 1.4 Options/Accessories

Options and accessories specially designed for this instrument are as shown below.

See “6.1.3 Options” for details of options.

#### Options

SE-605/SE-606/SE-607	Optical fiber cables (3m/10m/50m)
NH2054	Battery pack (one set)
CH5050A	Battery charger

#### Accessories

The accessories shown below can be purchased separately from the accessories shown on page x.

- Instruction Manual (CD)
- User's Guide (paper format)

Please order spare parts from Iwatsu office or our sales distributors.

# 1 2 34567

## Chapter 2 Exterior features and basic operations

In this chapter, exterior features and basic operations of this instrument are explained as follows.

- 2.1: Isolation Amplifier
- 2.2: Isolation Unit, battery pack, battery charger, insulation cover, etc.
- 2.3: Screen layout and basic operations of this instrument

## 2.1 Exterior features of Isolation Amplifier (SE-6000) and its overview

Exterior features and the overview of the front panel are explained in 2.1.1, and those of the rear panel in 2.1.2.

### 2.1.1 Exterior features of front panel and its overview

The front panel of Isolation Amplifier is shown in Figure 2.1, and each of sections ① to ④, sub screens, keys, terminals, switches, etc., is explained in Table 2.1.

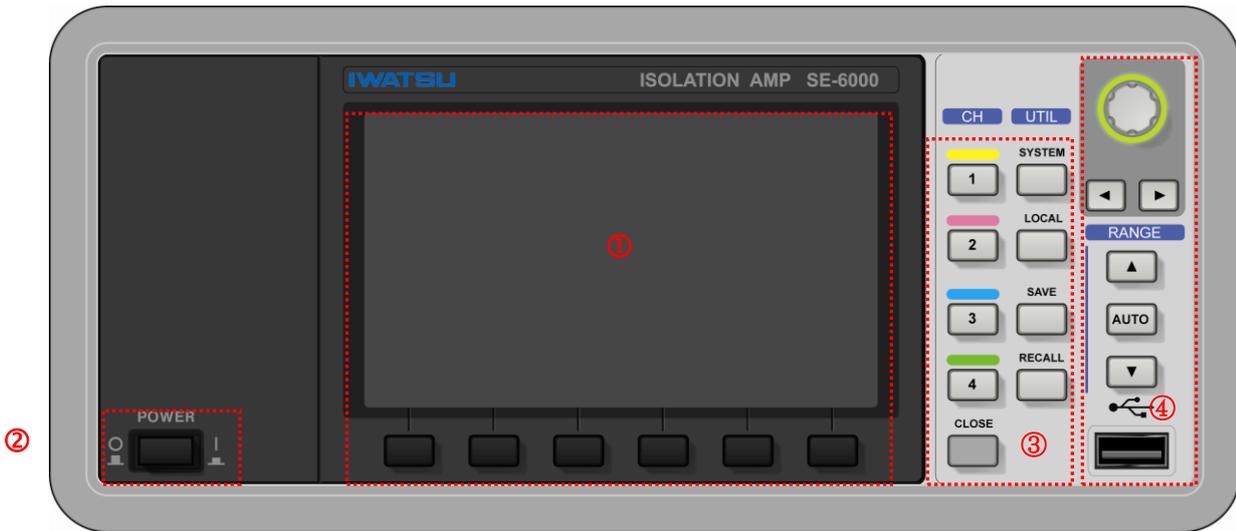


Figure 2.1 Front panel of SE-6000

Table 2.1 Explanations of each section of front panel of SE-6000

No.	Names	Explanations	See also
①	Display section	The display section consists of the LCD display and six menu keys beneath the screen. Menu keys each corresponding to the horizontal partitions of the setting menu in the LCD display, referred to as M1 to M6 keys for convenience in this document, are placed beneath the LCD display.	2.3
②	Power Switch	POWER switch of this instrument. • On:   State (Pressed) • Off: ● State (Unpressed)	3.1.3
③	FUNCTION section	Function keys of CH1 to CH4, SYSTEM, LOCAL, SAVE, RECALL, and CLOSE keys are placed.	2.1.1.1
④	Rotary knob & RANGE section	Rotary knob (switch) and arrow keys are in the upper position, [AUTO] key (AUTO RANGE) is in the middle, above and beneath the [AUTO] key are RANGE keys, and in the lowermost position is a USB port.	2.1.1.2

2.1.1.1 FUNCTION section

Figure 2.2 shows the FUNCTION section of the front panel, and the functions and name of each part are explained in Table 2.2.

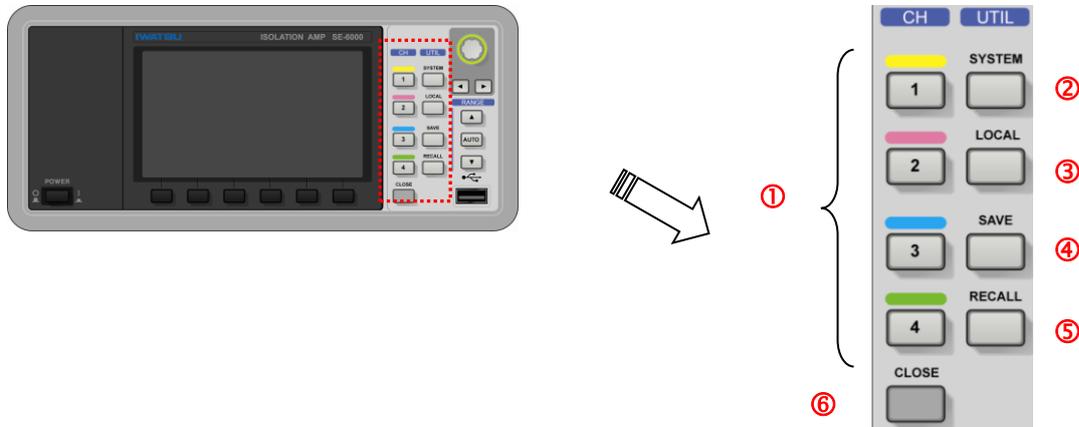


Figure 2.2 FUNCTION section

Table 2.2 Functions and name of each part of FUNCTION section

No.	Names	Functions (summary)	See also
①	CH1/CH2/CH3/CH4 keys	These are keys to open the menu screen of CH1 to CH4 at the bottom of the display for setting of each Isolation Unit connected to CH1 to CH4.	4.1
②	SYSTEM key	This is a key to open the SYSTEM menu at the bottom of the display for setting the whole system.	4.4
③	LOCAL key	This is a key to change the status of this instrument from remote control to local control. It is operative only when the instrument is remotely controlled.	—
④	SAVE key	This is a key to open the SAVE menu at the bottom of the display for saving setting conditions of this instrument to internal memory or USB memory.	4.2
⑤	RECALL key	This is a key to open the RECALL menu at the bottom of the display for recalling setting conditions of this instrument from internal memory or USB memory.	4.3
⑥	CLOSE key	This is a key to close the submenu displayed at the bottom of the display. Each time this key is pressed once, one submenu is closed.	—

## Exterior features and basic operations

### 2.1.1.2 Rotary knob & RANGE section

Figure 2.3 shows the rotary knob and RANGE section, and the name of each part and its functions are explained in Table 2.3.

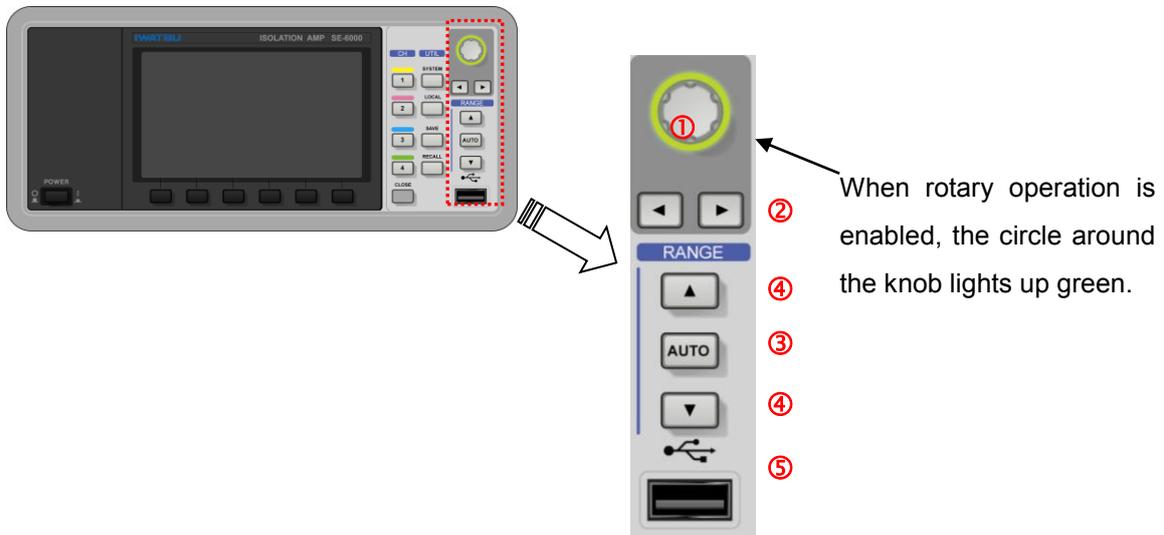


Figure 2.3 Rotary knob & RANGE section

Table 2.3 Name of each part and functions of rotary knob & RANGE section

No.	Names	Functions (summary)	See also
①	Rotary knob (Switch)	<p>&lt;When circle around the rotary knob is lit&gt;</p> <ul style="list-style-type: none"> <li>This knob is to select one from among several setting items in the screen menu. You can select an item by rotating the knob clockwise or counterclockwise.</li> <li>You can select a character, number, symbol, or list with this knob for input.</li> </ul> <p>&lt;Regardless of whether or not the circle around the rotary knob is lit&gt;</p> <ul style="list-style-type: none"> <li>It works as a switch to return the menu to the upper level. (Same function as the CLOSE key explained in 2.1.1.1)</li> </ul> <p>You can go up the menu to one upper level every time you push the rotary knob.</p>	2.3.2  2.1.1.1
②	Arrow keys	These are keys to move the cursor to a character, number, or symbol for selection when the circle around the rotary knob is lit.	2.3.2
③	AUTO key	This is a key to set optimal range and offset automatically to the Isolation Unit. This auto function is enabled for the channels CH menu which is displayed.	4.1.1.3
④	Range keys (Upper range/ lower range)	These are keys to change the range of the Isolation Unit. You can change to the upper range by the key with the upward arrow and to the lower range by the key with the downward arrow.	4.1.1
⑤	USB port	<ul style="list-style-type: none"> <li>This is a USB port to insert USB memory for saving and recalling setting conditions.</li> <li>It is also used for firmware update of this instrument.</li> </ul>	4.2, 4.3 4.4.1

2.1.2 Exterior features of rear panel and its overview

Figure 2.4 shows the rear panel of the Isolation Amplifier, and name and functions of each of sections ① to ④ are explained in Table 2.4.

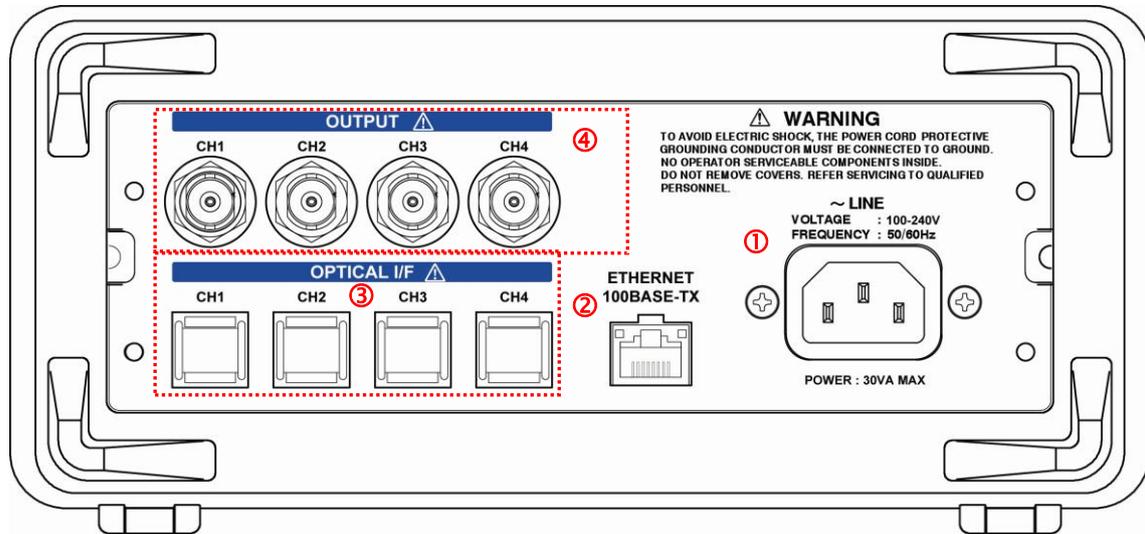


Figure 2.4 Rear panel of SE-6000

Table 2.4 Exterior features of rear panel of SE-6000 and its overview

No.	Name	Explanations and overview of functions	See also
①	AC LINE INPUT	<ul style="list-style-type: none"> <li>This is a power inlet socket. Use the attached power cord for power supply.</li> <li>* Specifications of the power inlet are shown above the inlet socket.</li> </ul>	3.1, 3.2 6.1
②	LAN (ETHERNET) socket	<ul style="list-style-type: none"> <li>This is an Ethernet port for LAN interface.</li> <li>You can connect this instrument to such equipment as a PC to control remotely.</li> <li>See the Remote Control Manual for commands, directions, etc.</li> </ul>	Remote control manual
③	OPTICAL I/F CH1/CH2/CH3/CH4 optical sockets	These are optical sockets for connecting this instrument with the Isolation Unit by optical fiber cables. This instrument can be connected to up to four Isolation Units by optical fiber cables to transmit and receive optical digital signals.	3.2 6.1
④	OUTPUT CH1/CH2/CH3/CH4 terminals	These are BNC terminals to output input signals to monitors such as oscilloscopes.	3.2 6.1

## 2.2 Exterior features of Isolation Unit (SE-6011), related parts, and overview

Exterior features of the front panel and its overview is explained in 2.1.1.

Instructions and precautions for handling the battery pack, battery charger, and insulation covers are explained from 2.2.2 to 2.2.4.

### 2.2.1 Exterior features of front panel and its overview

Figure 2.5 shows the front panel of the Isolation Unit. The name of each of parts ① to ⑨, shown in the figure, and explanations of switch, terminals, and lamps are shown in Table 2.5.

The internal cover and insulation cover should be installed to the Isolation Unit during measurements. Figure 2.5 (a) shows terminals, lamps, and the power switch of the front panel without the insulation cover. Figure 2.5 (b) shows the battery pack and handgrip which are underneath the internal cover shown in Figure 2.5 (a).

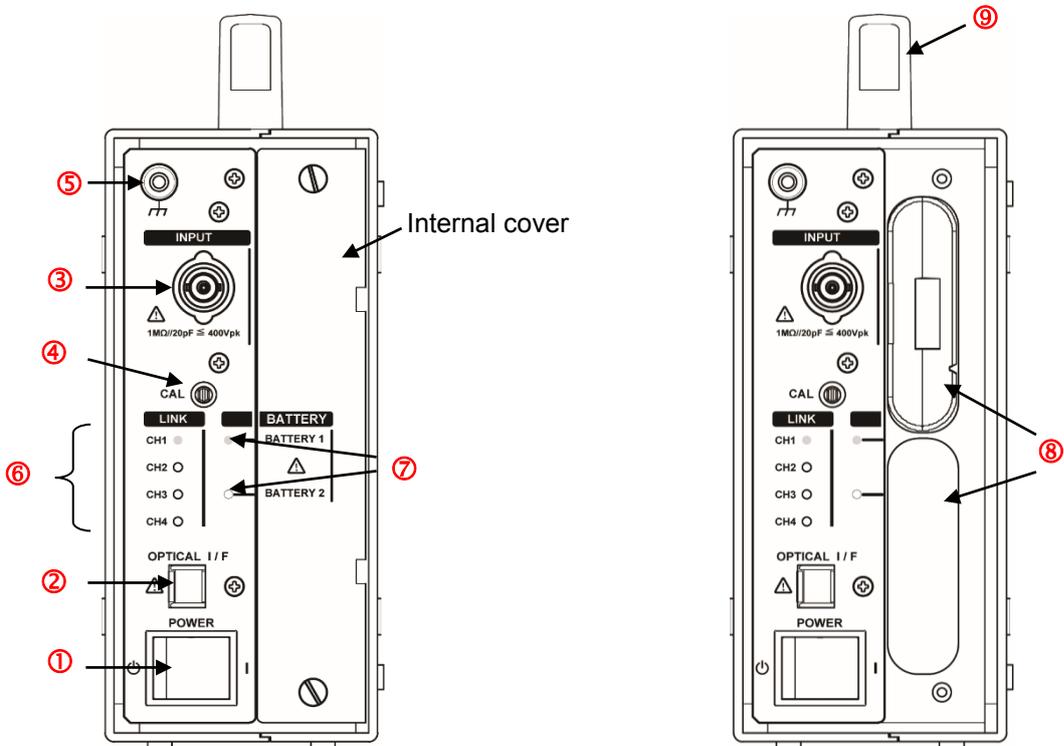


Figure 2.5(a) Front panel of SE-6011 without insulation cover (opened)

Figure 2.5(b) Front panel of SE-6011 without insulation cover and internal cover (opened)

Table 2.5 Exterior features of front panel of SE-6011 and its overview

No.	Names	Explanations	See also
①	POWER switch	This is the POWER switch of the Isolation Unit. <ul style="list-style-type: none"> <li>• On: When the switch is pushed to the I side.</li> <li>• Standby: When the switch is pushed to the <math>\odot</math> side.</li> </ul>	3.1.3
②	OPTICAL I/F socket	This is an optical connector of the optical fiber cable to connect the Isolation Unit with the Isolation Amplifier to transmit and receive optical digital signals. * Caution: Do not catch your eye through directly or the lens system because invisible laser beam might be launched toward outside while the isolation unit operates.	3.2
③	Input terminals	These are BNC terminals for analog signal input from a probe, etc.	3.2
④	CAL terminal	This is a calibration terminal to output a calibration signal to probes, etc. <ul style="list-style-type: none"> <li>• A 3Vp-p/1kHz square wave will be output.</li> </ul>	6.1
⑤	Frame terminal	This is an earth terminal to the ground Isolation Unit after floating measurement for safety.	—
⑥	LINK lamps CH1/CH2/CH3/CH4	These are lamps to indicate channel(s) to which the Isolation Amplifier is connected. All the lamps blink in turn while not detecting connections. When detection completes, the corresponding lamp(s) will be lit. * CH1: yellow, CH2: red, CH3: blue, CH4: green	—
⑦	BATTERY lamps	These are battery lamps to indicate which side of the battery pack is used, by blinking of the lamp of the corresponding side. There are two levels of blinking speed. When available capacity of the battery pack becomes no more than 6%, the lamp blinks at high speed. Blinking period is as follows. <ul style="list-style-type: none"> <li>• Normal condition: 2s</li> <li>• Capacity with 6% or less: 0.25s</li> </ul> Lamp of the side not used <ul style="list-style-type: none"> <li>• Will be off when the battery pack is not mounted, or when available capacity is low.</li> <li>• Will be continuously lit when the battery pack is mounted and has sufficient available capacity.</li> </ul>	2.2.2
⑧	Battery pack Battery slot	These are slots for the insert battery pack and a mounted battery pack. Up to two battery packs can be mounted.	2.2.2
⑨	Handgrip	This is a handgrip to hold when transporting or moving the instrument.	—

## Exterior features and basic operations

### 2.2.2 Battery pack

#### 2.2.2.1 Instructions for handling

##### (1) Mounting/dismounting

The battery pack is delivered with 50% of its full capacity charged. It is possible to use the battery pack as delivered; however, we recommend charging it fully before performing measurements.

\* For charging battery packs, see 2.2.3.

##### 1) Dismounting battery pack

- a) Remove the insulation cover of the Isolation Unit.

Remove the insulation cover (Figure 2.6 (a)), which is made from two parts; i.e., right and left halves, by pushing the upper and lower fasteners of the left half of the insulation cover using a coin (or a driver, etc.).

- b) Unfasten the upper and lower screws of the internal cover to remove it, which is on the right side of the front of the Isolation Unit (Figure 2.6 (b)).

- c) Remove the battery pack slowly by pulling the black tape attached to it (see Figure 2.6 (c) on the next page) while holding the Isolation Unit so that it remains stationary.

##### 2) Mounting battery pack

When mounting a battery pack right after dismantling one; i.e., after c) above, begin the procedures from c) below. Otherwise, start from a) below.

- a) Remove the insulation cover of the Isolation Unit.

- b) Unfasten the upper and lower screws of the internal cover to remove it, which is on the right side of the front of the Isolation Unit.

- c) Insert the battery pack to the slot with black tape on the left side. (See Figure 2.6 (c) on the next page.)

- d) Fix the internal cover by fastening two screws to the upper and lower screw holes of the internal cover.

- e) Attach the insulation cover of the Isolation Unit.

Fix the insulation cover by pushing the upper and lower buttons of the left half of the insulation cover shown in Figure 2.6 (a) using a thin stick, etc.

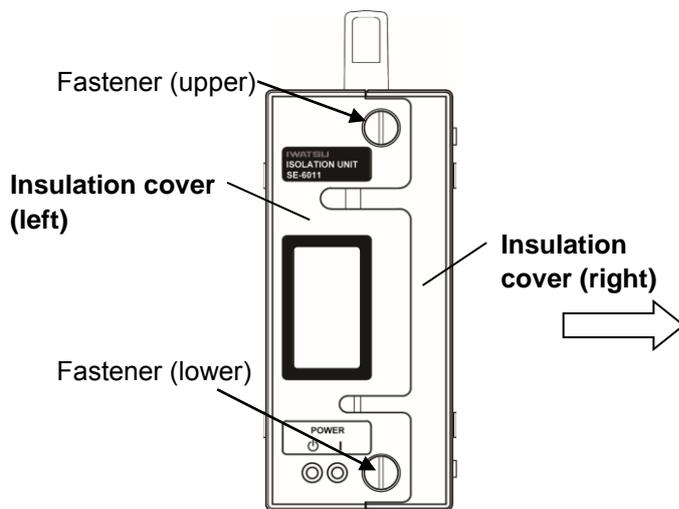


Figure 2.6 (a) With insulation cover

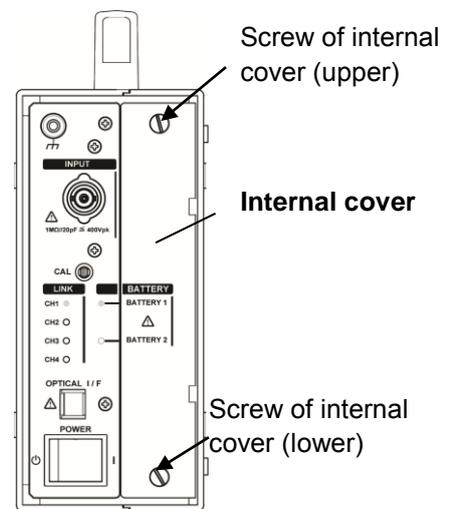


Figure 2.6 (b) Without insulation cover

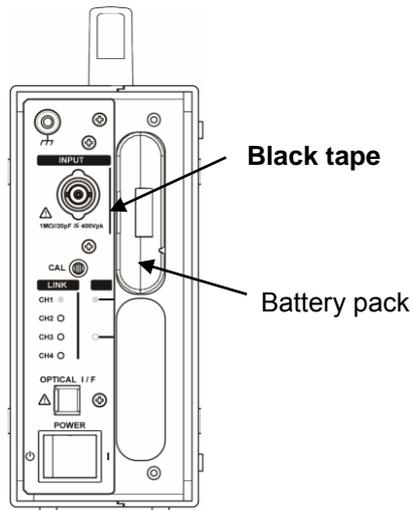


Figure 2.6 (c) Without internal cover

## (2) Storage

If you do not have a plan to use the Isolation Unit in the immediate future, take the battery pack out from the Isolation Unit, and keep it separately under an environment of about 5°C to 20°C.

If storing the battery pack for a prolonged period, keep the charging indicator level to level 2 (■■■) or level 3 (■■■■). (See Figure 2.7 on the next page.)

### Caution!

Storing the battery pack for a prolonged period with full charge may shorten the life time of the battery pack.

Charge the battery pack once every half year or so, because over discharge makes the battery pack unusable

To avoid over discharge during the storage for a prolonged period, keeping the battery pack indicator level to level 2 (■■■) or level 3 (■■■■) is advisable.

### Memo!

Two battery packs can be mounted to one Isolation Unit, but it can be operated with only one battery pack.

## Exterior features and basic operations

### 2.2.2.2 Display of available capacity of battery pack

You can check the available capacity of the battery pack by the screen of the Isolation Amplifier, by level indicators of the battery pack, and by BATTERY lamps of the Isolation Unit. Among them, level indicators of the battery pack are only for rough guideline, and for more accurate value of available capacity, see the screen of the Isolation Amplifier.

#### (1) Display of available capacity by battery indicator of battery pack.

Available capacity of battery pack is indicated by the number of lit ■ signs as shown in Figure 2.7. The greater numbers of ■ sign are lit, the higher the available capacity.

However, when the battery pack is mounted to the Isolation Unit, it is invisible, because under ordinary operation conditions the battery pack is beneath the insulation cover. Use this indicator as a guideline of available capacity during storage of the battery pack.

During ordinary operations, use the screen of the Isolation Amplifier as explained in (2) below.

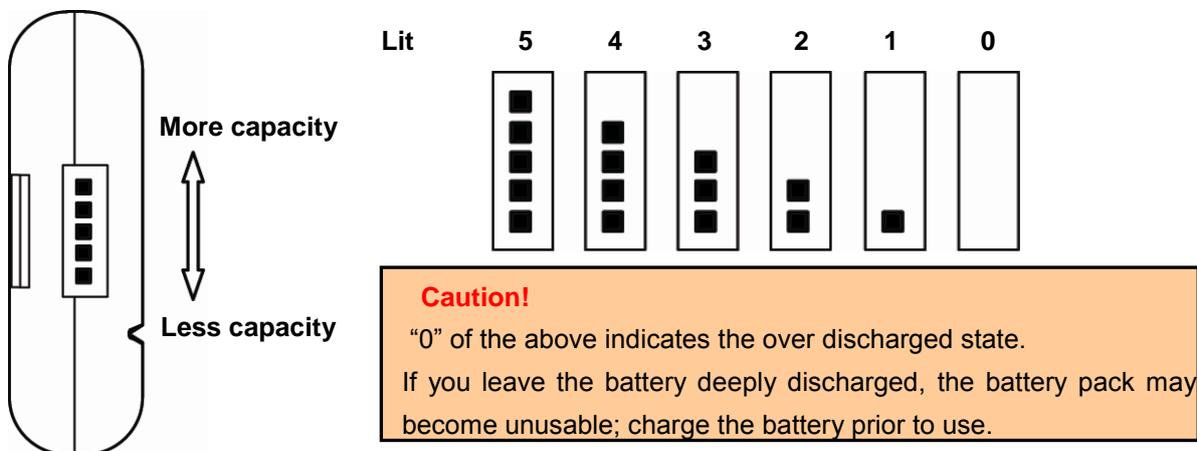


Figure 2.7 Display of available capacity by level indicator

#### (2) Display of available capacity on the screen of the Isolation Amplifier.

When the battery pack is mounted in the Isolation Unit, available capacity is displayed on the screen of the Isolation Amplifier as shown in Figure 2.8 under ordinary operation conditions.

2014/10/01 16:46					
	BATTERY1,2	COUPLING	RANGE	OFFSET	BANDWIDTH
1	No link				
2	15:07	DC	2.50V	-4.00V	FULL
3	No link				
4	No link				
CH2					
STATUS	PROBE AUTO	COUPLING DC	RANGE 2.50V	OFFSET -4.00V	BANDWIDTH FULL

- Mounted battery pack: only BATTERY1    ○ Channel in operation: CH2
- Available capacity: BATTERY1 15 hours 7 minutes

Figure 2.8 Example of display of available capacity on the screen of the Isolation Amplifier

Variations of the battery icons and their meanings are as shown in Table 2.6.

Available time of the battery pack is displayed inside the battery icon of the currently used battery pack in the format of XX: YY which means XX hours YY minutes as shown in Figure 2.7 on the previous page

**Table 2.6 Battery icons and available capacity**

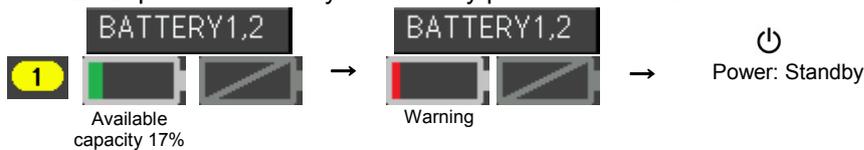
Meaning	In operation <small>note1</small>	Not in operation <small>note2</small>	Available capacity of battery pack
None			Battery pack is not mounted or not detected
2% or less			Available capacity of battery pack is 2% or less. If all the battery packs are under this condition, the instrument turns into standby mode within several seconds in order to protect the batteries.
Warning		Not displayed	Available capacities of all the battery packs are between 3% and 6%. If the battery pack is not in operation, the icon for 6% shown below will be displayed. If it becomes less than 3%, the instrument turns into standby mode. It takes about 30 minutes to turn into stanby mode after available capacity becomes 6% or less
6%			between 3% and 6%, inclusive
17%			between 7% and 17%, inclusive
33%			between 18% and 33%, inclusive
50%			Between 34% and 50%, inclusive
67%			Between 51% and 67%, inclusive
83%			Between 68% and 83%, inclusive
100%			between 84% and 100%, inclusive

Note 1. In operation means the battery pack is currently used as a power source.

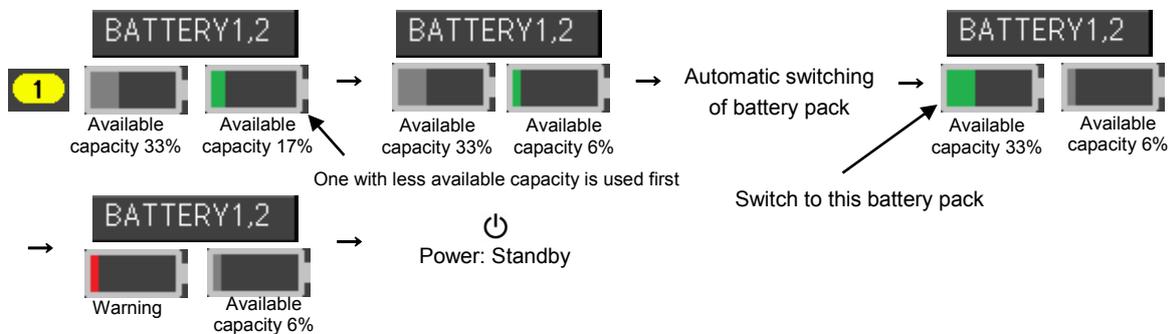
Note 2. Not in operation means the battery pack is not currently used as a power source.

The Isolation Unit has two slots for battery packs, and two battery packs can be mounted simultaneously. However, selection of battery pack is automatically controlled by this instrument, and cannot be changed by the customer. The battery pack with less available capacity is used first as shown in example 2 below.

<Example 1. When only one battery pack is mounted>



<Example 2. When two battery packs are mounted>



**(3) BATTERY lamps of Isolation Unit**

Available capacity of battery pack can also be checked with BATTERY lamps of the Isolation Unit.

See item ⑦ of Table 2.5 in 2.2.1.

## Exterior features and basic operations

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### 2.2.2.3 Transportation

#### (1) Transportation

Batteries of the Isolation Unit are lithium-ion batteries, and are subject to the United Nations Recommendations when transported by air or sea. The battery pack of the Isolation Unit can be treated as non-dangerous goods because it is an assembled battery pack with less than 100Wh (total lithium equivalent value of less than 8g). However, there is a limitation as to the number of battery packs within one package and its weight, and it is also necessary to display the lithium battery pack handling label and Non-Dangerous Goods Declaration Form, to keep the battery pack inside a package which withstands a 1.2m drop test, etc.

If you ship this instrument by air or sea, check with the operator or carrier in advance.

#### (2) Bringing into passenger airplanes

There are also regulations for bringing lithium ion battery packs into passenger airplanes. Each airline has its own regulations based on the Civil Aeronautics Act, the Dangerous Goods Regulations of The International Air Transport Association (IATA), etc., which prohibits accepting lithium ion batteries as check-in luggage (carry-on only), and limits the number of auxiliary batteries to two per person regardless of the number of instruments he/she carries, while some airlines have even stricter regulations. We recommend contacting your airline company in advance.

#### (3) Charging state during transportation

When you airlift the battery pack, please confirm the level indicator of the battery is 1(■).

When you transport the battery pack by other way, please confirm the level indicator of the battery is 2(■■) or 3(■■■).

### 2.2.2.4 Consumption and disposal

#### (1) Consumption

Battery packs are consumables. Lifetime of a battery pack depends on usage and storage conditions. Conform to “2.2.2.1 Instructions for handling” when using and storing battery packs.

Even under room temperature, a battery pack inevitably degrades after several hundred cycles of charging and discharging. Normally this instrument can be operated for approximately 15 hours with one battery pack. Contact Iwatsu office or our sales distributors for consultation when operation duration becomes shorter than the norm.

Battery packs can be purchased as options when necessary.

#### (2) Disposal

When you dispose of battery packs, conform to local laws or regulations, and contract local recycling companies.

### 2.2.3 Charging battery pack

When you charge battery packs attached to the Isolation Unit, use our battery charger (option CH5050A). Order from our Sales Department or sales office when you need a battery charger.

Comply with the precautions written below for the handling and storage of battery packs and battery chargers.

#### Caution!

- Upon delivery, battery pack is charged to about 50%. Charge the battery pack prior to use.
- Do not wet or place a battery pack, battery charger, AC adaptor, or power cord in a humid place.  
Doing so may cause electric shock or malfunction.
- Do not use power cord attached to the battery charger with other equipments.
- Do not open the case of the battery pack, battery charger, or AC adaptor.  
Doing so may cause electric shock, fire, or malfunction. These items cannot be repaired by the customer. Note that if any of these is modified or the case is opened, we may not be able to undertake the repair.
- A fan is equipped at the rear of battery charger. Do not hinder the ventilation by shutting or putting something near the ventilation holes. Internal temperature may rise to cause fire or malfunction.
- Do not put the battery pack or battery charger close to any heat source.  
Doing so may cause overheat to result in fire or malfunction. Store them in a cool place.
- The battery pack and battery charger may be hot during charging, right after charging, during calibration, or right after calibration. Be careful not to get burnt, etc.

#### (1) Overview

The battery charger has the features as follows.

- Two battery packs can be charged simultaneously and independently.
- There are two modes, which are charging only, and charging and calibration.

The battery charger not only charges the battery pack, but it can also calibrate the display function of available capacity of the battery pack. Status of a battery changes with charging and discharging cycles and lapse of time, and at the same time accuracy of the display of available capacity changes. If the red LED blinks when the battery pack is set to the battery charger, this indicates that accuracy has degraded. If this occurs, use the charging and calibration mode.

If the red LED turns on continuously when the battery pack is set to the battery charger, this indicates that there is something wrong with the battery pack. Stop charging and do not use the battery pack. Contact Iwatsu office or our sales distributors for consultation.

Additionally, accessories of the battery charger are written in <Options> of Components on page x, and specifications are described in 6.1.3.

## Exterior features and basic operations

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### (2) Procedures for charging

<Preparation (common to charging only, and charging and calibration mode)>

- 1) Insert the DC connector plug of the AC adaptor to the DC connector socket (female, see Figure 2.9) of the battery charger.
- 2) Connect the AC adaptor and the attached power cord (3-core).
- 3) Insert the power plug (3-core) into an AC power outlet.

Green, blue, and red lamps on the status window of the battery charger (see Figure 2.9) turn on temporarily for several seconds before turning off.

<Charging only mode>

- 4) Insert the battery pack to the battery bay of the battery charger (see Figure 2.9).

\*1. Set the battery pack in such a direction that five terminals of the battery pack and the battery charger fit.

The green lamp in the status window of the battery charger and indicator ■ of the battery pack blink, and charging starts automatically.

\*2. Charging takes about 5 hours.

- 5) When charging completes, the green lamp in the status window of the battery charger lights continuously.

Remove the battery pack from the battery charger.

<Charging and calibration mode>

- 4) Insert the battery pack to the battery bay of the battery charger (see Figure 2.9).

\*1. Set the battery pack in such a direction that five terminals of the battery pack and the battery charger fit.

- 5) Push the calibration button (see Figure 2.9) corresponding to the inserted battery pack.

The blue lamp on the front face of the battery charger and indicator ■ of the battery pack blink, and charging and calibration start automatically.

\*2. Charging and calibration take 18 to 24 hours.

- 6) When charging completes, the blue lamp in the status window of the battery charger stops blinking and begins to light continuously.

Remove the battery pack from the battery charger.

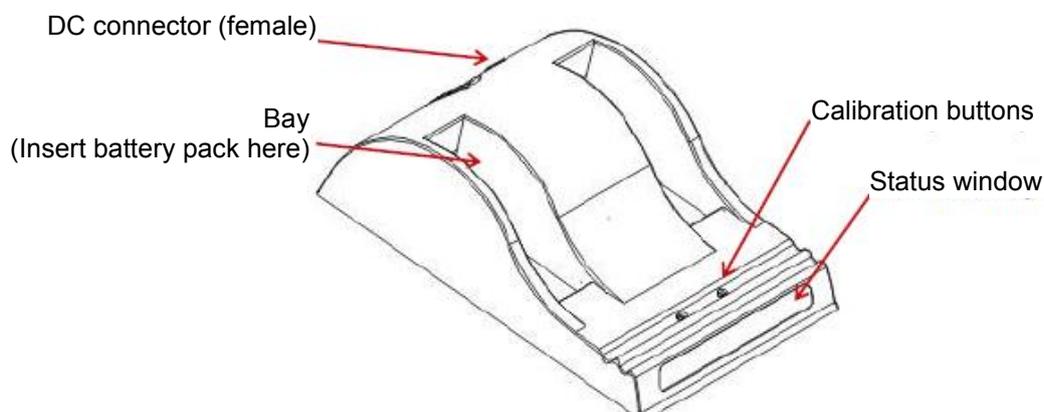


Figure 2.9 Battery charger

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### 2.2.4 Insulation cover

The insulation cover not only insulates the units from each other, but also prevents electric shock to the operator when voltage is applied during measurements. Maximum withstanding voltage of the insulation cover is 1kV. All the electrically conductive parts of the housing of the Isolation Unit are covered by the insulation cover, and only the insulation cover of the front panel is detachable. Open the insulation cover of the front panel for connection of the probe cable and optical fiber cable, and mounting and dismounting of battery packs to the unit. However, as shown in Figure 2.10, turning the POWER switch to ON or STANDBY is possible with the insulation cover by pushing the button.

Before handling, read the precautions written below together with the warnings written on pages ii to vi of this manual carefully.

**Caution!**

- Never touch the probe cable, BNC cables etc., during measurements or while voltage is applied. Touching the probe cable or BNC cables may cause electric shock, fire, or malfunction.
- Be sure to discharge accumulated charge using either one of the methods explained below, whichever is safer, after the measurement and turning off the power of device measured. Never touch the instrument until safety is confirmed. If accumulated charge is not discharged, it may cause electric shock, fire, or malfunction.
  - Method 1: Discharge the accumulated charge through the device measured using an earthing stick, etc.
  - Method 2: Discharge the accumulated charge through the earth terminal inside the front insulation cover of the Isolation Unit using earth sticks, etc. However, never touch any parts inside the Isolation Unit except the earth terminal.

For attaching and detaching of insulation cover, see (1) and (2) in “2.2.2.1 Instructions for handling.”

For the appearance of Isolation Unit and insulation cover, see 6.2.2.

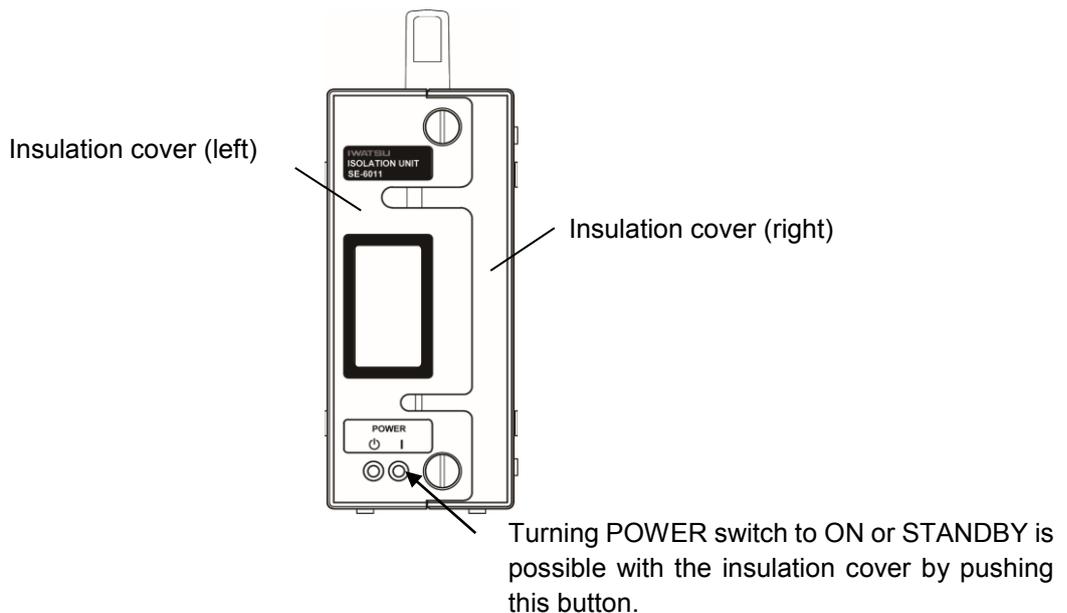


Figure 2.10 With insulation cover

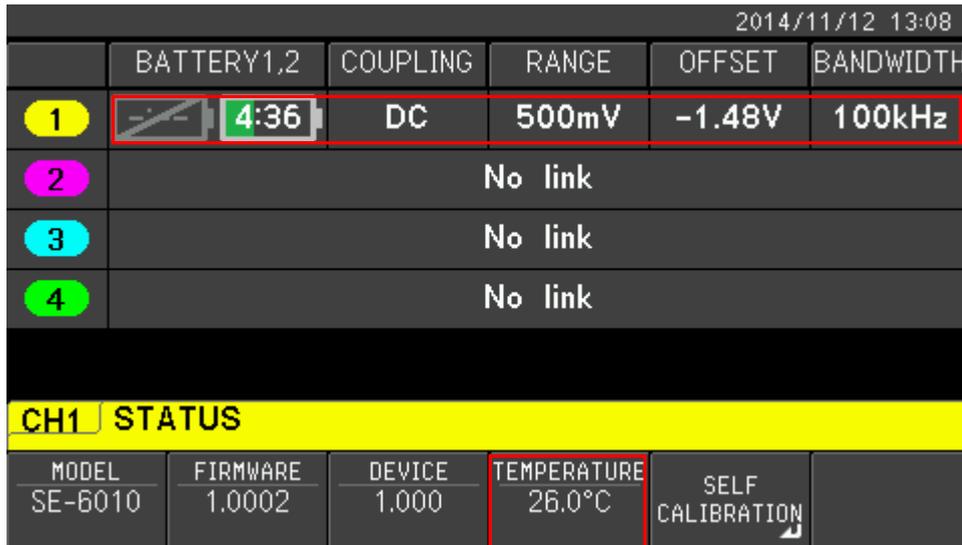
## Exterior features and basic operations

### 2.2.5 Protection function for temperature (Overheat prevention)

This instrument monitors the internal temperature of the Isolation Unit at all times, and shuts down the power of the Isolation Unit automatically if temperature goes beyond the designated range.

#### (1) Temperature monitor

The temperature of each Isolation Unit is monitored with the corresponding CH/STATUS/TEMPERATURE menu as shown in the figure below. (Inside the red rectangle of Figure 2.11)



The screenshot shows the instrument's display with the date and time '2014/11/12 13:08' at the top right. Below this is a menu with columns: BATTERY1,2, COUPLING, RANGE, OFFSET, and BANDWIDTH. The first row is highlighted with a red rectangle and contains: a battery icon, '4:36', 'DC', '500mV', '-1.48V', and '100kHz'. Below this are three rows with 'No link' in the RANGE column, each preceded by a colored circle (2, 3, 4). A yellow bar at the bottom reads 'CH1 STATUS'. Below this bar is a table with columns: MODEL, FIRMWARE, DEVICE, TEMPERATURE, and SELF CALIBRATION. The TEMPERATURE column shows '26.0°C' and is highlighted with a red rectangle.

	BATTERY1,2	COUPLING	RANGE	OFFSET	BANDWIDTH	
1		4:36	DC	500mV	-1.48V	100kHz
2			No link			
3			No link			
4			No link			
CH1 STATUS						
MODEL	FIRMWARE	DEVICE	TEMPERATURE	SELF CALIBRATION		
SE-6010	1.0002	1.000	26.0°C			

Figure 2.11 Example of temperature monitor (SE-6011)

#### (2) Temperature range for overheat protection

The temperature range for overheat protection is between  $-15^{\circ}\text{C}$  and  $+65^{\circ}\text{C}$ , and if internal temperature of the Isolation Unit goes outside this range, the protection function will be enabled.

#### (3) Message

When the protection function is enabled, a message "Outside of the operating temperature Range." will be displayed in the readout display area shown in Figure 2.11.

#### (4) Protection function and recovery procedures

When the protection function is enabled, only the power of Isolation Unit will be shut down.

After the shutdown, follow the procedures written below to recover the instrument.

- Make the internal temperature of the Isolation Unit between  $-15^{\circ}\text{C}$  and  $+65^{\circ}\text{C}$ .
- Turn the POWER switch of the Isolation Unit to STANDBY temporarily and then turn back to ON for restart.

## 2.3 Screen layout and basics of menus

The Isolation Amplifier has all the functions of setting, controlling, and display of the whole system of this instrument.

In this section, the screen layout of the Isolation Amplifier and basic operations of menus displayed at the bottom of the screen are explained.

### 2.3.1 Screen layout

When this instrument is turned on, the startup screen with the IWATSU logo is displayed for several seconds before turning into the normal screen.

An example of the normal screen is shown in Figure 2.12.



Figure 2.12 Example of normal screen (CH menu)

Table 2.7 Screen layout and each content

No.	Names	Explanations	See also
①	Message display area	Error and warning messages are shown on the left and the current date and time on the right.	7.2
②	Readout display area	Settings and the status of CH1 to CH4 are displayed.	4.1
③	Menu display area	Settings of each menu corresponding to the function keys of CH1 to CH4, SYSTEM, SAVE, and RECALL in the FUNCTION section are displayed.	2.3.2 4.1 to 4.4
④	Menu key	These are keys to select each menu explained in ③.	2.3.2

## Exterior features and basic operations

<Readout display area>

The readout display area shown in ② of Figure 2.12 is explained in Figure 2.13 and Table 2.8.

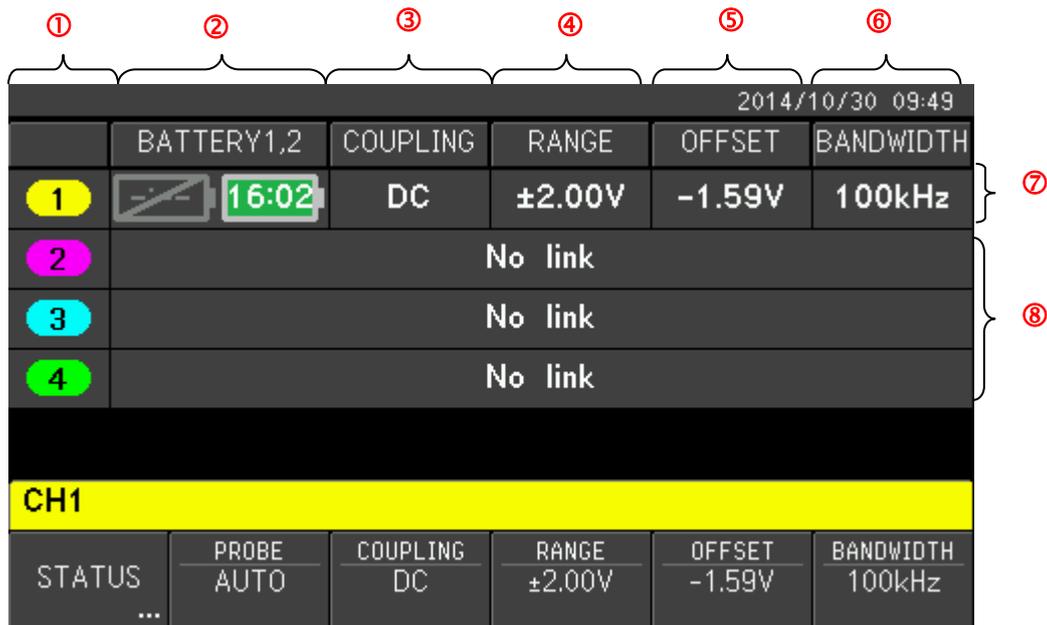


Figure 2.13 Example of normal screen (CH menu)

Table 2.8 Name of each part and overview of readout display area

No.	Names	Explanations	See also
①	CH information	A different color is assigned to each channel, as follows. CH1: yellow, CH2: magenta, CH3: cyan, CH4: green.	4.1
②	BATTERY1, 2	Displays the information of the battery pack of the Isolation Unit. <ul style="list-style-type: none"> <li>Layout: BATTERY1 on the left and BATTERY2 on the right.</li> <li>Display: Available time and capacity of the battery pack using icons. For details of the icons, see Table 2.6.</li> </ul>	2.2.2.2
③	COUPLING	Status of input coupling of the corresponding CH of the Isolation Unit is displayed.	4.1
④	RANGE	Range of the corresponding CH of the Isolation Unit is displayed.	4.1
⑤	OFFSET	Offset of the corresponding CH of the Isolation Unit is displayed.	4.1
⑥	BANDWIDTH	Bandwidth of the corresponding CH of the Isolation Unit is displayed.	4.1
⑦	Display of normal connection	This example screen shows that the Isolation Amplifier is connected to the Isolation Unit with optical fiber cable, and optical digital signal input and control signal output are functioning properly.	4.1
⑧	Display of No link (or link not detected is shown.)	This example screen shows that the Isolation Unit is not connected to optical fiber cable, or the Isolation Unit is not working properly. <ul style="list-style-type: none"> <li>Battery pack not mounted</li> <li>POWER switch not turned ON</li> </ul>	4.1

### 2.3.2 Basics of menus

Basic operations of whole procedures from setting to using this instrument are explained.

Operations using the menu displayed at the bottom of the screen are explained together with complex operations involving keys and rotary knob (switch).

#### 2.3.2.1 Open/Close menu

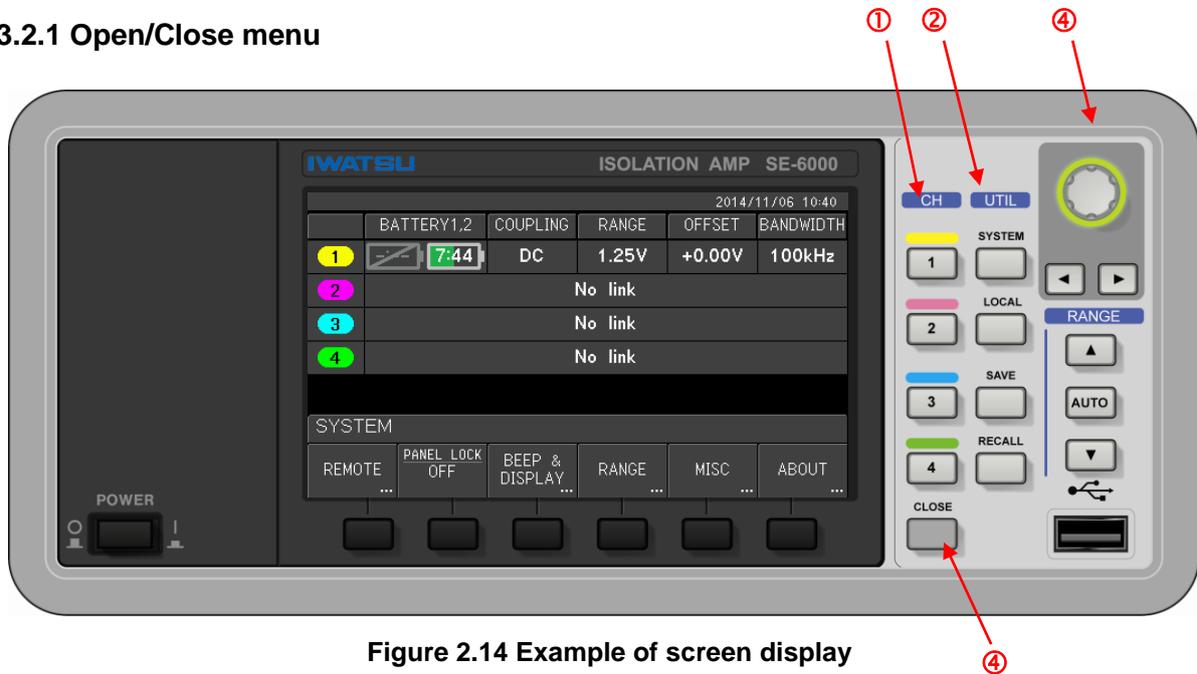


Figure 2.14 Example of screen display

#### Operation Procedures 1. Open the menu of FUNCTION (CH and SYSTEM)

Procedures using the menu screen are explained below in accordance with the example of the SYSTEM menu screen shown in Figure 2.14.

- 1) Press the [CH1] key shown in Figure 2.14. The CH1 menu opens as shown below.

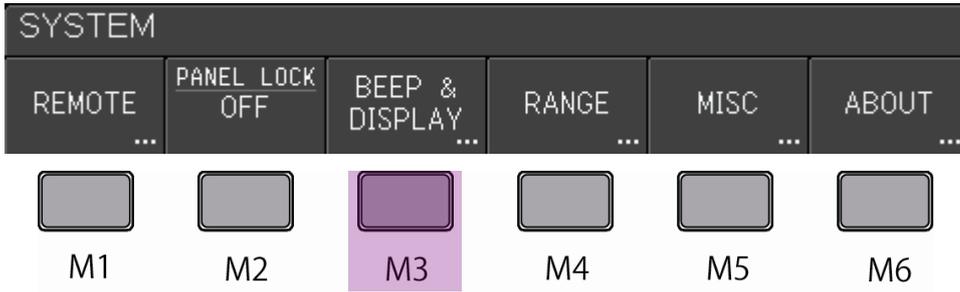
CH1					
STATUS ...	PROBE AUTO	COUPLING DC	RANGE ±2.00V	OFFSET -1.59V	BANDWIDTH 100kHz

- 2) Pressing the [SYSTEM] key shown in Figure 2.14 in the 1) opens SYSTEM menu as shown below.

SYSTEM					
REMOTE ...	PANEL LOCK OFF	BEEP & DISPLAY ...	RANGE ...	MISC ...	ABOUT ...

**Operation Procedures** 2. Open submenu

3) Press the M3 key in the SYSTEM menu shown below.

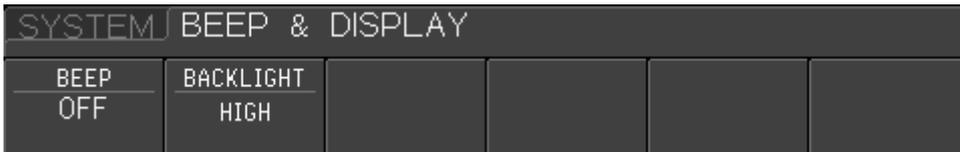


The BEEP & DISPLAY submenu opens as shown below.

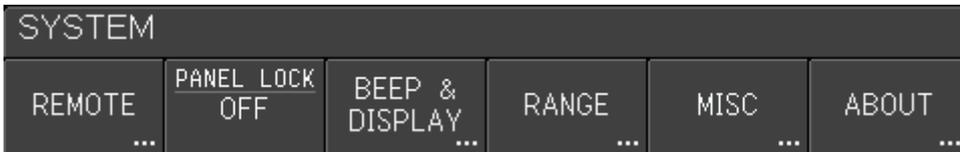


**Operation Procedures** 3. Close submenu

4) Press the [CLOSE] key or the rotary knob shown in Figure 2.14 on the previous page in the BEEP & DISPLAY submenu shown below.



The screen returns to the SYSTEM menu as shown below.



2.3.2.2 Select item within the menu

How to set SYSTEM/BEEP & DISPLAY/BACKLIGHT: LOW is explained as an example.

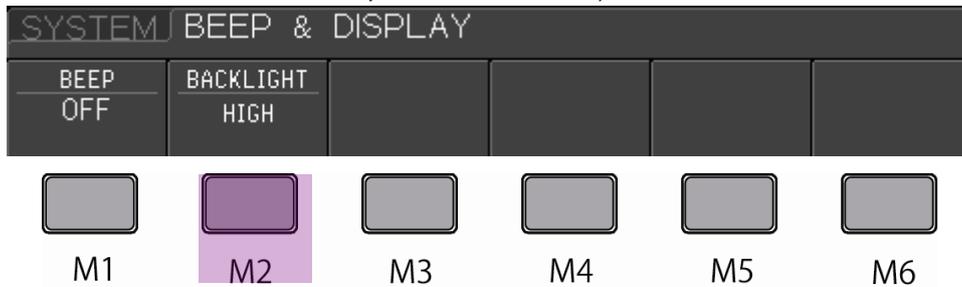
**Operation Procedures** 1. Select an item within the menu.

- 1) Press the M3 key in the SYSTEM menu shown below. The BEEP & DISPLAY submenu opens as shown below in 2).



- 2) Select the BACKLIGHT menu by pressing the M2 key in the BEEP & DISPLAY submenu shown below.

The BACK LIGHT submenu opens as shown in 3).



- 3) Select LOW by pressing the M2 key in the BACKLIGHT submenu shown below.



SYSTEM/BEEP & DISPLAY/LOW will be set as shown below.



## Exterior features and basic operations

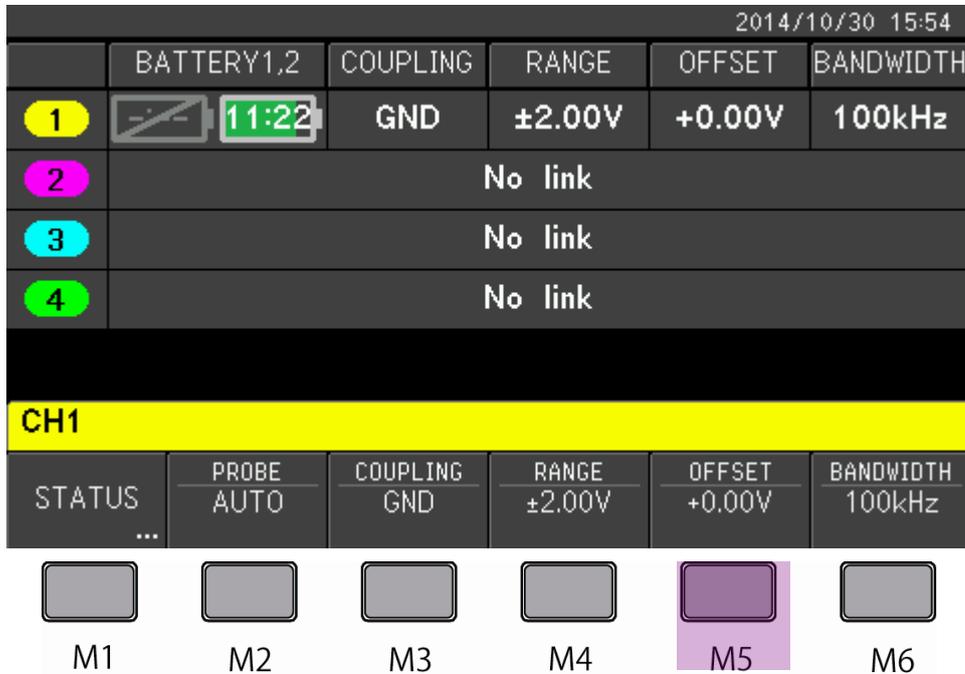
### 2.3.2.3 Set value to item within the menu

How to set CH1/OFFSET: +100mV is explained as an example.

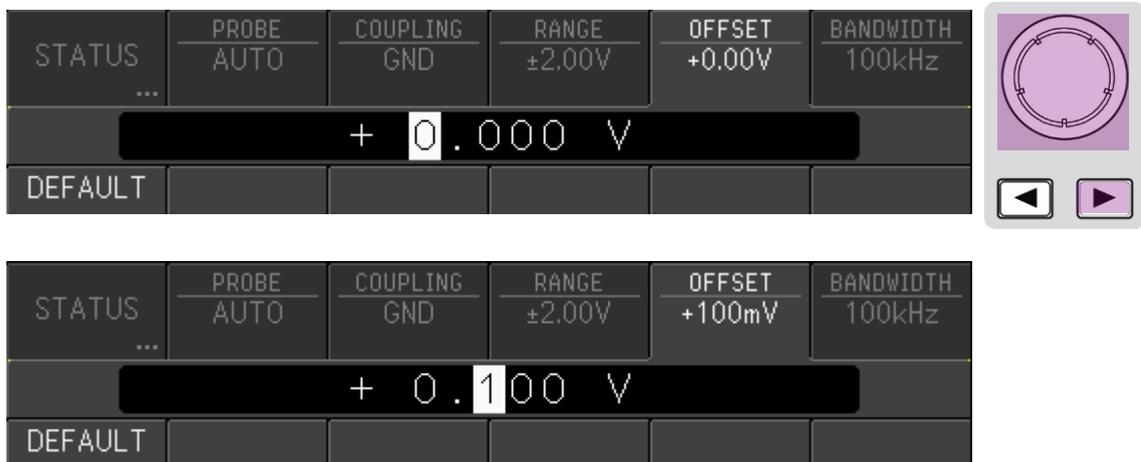
#### Operation Procedures

#### 1. Set value to an item within the menu (Change OFFSET value from +0.000V to +100mV)

- 1) Press the M5 key in the CH1 menu shown below. The OFFSET submenu opens as shown in 2).



- 2) The OFFSET submenu opens as shown below. Set to +0.100V by pressing the right arrow key and turning the rotary knob clockwise.



- 3) The screen returns to the OFFSET menu shown below by pressing the [CLOSE] key or the rotary knob.



2.3.2.4 Set characters to item within the menu

Directory and file names are necessary to save setting conditions to external memory such as USB memories.

Default settings are as follows. File names are automatically changed every time by adding the subsequent number at the end.

- DIRECTORY: SETUP
- FILENAME: STUP0000 -

How to set these names is explained in this section.

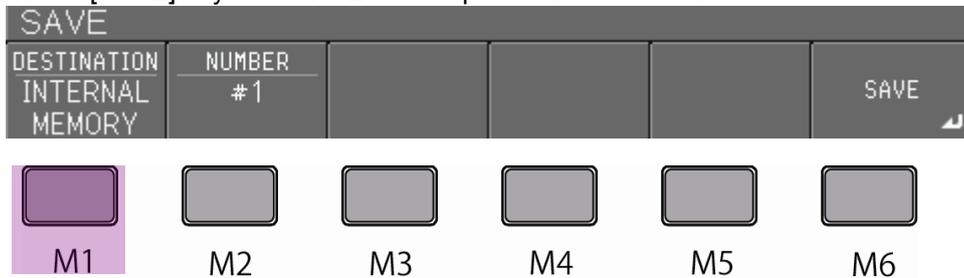
**Operation Procedures**

**1. Save setting conditions to USB memory**

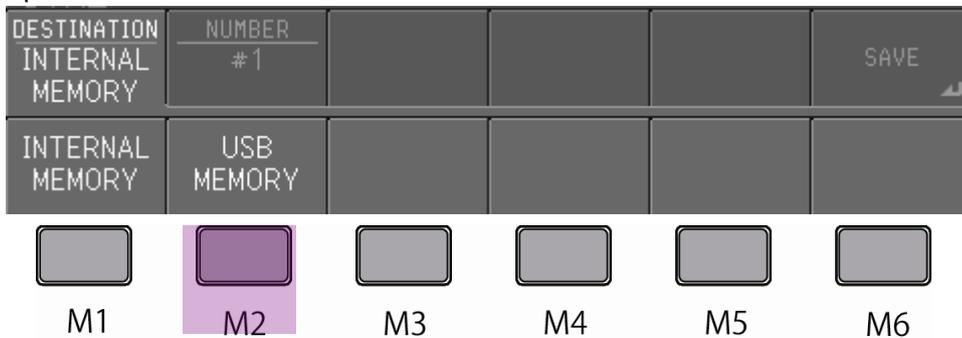
Example SAVE menu

- DIRECTORY: SET\_A • FILENAME: SETA0000 -

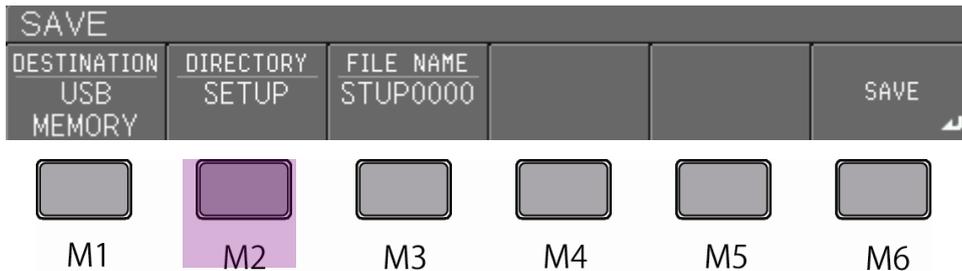
- 1) Press [SAVE] key. The SAVE menu opens as shown below.



- 2) Press the M1 key in the above 1) to select the DESTINATION menu. The DESTINATION menu opens as shown below.



- 3) Press the M2 key in the above 2) to select USB MEMORY as the destination of storage. The screen returns to the SAVE menu as shown below.

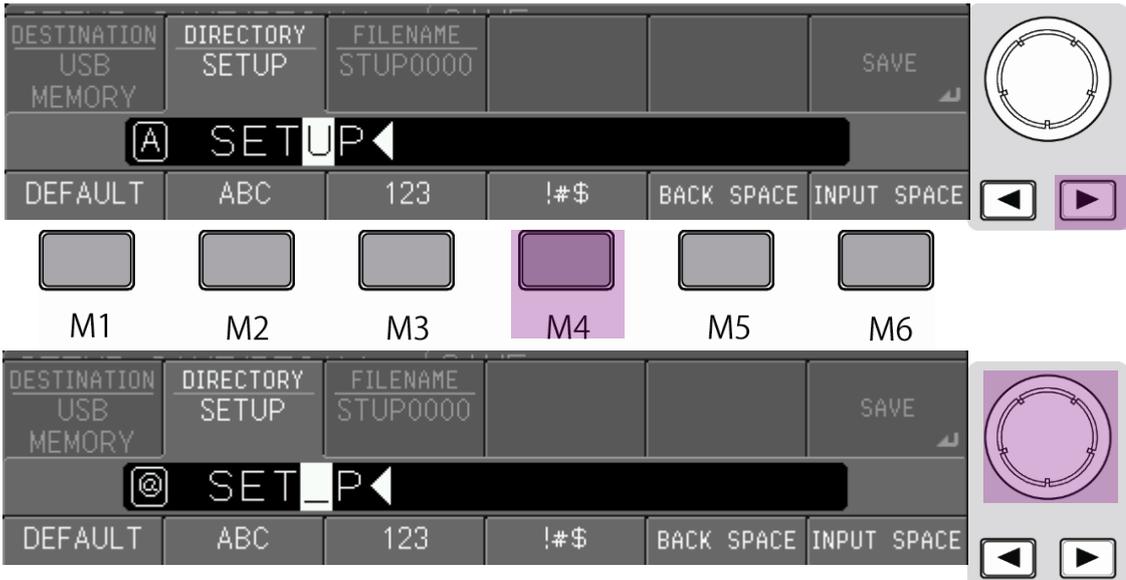


## Exterior features and basic operations

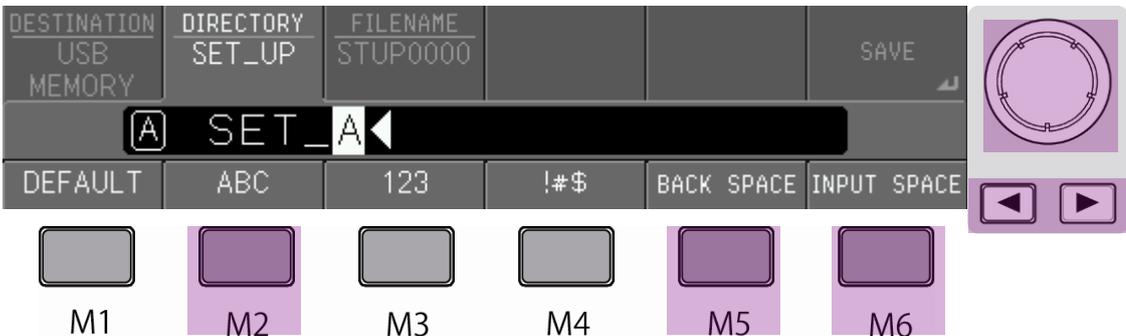
- 4) Press the M2 key in the above 3) to select DIRECTORY. The DIRECTORY menu opens as shown below.



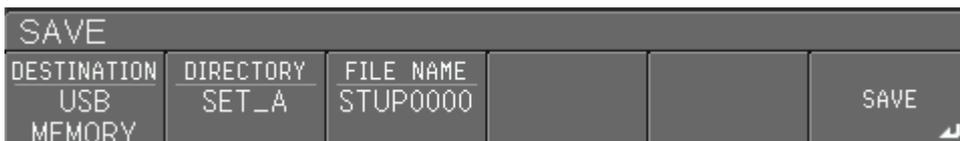
- 5) Press the right arrow key under the rotary knob to select the character position to input. Press the M4 key to select symbols of [!#\$] which are beneath the menu.



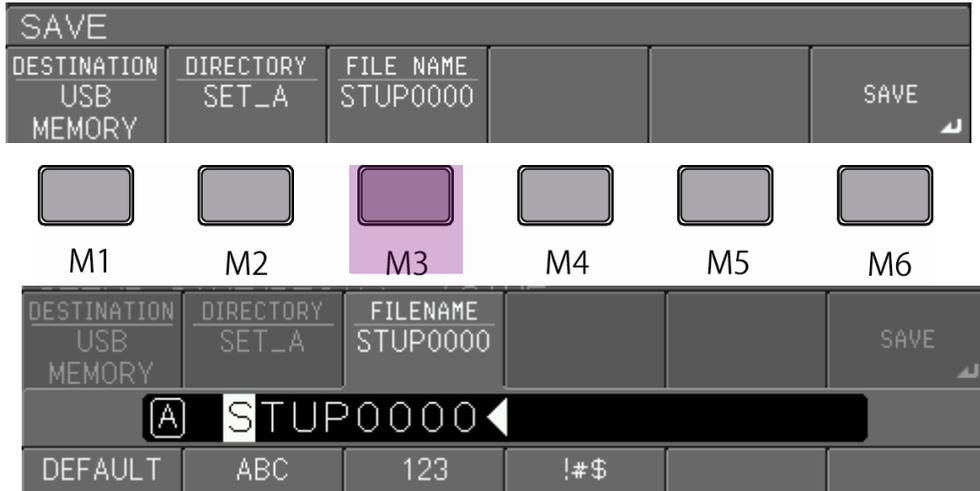
Continue editing as shown below using the rotary knob, arrow key, and menu key.



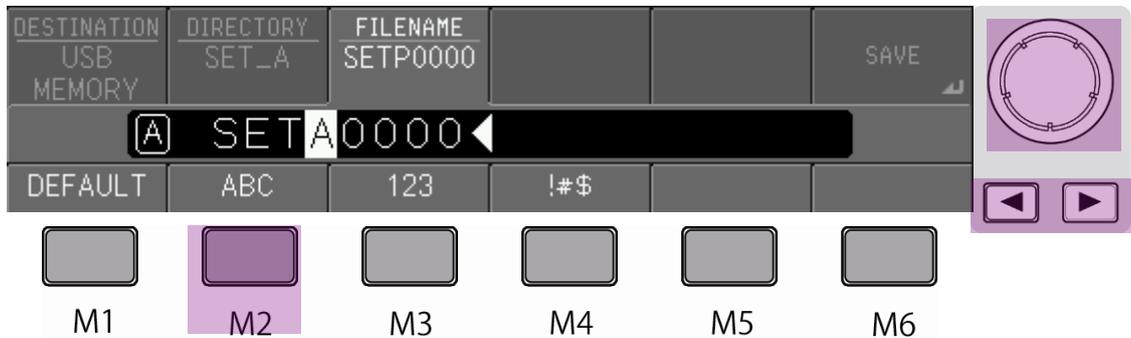
- 6) Press the [CLOSE] key when finished editing in 5). The edited directory name is shown in the DIRECTORY menu as shown below.



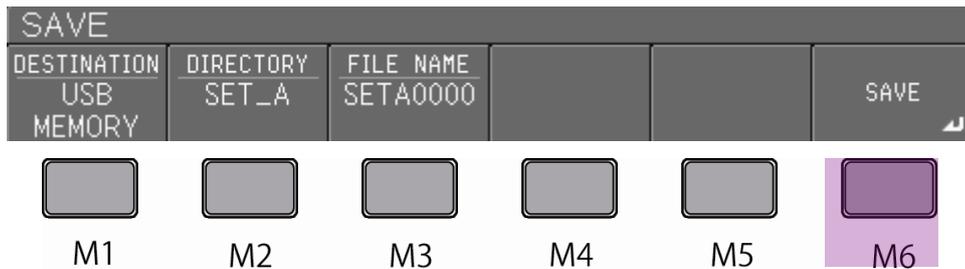
- 7) Press the M3 key to open the FILENAME menu shown in the figure after the next.



- 8) Edit file name using the rotary knob, arrow key, and menu key as shown below, which are the same procedures described in 5) on the previous page.



- 9) Press the [CLOSE] key when finished editing in 8). The screen returns to SAVE menu as shown below.



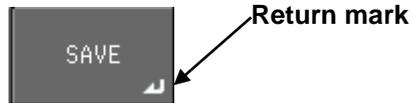
- 10) Press the M6 key in 9) to save setting conditions to USB memory with the edited directory and file names.

## Exterior features and basic operations

### 2.3.2.5 Implement setting items within menu

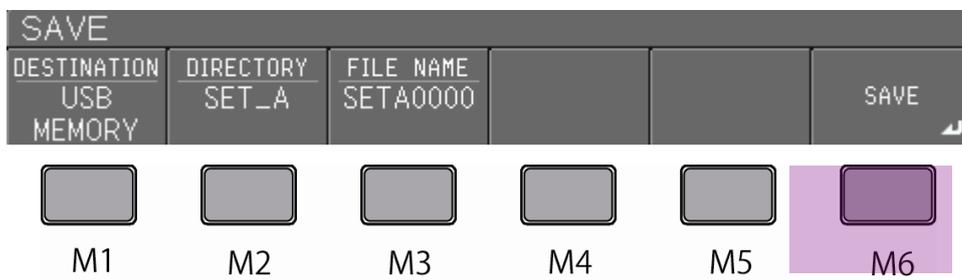
In the case of the SAVE/RECALL menu explained in the previous section 2.3.2.4, each item is implemented when pressing the menu key of M1 - M6 after all the procedures are finished.

To indicate the menu to implement an actual command, a "return mark" is shown at the bottom right position in the displayed soft key as shown below, which shows the SAVE menu as an example.

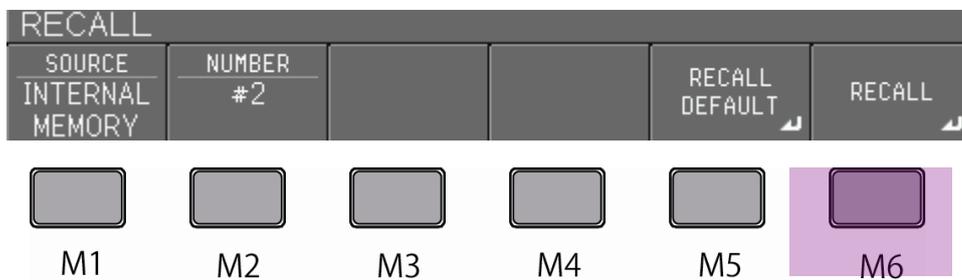


Examples of menu items for actual implementations are shown below.

Example 1 SAVE menu



Example 2 RECALL menu



# 12 3 4567

## Chapter 3 Installation and preparations

In this chapter, preparations and construction of measurement systems using this instrument are explained.

### 3.1 Precautions for installation

This instrument has to be installed to a place where environmental conditions conform to “3.1.1 Installation conditions” written below. Additionally, make sure to read “Safety Precautions” at the beginning of this document for warnings and cautions.

For actual setup, see “3.1.2 Installation states.”

#### 3.1.1 Installation conditions

☆ Flat and horizontal place

Install this instrument at a stable and horizontal place. If it is used at an unstable place, it may topple or drop, which may cause injury or malfunction.

To set up the Isolation Amplifier into a rack, remove the handle and protector, and use a rack designed for the outer dimensions of 226mm in width, 100mm in height, and 366mm in depth (excluding protruding parts such as protectors, handle, and connectors). As for the Isolation Unit, use a rack designed for the outer dimensions of 90mm in width, 203mm in width, and 298mm in depth (excluding protruding parts such as handgrip and connectors), and the insulation cover is a must with the Isolation Unit.

☆ Well ventilated place

The Isolation Amplifier has ventilation holes on both sides. To avoid rise of temperature inside the instrument, keep enough room around the instrument and do not block the ventilation holes.

☆ Temperature and humidity ranges for operation and storage

See the first item of the cautions written on page viii “Always use this instrument only within the rated operating environment range.”

**Caution!**

When you move this instrument to another place with different temperature or humidity, dew condensation may occur due to the change of temperature.

For this case, take time to move the instrument, to avoid sudden change in temperature.

### 3.1.2 Installation states

#### (1) Isolation Amplifier

Place horizontally or at a slant using the handle as shown in Figure 3.1 (a) or (b). To rotate handle, widen the handle at its joint to the body, rotate to any one of the positions shown in Figure 3.1 (a), (b), and (c), and push the handle back to lock.

**Caution!** Do not nip your finger by the handle when moving it.

The position shown in the Figure 3.1 (c), in which back of the instrument faces downward, is only for temporary storage. **Do not use this instrument in this position.**

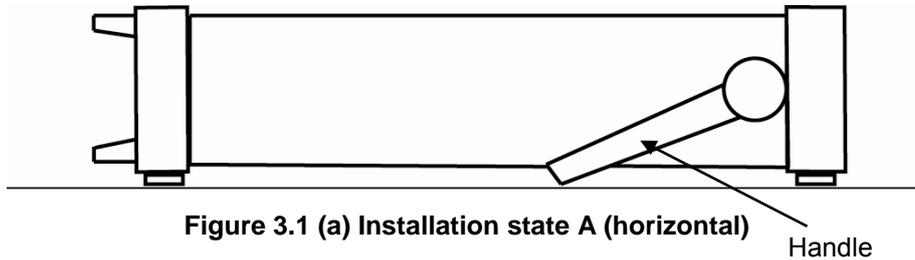


Figure 3.1 (a) Installation state A (horizontal)

Joint of handle to the body

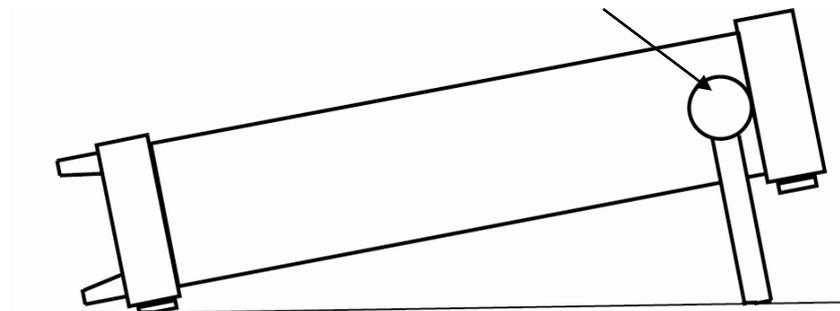
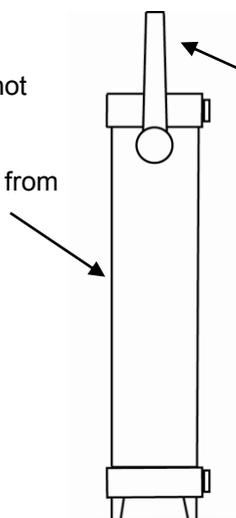


Figure 3.1 (b) Installation state B (slanted using handle)

This is only for temporary storage; do not measure in this position. Be careful because it is liable to topple from vibration or impact.



When you carry the Isolation Amplifier, hold the handle in this position.

Figure 3.1 (c) State C (with its back facing downwards)

## Installation and preparations

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### (2) Isolation Unit

The installation state A shown in Figure 3.2 (a) is the standard position. It is also possible to set the Isolation Unit with the battery pack downward as shown in Figure 3.2 (b) (installation state B).

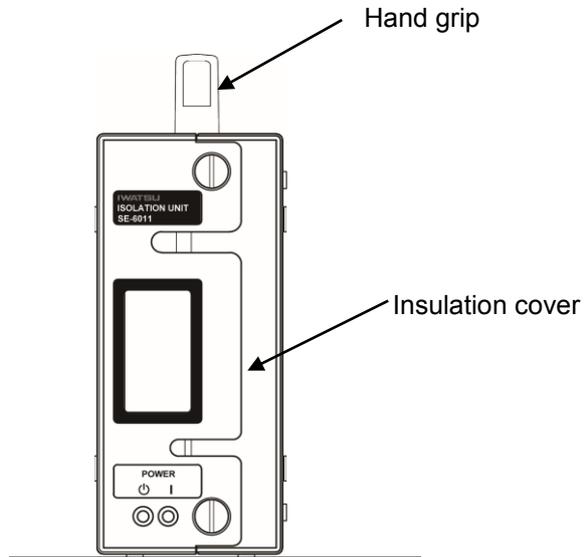


Figure 3.2 (a) Installation state A (standard)

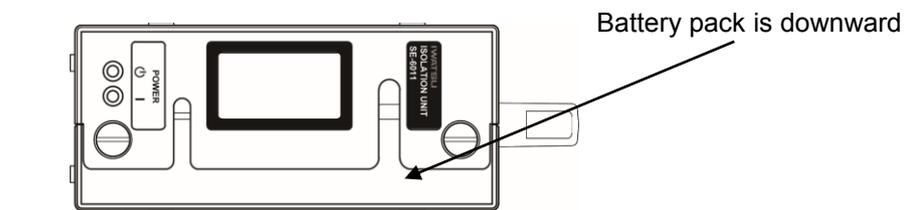
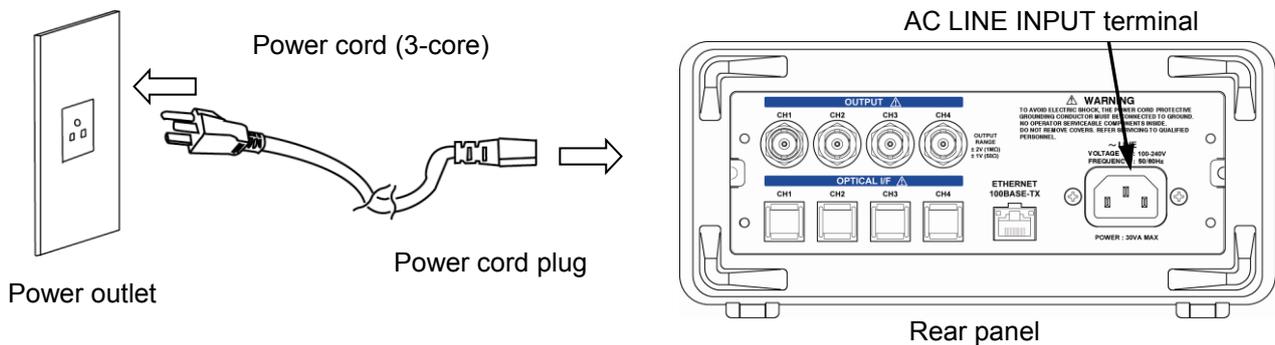


Figure 3.2 (b) Installation state B (with battery pack downward)

## 3.1.3 Power cord connection/power on (Isolation Amplifier SE-6000)

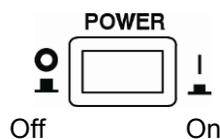
Warnings and cautions for the power cord and wiring of power cord are explained in the beginning of this manual on pages iii to viii. Make sure to read these warnings and cautions before connecting this instrument to power supply. Procedures for wiring of power cord and turning power on are explained in 1) to 4) written below.

- 1) Confirm that the POWER switch which is at the lower left of the front panel is off (status of **●** : switch is in its protruding position).
- 2) Insert attached power cord plug to AC LINE INPUT terminal on the back panel. (See Figure 3.3)



**Figure 3.3 Connection of power cord**

- 3) Push the POWER switch at the lower left of the front panel in Figure 3.4 to turn the power on (status of **I**: switch is in its sunk position). After power on, the start-up screen is displayed temporarily before the normal setting screen appears in several seconds.
- 4) To shut the power down, push the POWER switch to turn it off (status of **●**: switch is in its protruding position).



**Figure 3.4 Power ON/OFF**

### 3.2 Connection of instruments

Connection of instruments to construct the whole measurement system of this instrument is explained.

\* In this example, the Isolation Unit is connected to CH1.

#### ◆ Instruments and schematic illustration of the whole measurement system

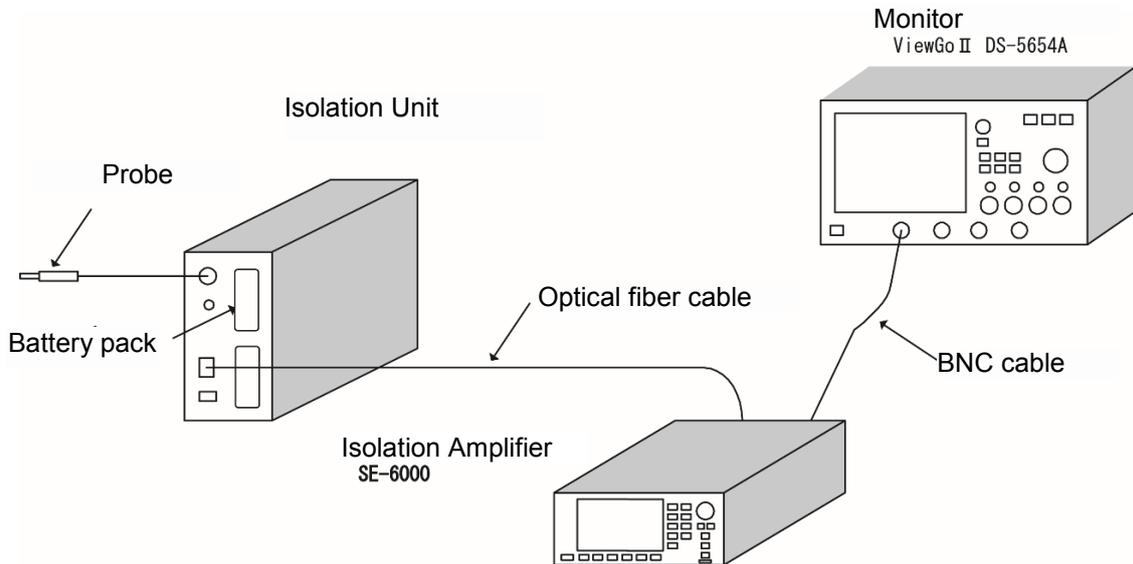


Figure 3.5 Example of constructed system

**Caution!** Power switches of each unit and amplifier have to be kept off at connection.

#### ◆ Connection procedures

##### (1) Isolation Unit

###### 1) Insert battery pack

\*1. Insert in such a direction that five terminals of the battery pack and battery bay fit.

Black tape is on the left side from your view.

\*2. Insert while holding the Isolation Amplifier stationary.

###### 2) Connect optical fiber cable.

\* Insert the connector of the optical fiber cable plug to the OPTICAL I/F socket on the front panel until it clicks into place.

###### 3) Connect the BNC plug of the probe to the input terminal on the front panel.

###### 4) Install insulation cover.

##### (2) Isolation Amplifier

###### 1) Connect the optical fiber cable.

\* Insert the optical fiber cable connector to CH1 of the OPTICAL I/F socket on the back until it clicks into place.

###### 2) Connect the BNC cable.

\* Connect the BNC cable. to CH1 of the OUTPUT terminal on the back.

###### 3) Connect the power cord to the AC LINE INPUT terminal on the back. Insert the power cord plug into the AC power outlet.

##### (3) Monitor (output destination)

###### 1) Connect the BNC cable to CH1 of the monitor input.

### 3.3 System startup

After “Connection of instruments” explained in 3.2, start up the system with the following procedures. In this example, the input signal of Isolation Amplifier SE-6000 is monitored by digital oscilloscope DS-5654A.

#### ◆ Procedures for system startup

##### (1) Power on

Push the POWER switches of 1) to 3) written below to turn them on.

\* In no particular order. 30-minute or more warm-up time is necessary before starting measurements.

- 1) Digital oscilloscope DS-5654A
- 2) Isolation Amplifier SE-6000
- 3) Isolation Unit SE-6011

##### (2) Settings of Isolation Amplifier SE-6000 and digital oscilloscope DS-5654

Select input coupling impedance of digital oscilloscope to either DC50Ω or DC1MΩ referring to the following depending upon the characteristics of data, purpose of measurement, etc.

- DC50Ω : To obtain good frequency characteristics.
- DC1MΩ : To obtain high precision in amplitude of measured signal.

Setting procedures of DC50Ω and DC1MΩ are explained separately below.

##### <In the case of DC50Ω>

- 1) Set each parameter in the SYSTEM menu of the Isolation Amplifier SE-6000 as follows.
  - a) SYSTEM/RANGE/OUTPUT ⇒ ±0.8V (50Ω) ±1.6V (1MΩ)
  - b) SYSTEM/RANGE/SCALE ⇒ 1/8DIV
- 2) Set CH menu, range, and offset of digital oscilloscope DS-5654A as follows.
  - a) CH1 Coupling ⇒ DC50Ω
  - b) CH1 Volt/div ⇒ 200mV/div
  - c) CH1 OFFSET ⇒ 0V

Because output of Isolation Amplifier is ±0.8V, input range of 200mV/div is appropriate to display the measured signal to the full-scale of the screen of the digital oscilloscope.

## Installation and preparations

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### <In the case of DC 1MΩ>

1) Set each parameter in the SYSTEM menu of Isolation Amplifier SE-6000 as follows.

- a) SYSTEM/RANGE/OUTPUT ⇒ ±1V (50Ω) ±2V (1MΩ)
- b) SYSTEM/RANGE/SCALE ⇒ 1/8DIV

Since output is set to ±1V at 50Ω load, ±2V, which is twice the value for 50Ω load, is output with 1MΩ load.

2) Set CH menu, range, and offset of digital oscilloscope DS-5654A as follows.

- a) CH1 Coupling ⇒ DC1MΩ
- b) CH1 Volt/div ⇒ 500mV/div
- c) CH1 OFFSET ⇒ 0V

Because output of Isolation Amplifier is ±2V, input range of 500mV/div is appropriate for displaying the measured signal to the full-scale of screen of the digital oscilloscope.

#### Memo

If ±0.8V (50Ω) is selected with 1MΩ load, output is ±1.6V, which is twice the value for 50Ω load. Because there is no such range with DS-5654A to display ±1.6V at full scale, ±1V (50Ω) is selected here.

This setting is to be adjusted according to the equipment used for the monitor.

Because range and offset of Isolation Unit will be adjusted according to the input signal, it is not necessary to change the range of oscilloscope afterwards.

The following procedures, **(3)** to **(6)**, are common to DC50Ω and DC1MΩ.

### **(3) Input of measurement signal**

Input measurement signal to Isolation Unit SE-6011.

### **(4) Adjustment of Isolation Amplifier SE-6000**

Adjust coupling, range, offset, etc., of the Isolation Unit in the menu of the Isolation Amplifier so that the observed signal is displayed within the screen of the digital oscilloscope.

- \*1. For setting procedures, see “4.1 CH menu.”
- \*2. Setting value of the RANGE of Isolation Amplifier is equal to the range of vertical axis of the digital oscilloscope screen.

To display the measured voltage value corresponding to the input signal, just like automatic measurement results of digital oscilloscope, vertical axis range of the digital oscilloscope and RANGE of SE-6000 have to match by rescaling.

### **(5) Rescaling of digital oscilloscope DS-5654A**

Rescale the digital oscilloscope according to the range and offset of the Isolation Amplifier.

### (6) Deskew of digital oscilloscope DS-5654A

When signals from multiple channels are input to the Isolation Amplifier and monitored by the digital oscilloscope, delay time may be different for each channel due to difference in length of optical fiber cable or electrical path.

Such adjustments in time domain as difference in delays are performed by Deskew of the digital oscilloscope. Adjust the delay of each channel to the channel with the smallest delay using a single signal source.

Examples of observed waveforms of CH1 to CH3 from a single signal source are shown in Figure 3.6. In this case, adjust the delays of CH2 and CH3 to CH1, since CH1 has the smallest delay. Since delay times of CH2 and CH3 as compared to CH1 are 0.10ns and 0.20ns, set CH/Deskew of CH2 and CH3 of digital oscilloscope to +0.10ns and +0.20ns, respectively. By using this instrument and the oscilloscope with these adjustments, difference in delay time of each channel can be cancelled. However, skew between each channel can change as much as 20ns when the Isolation Amplifier or Isolation Unit is rebooted, or optical fiber cable is re-inserted after removal.

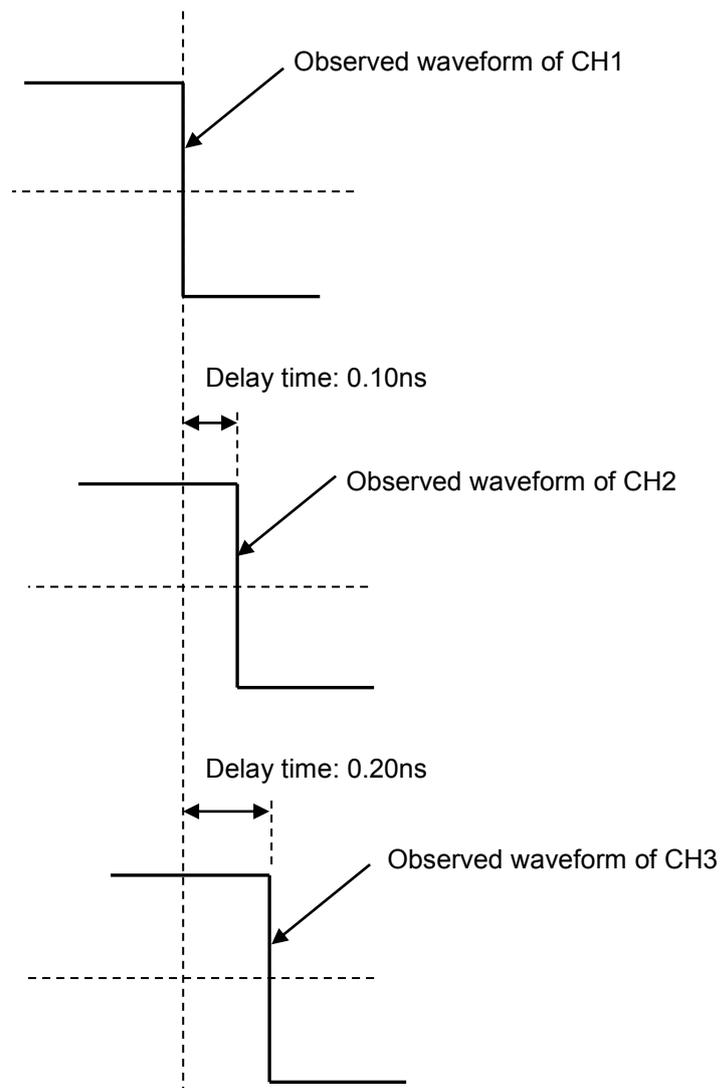


Figure 3.6 Example of observed waveforms of CH1 to CH3 from a single signal source

# 123 4 567

## Chapter 4 Function setting

In this chapter, function settings of each CH and the whole system of this instrument are explained.

# Function setting

## 4.1 CH menu

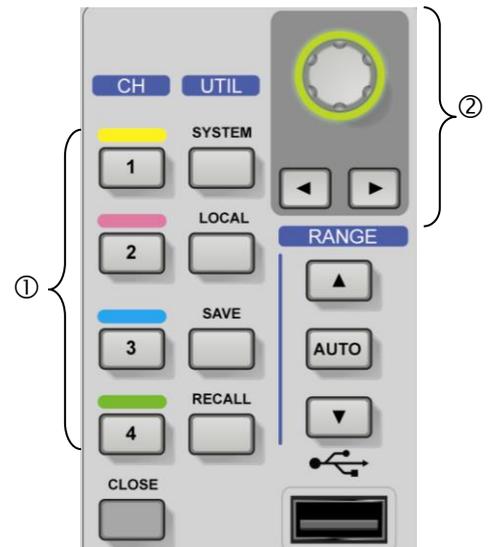
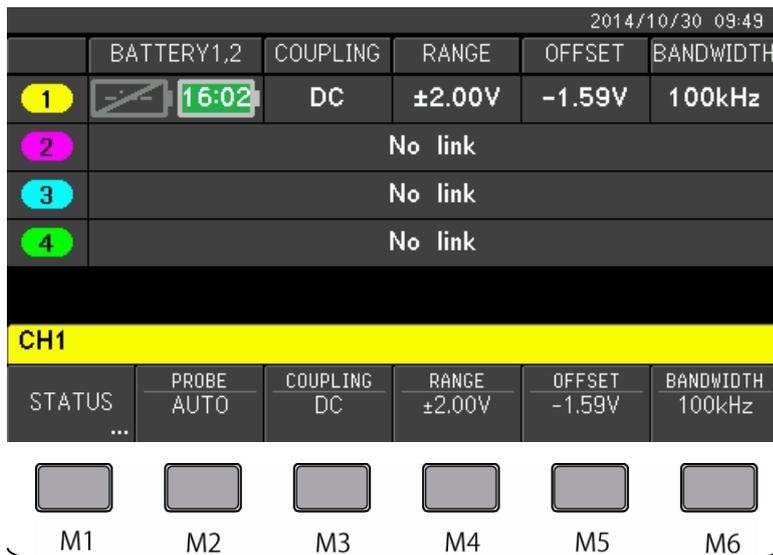
Each Isolation Unit corresponds to one CH. Up to 4 channels can be connected to one Isolation Amplifier. Settings of each Isolation Unit are performed by the CH menu of the Isolation Amplifier.

In this section, the CH menu screen, setting procedures, and details of settings are explained. The keys CH1 to CH4 of the Isolation Amplifier correspond to the menu of CH1 to CH4, respectively.

Setting procedures and their details, which are common to all channels, are explained with the CH1 screen as an example.

### Operation Procedures

- 1) Press one of the keys [1] to [4] from the CH row to select the CH.  
\* If status of the selected CH is No Link (link not detected), the CH menu will not be displayed.
- 2) Select an item in the menu at the bottom of the screen by pressing the rotary knob or menu key of M1 to M6 underneath the display. For operation procedures, see “2.3.2 Basics of menus.” Details of each CH menu setting are explained in the table “◆ CH menu items and details of settings” on the next page.



◆ CH menu items and details of settings

Menu items (1st)	Menu items (2nd)	Details	See also
STATUS		To display information of Isolation Unit connected to the CH.	6.1.1
	• MODEL	• To display model name of the Isolation Unit connected to the CH.	—
	• FIRMWARE	• To display version number of firmware of the Isolation Unit. • See 4.4 for firmware version up.	4.4
	• DEVICE	• To display version number of control device of the Isolation Unit.	—
	• TEMPERATURE	• To display internal temperature of the Isolation Unit. • Protection function is enabled when internal temperature falls outside the temperature range of $-15^{\circ}\text{C}$ to $+65^{\circ}\text{C}$ . See 2.2.5 for details.	2.2.5
	• SELF CALIBRATION	• To perform self-calibration. See 5.3.2 for details.	5.3.2
PROBE		To display and set attenuation ratio of probe to be connected to the Isolation Unit.	6.1.1
	• DEFAULT	• Attenuation ratio: AUTO	—
	* Select numerical value	• Select numerical value of attenuation ratio of the probe by rotating the rotary knob. When a probe with the probesense function is connected, attenuation ratio is automatically set by selecting AUTO. This attenuation ratio is applied to RANGE and OFFSET voltage. • Setting value: AUTO, 1 : 1, 5 : 1, 10 : 1, 20 : 1, 50 : 1, 100 : 1, 200 : 1, 500 : 1, 1000 : 1, 2000 : 1	
COUPLING		To display and set coupling of probe to be connected to the Isolation Unit.	6.1.1
	• DC	• To select DC coupling.	—
	• AC	• To select AC coupling.	
	• GND	• 0V input operation regardless of input signal.	
RANGE		To display and set input range of Isolation Unit. (Input range is for full-scale)	6.1.1
	• DEFAULT	Actual settings depend on SYSTEM/SCALE menu settings.	—
	* Select numerical value	• In the case of output ranges of $\pm 1\text{V}$ ( $50\Omega$ ) and $\pm 2\text{V}$ ( $1\text{M}\Omega$ ) $\pm 50\text{mV}$ , $\pm 100\text{mV}$ , $\pm 200\text{mV}$ , $\pm 500\text{mV}$ , $\pm 1\text{V}$ , $\pm 2\text{V}$ , $\pm 5\text{V}$ , $\pm 10\text{V}$ , $\pm 20\text{V}$ , $\pm 50\text{V}$ • In the case of output ranges of $\pm 0.8\text{V}$ ( $50\Omega$ ) and $\pm 1.6\text{V}$ ( $1\text{M}\Omega$ ) $\pm 40\text{mV}$ , $\pm 80\text{mV}$ , $\pm 200\text{mV}$ , $\pm 400\text{mV}$ , $\pm 800\text{mV}$ , $\pm 2\text{V}$ , $\pm 4\text{V}$ , $\pm 8\text{V}$ , $\pm 20\text{V}$ , $\pm 40\text{V}$ Note 1) The above figures are when SYSTEM/RANGE/SCALE is 1/1. In the case of 1/8DIV, range values are 1/4 of the above. Note 2) These values can also be changed with key of the RANGE section.	
OFFSET		To display and set offset of input CH of Isolation Unit.	6.1.1
	• DEFAULT	• Offset: 0.000V	—
	* Numerical value setting	• To set numerical value within the range shown below for RANGE setting. If RANGE is within $\pm 500\text{mV}$ , $\pm 1\text{V}$ (resolution: 0.1mV) If RANGE is $\pm 800\text{mV}$ to $\pm 5\text{V}$ , $\pm 10\text{V}$ (resolution: 1mV) If RANGE is $\pm 8\text{V}$ to $\pm 50\text{V}$ , $\pm 100\text{V}$ (resolution: 10mV) Note) The above figures are when SYSTEM/RANGE/SCALE is 1/1. In the case of 1/8DIV, RANGE is 1/4 of the above.	
BANDWIDTH		To display and set bandwidth of input CH of Isolation Unit.	6.1.1
	• FULL	• No bandwidth limitation.	—
	• 10 MHz/1 MHz/100 kHz	• Select one from these three frequencies. • Exclude higher frequency component than the setting from signal.	

## Function setting

### 4.1.1 RANGE

Over-range display, auto range function, and the relationship among the RANGE displayed in CH menu, output range of Isolation Amplifier, input range of Isolation Unit, RANGE SCALE etc., are explained below.

#### 4.1.1.1 RANGE displayed in CH menu

Input range of Isolation Unit is centered at set value-OFFSET as shown in Figure 4.1 (a) on the next page, and actual ranges are shown in Table 4.1. Output range of the Isolation Amplifier is centered at 0 V as shown in Figure 4.1 (b) on the next page, and actual ranges are shown in Table 4.1.

Input range is set by RANGE, OFFSET in CH menu, and output range is set by RANGE OUTPUT in the SYSTEM menu.

**Table 4.1 Input range, output range, and RANGE display**

Isolation Unit input			Isolation Amplifier output
Input range RANGE - OFFSET	RANGE display of each CH		Output range* <sup>3</sup> (load)
	When RANGE SCALE is set to 1/1* <sup>1</sup>	When RANGE SCALE is set to 1/8DIV* <sup>2</sup>	
±50mV-OFFSET	±50mV	12.5mV	±1V (50Ω) ±2V (1MΩ)
±100mV-OFFSET	±100mV	25.0mV	
±200mV-OFFSET	±200mV	50.0mV	
±500mV-OFFSET	±500mV	125mV	
±1.00V-OFFSET	±1.00V	250mV	
±2.00V-OFFSET	±2.00V	500mV	
±5.00V-OFFSET	±5.00V	1.25V	
±10.0V-OFFSET	±10.0V	2.50V	
±20.0V-OFFSET	±20.0V	5.00V	
±50.0V-OFFSET	±50.0V	12.5V	
±40mV-OFFSET	±40mV	10.0mV	±0.8V (50Ω) ±1.6V (1MΩ)
±80mV-OFFSET	±80mV	20.0mV	
±200mV-OFFSET	±200mV	50.0mV	
±400mV-OFFSET	±400mV	100mV	
±800mV-OFFSET	±800mV	200mV	
±2.00V-OFFSET	±2.00V	500mV	
±4.00V-OFFSET	±4.00V	1.00V	
±8.00V-OFFSET	±8.00V	2.00V	
±20.0V-OFFSET	±20.0V	5.00V	
±40.0V-OFFSET	±40.0V	10.0V	

- \*1. 1/1 is set with RANGE SCALE in SYSTEM menu.  
These values correspond to full-scale of voltage, and are voltage values relative to the offset settings.
- \*2. 1/8DIV is set with RANGE SCALE in SYSTEM menu.  
These values are voltage of 1div displayed by oscilloscope.
- \*3. Output range is set with RANGE OUTPUT in SYSTEM menu.  
Output range can be set to two different values. This is because the amplitude for a 1MΩ load is twice the amplitude for a 50Ω load, and if step of input range of monitoring device is 1 - 2 - 5, there are cases where the monitoring device cannot display the input signal to its full-scale for both 50Ω and 1MΩ load with the same output range.  
For example, in the case where the output range is set to ±0.8V, full-scale of an oscilloscope set to 200mV/div corresponds to the output range when the input load is 50Ω, but if input load is changed to 1MΩ with the other settings remain the same, the output becomes twice (±1.6V) and 400mV/div is required to make the full-scale correspond to the output range, which is not possible. However, if output range is changed to ±1V to make the output be ±2V with 1MΩ load, full-scale of the oscilloscope with 500mV/div corresponds to the output range.

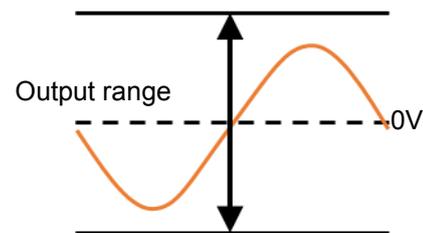
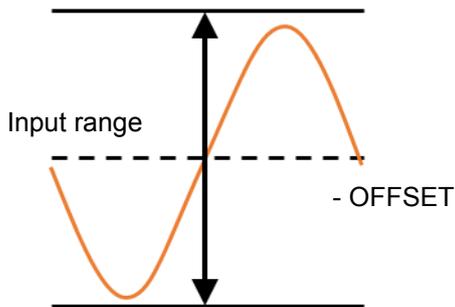


Figure 4.1 (a) Isolation Unit input range

Figure 4.1 (b) Isolation Amplifier output range

If output range of the Isolation Amplifier and display range of the oscilloscope are set to the same value, output signal of the Isolation Amplifier can be displayed to the full-scale of the oscilloscope screen. Input load of the oscilloscope can be selected from either 50Ω or 1MΩ. You can adjust output range of the Isolation Amplifier and display range of the oscilloscope as shown in Table 4.2 for each of 50Ω load and 1MΩ load to display the output signal of the Isolation Amplifier to the full-scale of the oscilloscope screen.

Table 4.2 Input load of oscilloscope and settings of Isolation Amplifier and oscilloscope

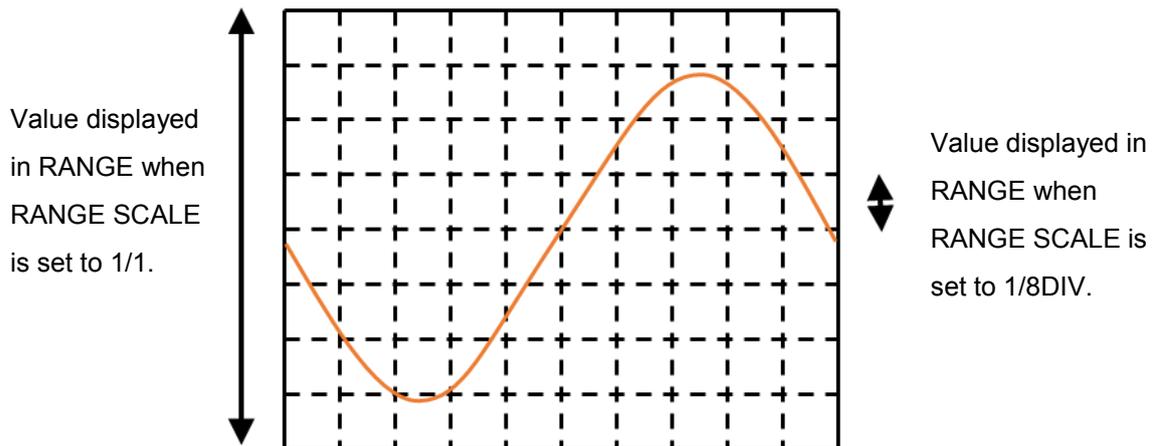
Input load of oscilloscope	Isolation Amplifier		Oscilloscope	
	RANGE OUTPUT	Output range	Display range	Voltage/division
50Ω	±0.8V (50Ω) ±1.6V (1MΩ)	±800mV	±800mV	200mV/div
1MΩ	±1V (50Ω) ±2V (1MΩ)	±2.00V	±2.00V	500mV/div

## Function setting

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Screens of most oscilloscopes are divided into 8 divisions vertically or voltage-wise as shown in Figure 4.2, and voltage value per division is set to the voltage range (unit: V/div). If you set RANGE SCALE of SYSTEM menu to 1/8DIV, 1/8 of the voltage input range can be displayed to the RANGE of each CH, which corresponds to the above-mentioned voltage range of the oscilloscope.

If full-scale of input range needs to be displayed to RANGE under the circumstances, for example, where output of the Isolation Amplifier is input to devices other than oscilloscopes, set RANGE SCALE to 1/1.



**Figure 4.2** If output of Isolation Amplifier is observed by oscilloscope

### 4.1.1.2 Over-range display

Range value of the CH is displayed in the read out display area inside the screen. If the range value is displayed in red as shown in Figure 4.3 (a), input signal is out of the input range, which is called over-range. In the case of over-range, open the RANGE menu and increase range setting or press the range key (key with upward arrow as shown in Figure 4.3 (c)). If input signal comes within the input range, display turns to normal as shown in Figure 4.3 (b).

2014/11/05 16:26					
	BATTERY1,2	COUPLING	RANGE	OFFSET	BANDWIDTH
1		12:21	DC	500mV	+0.00V 100kHz
2	No link				
3	No link				
4	No link				
<b>CH1</b>					
STATUS	PROBE	COUPLING	RANGE	OFFSET	BANDWIDTH
...	AUTO	DC	500mV	+0.00V	100kHz

Figure 4.3 (a) Display when Over-range

2014/11/05 16:40					
	BATTERY1,2	COUPLING	RANGE	OFFSET	BANDWIDTH
1		12:06	DC	1.25V	+0.00V 100kHz
2	No link				
3	No link				
4	No link				
<b>CH1</b>					
STATUS	PROBE	COUPLING	RANGE	OFFSET	BANDWIDTH
...	AUTO	DC	1.25V	+0.00V	100kHz

Figure 4.3 (b) Display when normal

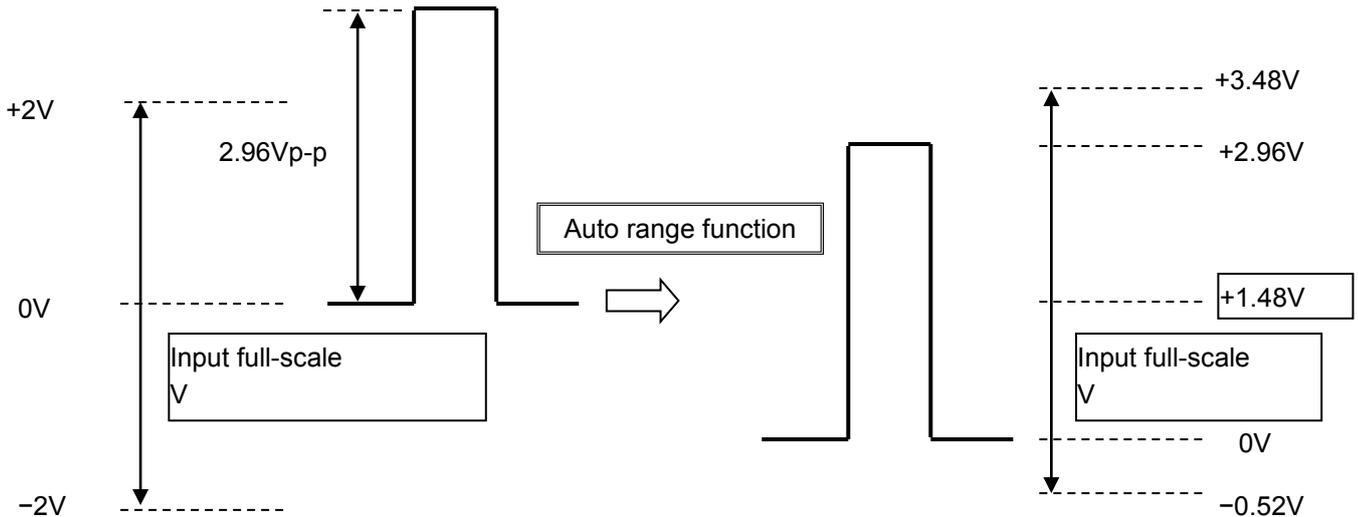


Figure 4.3 (c) Range key

## Function setting

### 4.1.1.3 Auto range function

If you press the [AUTO] key, range and offset are set to proper values in accordance with the input signal. If you use the auto range function when a square wave signal of 2.96Vp-p is input as shown in the left figure of Figure 4.4 (a), offset value will be set to -1.48V as shown in the right figure, and screen changes from Figure 4.4 (b) to (c). In this example, since 1/8DIV is set to 500mV, input range before auto range is  $\pm 2.00\text{V}-0\text{V}$  and that after auto range is  $\pm 2.00\text{V}+1.48\text{V}$ .



<Settings before auto range>

- Input range: 500mV (full-scale:  $\pm 2.00\text{V}$ )
- Offset: 0V

<Optimum settings after auto range>

- Input range: 500mV (full-scale:  $\pm 2.00\text{V}$ )
- Offset: -1.48V

Figure 4.4 (a) Example of auto range functions

2014/11/06 19:58					
	BATTERY1,2	COUPLING	RANGE	OFFSET	BANDWIDTH
1	3:47	DC	500mV	+0.00V	100kHz
2			No link		
3			No link		
4			No link		
CH1					
STATUS	PROBE AUTO	COUPLING DC	RANGE 500mV	OFFSET +0.00V	BANDWIDTH 100kHz

Figure 4.4 (b) Display before auto range

2014/11/06 19:58					
	BATTERY1,2	COUPLING	RANGE	OFFSET	BANDWIDTH
1	3:46	DC	500mV	-1.48V	100kHz
2			No link		
3			No link		
4			No link		
CH1					
STATUS	PROBE AUTO	COUPLING DC	RANGE 500mV	OFFSET -1.48V	BANDWIDTH 100kHz

Figure 4.4 (c) Display after auto range

### 4.1.2 BANDWIDTH

There are four selections in the CH/BANDWIDTH menu, and each bandwidth is as shown below.

- FULL : Frequency bandwidth is set to 30MHz, which is the maximum bandwidth of the Isolation Unit.
- 10 MHz : Excludes components of 10 MHz or more.
- 1 MHz : Excludes components of 1 MHz or more.
- 100 kHz : Excludes components of 100 kHz or more.

### 4.2 SAVE menu

Settings shown below can be saved by the SAVE menu.

#### (1) Settings

- 1) Settings of CH1 to CH4 (PROBE, COUPLING, RANGE, OFFSET, BANDWIDTH)
- 2) OUTPUT RANGE
- 3) RANGE SCALE

\* Items of 1) are to be set in the CH menu, and of 2) and 3) are to be set in the SYSTEM menu.

Those settings, 1) through 3), are saved as a set.

#### (2) DESTINATION

- 1) INTERNAL MEMORY

Up to ten sets of settings can be saved.

You can view the settings currently saved to the internal memory by selecting the number of the internal memory, #1 to #10, in the SAVE/NUMBER menu, as shown in Figure 4.5. Memory number can be changed by rotating the rotary knob.

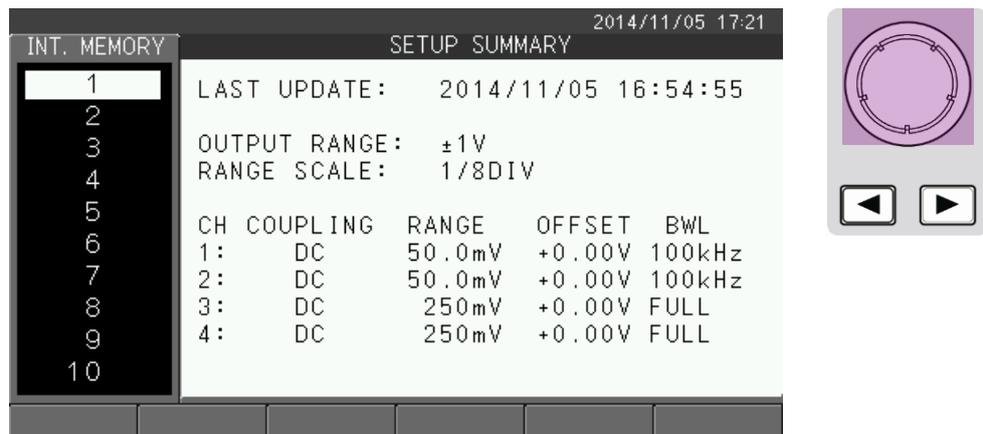


Figure 4.5 SETUP SUMMARY

- 2) USB MEMORY

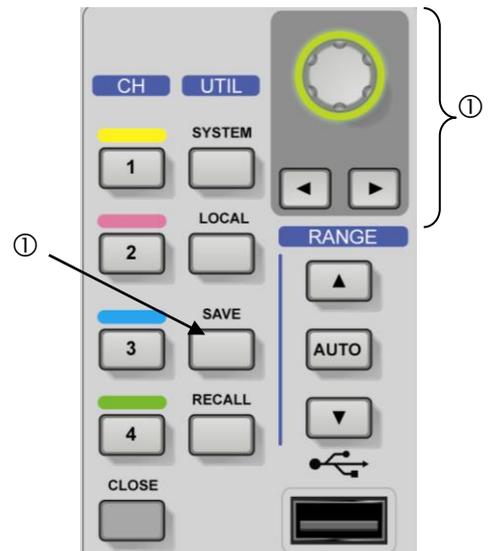
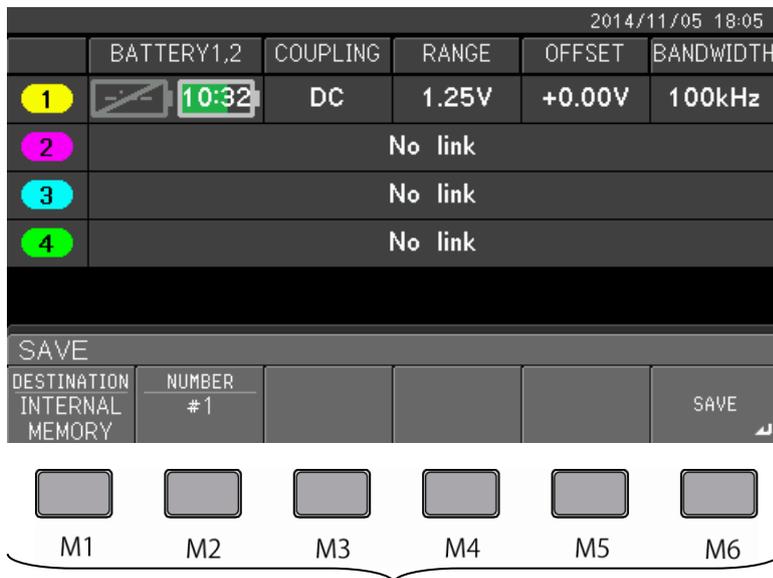
You can use file name to save each set of settings.

You can set name of the folder to be saved in the DIRECTORY menu and file name in the FILE NAME menu. (See 2.3.2.4 for operation procedures.)

Setting procedures and details are explained below.

**Operation Procedures**

- 1) Press the [SAVE] key to open the SAVE menu.
- 2) Use the menu at the bottom of the screen for setting. To select menu, use menu keys, M1 to M6, beneath the display or rotary knob. See “2.3.2 Basics of menus” for operation procedures. See “◆ Items of SAVE setting menu and details (destination: internal memory)” below and “◆ Items of SAVE setting menu and details (destination: USB memory)” on the next page for details of the SAVE menu.



②

◆ Items of SAVE setting menu and details (destination: internal memory)

Menu item (1st)	Menu item (2nd)	Details of setting	See also
DESTINATION		<ul style="list-style-type: none"> <li>To select and set the destination to save the settings from below.</li> </ul>	6.1.2
	<ul style="list-style-type: none"> <li>INTERNAL MEMORY</li> <li>USB MEMORY</li> </ul>	<ul style="list-style-type: none"> <li>To select internal memory of this instrument.</li> <li>To select USB memory.</li> </ul>	—
NUMBER		<ul style="list-style-type: none"> <li>Pressing the M2 key displays SETUP SUMMARY of the internal memory corresponding to the selected number.</li> <li>Select number of the internal memory, #1 to #10, using the rotary knob.</li> </ul>	
SAVE		<ul style="list-style-type: none"> <li>Save settings to the destination specified above (internal memory corresponding to the number specified).</li> </ul>	—

## Function setting

### ◆ Items of SAVE setting menu and details (destination: USB memory)

Menu item (1st)	Menu item (2nd)	Details of setting	See also
DESTINATION		<ul style="list-style-type: none"> <li>To select and set the destination to save the settings from below.</li> </ul>	6.1.2
	• INTERNAL MEMORY	<ul style="list-style-type: none"> <li>To select internal memory of this instrument.</li> </ul>	—
	• USB MEMORY	<ul style="list-style-type: none"> <li>To select USB memory.</li> </ul>	—
DIRECTORY		<ul style="list-style-type: none"> <li>To set directory name of the USB memory to which settings are to be saved. Input each character, number, or symbol of directory name at the cursor position of the DIRECTORY creation plate using the input and delete menu described below.</li> <li>Up to eight characters, numbers, or symbols in total can be used and displayed in the menu as the DIRECTORY name.</li> </ul>	—
	• DEFAULT	<ul style="list-style-type: none"> <li>To set DIRECTORY to "SETUP."</li> </ul>	—
	• ABC	<ul style="list-style-type: none"> <li>You can input capital letter of alphabet to the cursor position of the DIRECTORY creation plate. Input format is displayed as character at the head of the DIRECTORY creation plate. Letters change as you rotate the rotary knob, and pressing the knob closes the DIRECTORY menu.</li> </ul>	—
	• 123	<ul style="list-style-type: none"> <li>You can input numbers, 0 to 9, to the cursor position of the DIRECTORY creation plate. To select, press the M3 key, and input format is displayed as number at the head of DIRECTORY creation plate. Numbers change as you rotate the rotary knob, and pushing the knob closes the DIRECTORY menu.</li> </ul>	—
	• ! @\$	<ul style="list-style-type: none"> <li>You can input symbols, including space, to the cursor position of the DIRECTORY creation plate. To select, press the M4 key, and input format is displayed as symbol at the head of DIRECTORY creation plate. Symbol changes as you rotate the rotary knob, and pushing the knob closes the DIRECTORY menu.</li> </ul>	—
	• BACK SPACE	<ul style="list-style-type: none"> <li>Delete one character, number, or symbol in front of the cursor position on the DIRECTORY creation plate. To delete, press the M5 key.</li> </ul>	—
	• INPUT SPACE	<ul style="list-style-type: none"> <li>Input space to the cursor position on the DIRECTORY creation plate. To input, press the M6 key.</li> </ul>	—
FILE NAME		<ul style="list-style-type: none"> <li>To set file name of the settings to be saved to USB memory. Input each character, number, or symbol of the file name at the cursor position of the FILE NAME creation plate using input menu described below.</li> <li>Total number of characters, numbers, or symbols for file names is fixed to eight.</li> </ul>	—
	• DEFAULT	<ul style="list-style-type: none"> <li>To set FILE NAME to "STUP0000." "0000" can only be replaced by numbers.</li> </ul>	—
	• ABC	<ul style="list-style-type: none"> <li>You can input capital letters of alphabet to the cursor position of the FILE NAME creation plate. (Note) When cursor is in the position of "0000," only numbers can be input. Input format is displayed as character at the head of FILE NAME creation plate. Letters change as you rotate the rotary knob, and pushing the knob closes the FILE NAME menu.</li> </ul>	—
	• 123	<ul style="list-style-type: none"> <li>You can input numbers, 0 to 9, to the cursor position of the FILE NAME creation plate. To select, press the M3 key, and input format is displayed as number at the head of the FILE NAME creation plate. Number changes as you the rotate rotary knob, and pushing the knob closes the FILE NAME menu.</li> </ul>	—
	• ! @\$	<ul style="list-style-type: none"> <li>You can input symbols to the cursor position of the FILE NAME creation plate. (Note) When cursor is in the position of "0000" of the FILE NAME, only numbers can be input. To select, press the M4 key, and input format is displayed as symbol at the head of FILE NAME creation plate. Symbols change as you rotate the rotary knob, and pushing the knob closes the FILE NAME menu.</li> </ul>	—
SAVE		<ul style="list-style-type: none"> <li>To save settings to the directory and file names specified above.</li> </ul>	—

## 4.3 RECALL menu

You can retrieve settings from sources explained below by the RECALL menu.

Content of the retrieved settings are the same as explained in (1) of 4.2 SAVE menu.

### (1) SOURCE

#### 1) INTERNAL MEMORY

You can view the settings currently saved to the internal memory by selecting the corresponding number of internal memory, #1 to #10, in the RECALL/NUMBER menu, as shown in Figure 4.6.

Rotate rotary knob to change the memory number.

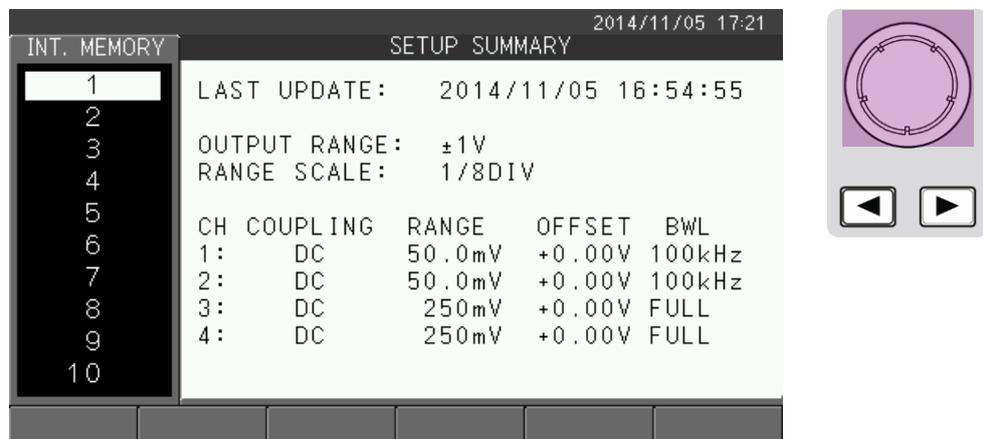


Figure 4.6 SETUP SUMMARY

#### 2) USB MEMORY

You can specify the source folder name in the RECALL/DIRECTORY menu.

(See 2.3.2.4 for operation procedures)

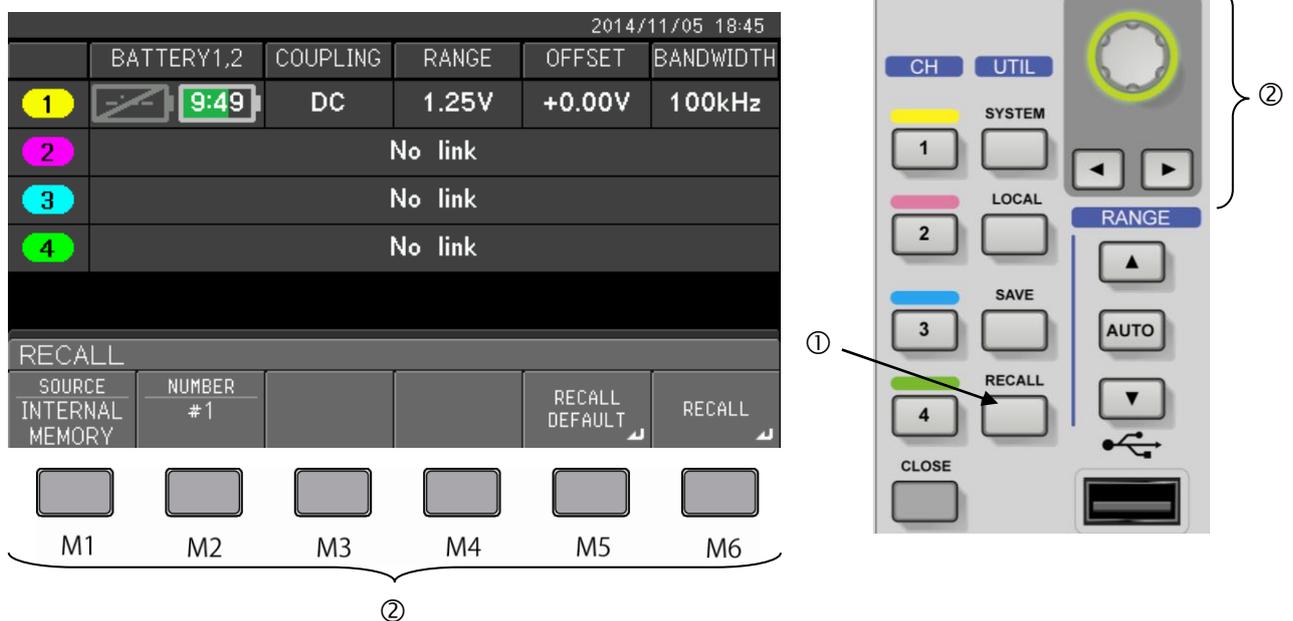
You can view file names in the specified folder and settings saved to the selected file in USB memory by selecting the FILE NAME menu. You can select a file by rotating the rotary knob.

## Function setting

Setting procedures and details of the RECALL menu are explained below.

### Operation Procedures

- 1) Press the [RECALL] key to open the RECALL menu.
- 2) Use the menu at the bottom of the screen for setting. Select menu using menu keys, M1 to M6, beneath the display or rotary knob. See “2.3.2 Basics of menus” for operation procedures. See “◆ Items of RECALL setting menu and details (source: internal memory)” below and “◆ Items of RECALL setting menu and details (source: USB memory)” on the next page for details of the RECALL menu.



### ◆ Items of RECALL setting menu and details (source: internal memory)

Menu item (1st)	Menu item (2nd)	Details of setting	See also
SOURCE		<ul style="list-style-type: none"> <li>To select and set the source to retrieve the settings from below.</li> </ul>	6.1.2
	INTERNAL MEMORY	<ul style="list-style-type: none"> <li>To select internal memory of this instrument.</li> </ul>	—
	USB MEMORY	<ul style="list-style-type: none"> <li>To select USB memory.</li> </ul>	—
NUMBER		<ul style="list-style-type: none"> <li>Press the M2 key, and select number of internal memory, #1 to #10 by rotating the rotary knob.</li> <li>SETUP SUMMARY (summary of settings) corresponding to the memory number at cursor position will be displayed.</li> </ul>	—
RECALL DEFAULT		<ul style="list-style-type: none"> <li>To retrieve factory default settings.</li> </ul>	—
RECALL		<ul style="list-style-type: none"> <li>To retrieve settings from the source specified above. To retrieve, press the M6 key.</li> </ul>	—

◆ Items of RECALL setting menu and details (source: USB memory)

Menu item (1st)	Menu item (2nd)	Details of setting	See also
SOURCE		<ul style="list-style-type: none"> <li>To select and set the source to retrieve the settings from below.</li> </ul>	6.1.2
	• INTERNAL MEMORY	<ul style="list-style-type: none"> <li>To select internal memory of this instrument.</li> </ul>	—
	• USB MEMORY	<ul style="list-style-type: none"> <li>To select USB memory.</li> </ul>	—
DIRECTORY		<ul style="list-style-type: none"> <li>To set source directory name of USB memory from which settings are to be retrieved. Input each character, number, or symbol of directory name at the cursor position of the DIRECTORY creation plate by the input and delete menu described below.</li> <li>Up to eight characters, numbers, or symbols in total can be used and displayed in the menu as names.</li> </ul>	—
	• DEFAULT	<ul style="list-style-type: none"> <li>To set DIRECTORY to "SETUP" format.</li> </ul>	—
	• ABC	<ul style="list-style-type: none"> <li>You can input capital letter of the alphabet to the cursor position of the DIRECTORY creation plate. To select, press the M2 key, and input format is displayed as character at the head of the DIRECTORY creation plate. Letters change as you rotate the rotary knob, and pushing the knob closes the DIRECTORY menu.</li> </ul>	—
	• 123	<ul style="list-style-type: none"> <li>You can input numbers, 0 to 9, to the cursor position of the DIRECTORY creation plate. To select, press the M3 key, and input format is displayed as number at the head of the DIRECTORY creation plate. Numbers change as you rotate the rotary knob, and pushing the knob closes the DIRECTORY menu.</li> </ul>	—
	• ! @\$	<ul style="list-style-type: none"> <li>You can input symbols, including space, to the cursor position of the DIRECTORY creation plate. Select by the M4 key, and input format is displayed as symbol at the head of the DIRECTORY creation plate. Symbols change as you rotate the rotary knob, and pushing the knob closes the DIRECTORY menu.</li> </ul>	—
	• BACK SPACE	<ul style="list-style-type: none"> <li>Delete one character, number, or symbol in front of the cursor position of the DIRECTORY creation plate. To delete, press the M5 key.</li> </ul>	—
	• INPUT SPACE	<ul style="list-style-type: none"> <li>To input space to the cursor position on the DIRECTORY creation plate. To input, press the M6 key.</li> </ul>	—
FILE NAME		<ul style="list-style-type: none"> <li>Select file name of the settings to be retrieved from USB memory.</li> <li>Select file name from displayed FILE LIST by rotating the rotary knob.</li> </ul>	—
RECALL DEFAULT		<ul style="list-style-type: none"> <li>To retrieve factory default settings.</li> </ul>	—
RECALL		<ul style="list-style-type: none"> <li>Retrieve settings from the source specified above. To retrieve, press the M6 key.</li> </ul>	—

## 4.4 SYSTEM menu

You can set the settings explained below by the SYSTEM menu.

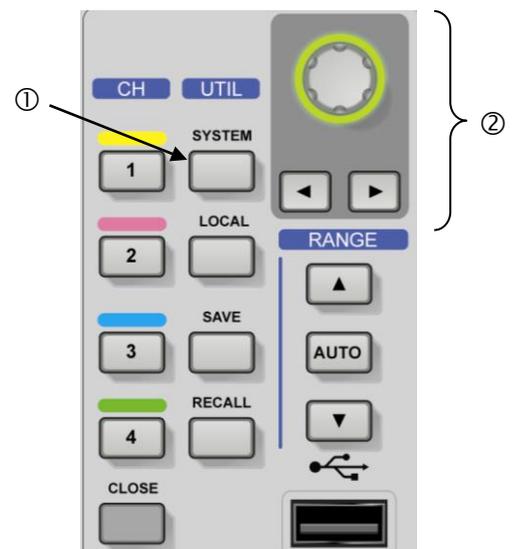
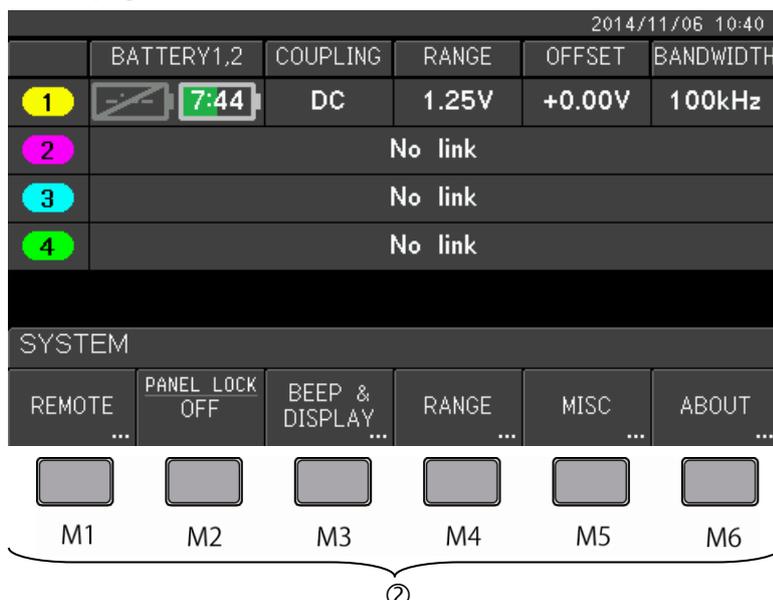
- REMOTE
  - Display and settings of LAN interface of remote control.
- PANEL LOCK
  - Display and settings of ON/OFF of panel lock.
- BEEP & DISPLAY
  - Display and settings of ON/OFF of beep sound.
  - Display and settings of LOW/HIGH of backlight brightness of LCD screen.
- RANGE
  - Display and selection of input/output range.
  - Display and selection of voltage value displayed to RANGE.
- MISC
  - Display and settings of date and time.
  - To perform firmware update.
  - To initialize all the settings.
- ABOUT
  - Display of such information as model name, firmware version number, and internal temperature (SE-6000).

Setting procedures and details of the SYSTEM menu are explained below.

### Operation Procedures

- 1) Press the [SYSTEM] key to open the SYSTEM menu at the bottom of the display.
- 2) Set each function in the SYSTEM menu.

Select menu using menu keys, M1 to M6, beneath the display or the rotary knob. See “2.3.2 Basics of menus” for operation procedures. See “◆ Setting items and details of SYSTEM menu” on the next page for details of the SYSTEM menu.



◆ Setting items and details of SYSTEM menu

Menu item (1st)	Menu item (2nd)	Details of setting	See also
REMOTE		<b>To display and set the setting of remote control by LAN.</b>	6.1.2
	• DHCP	<ul style="list-style-type: none"> <li>• OFF: To set ADDRESS, GATEWAY, and SUBNET MASK manually.</li> <li>• ON: To obtain ADDRESS, GATEWAY, and SUBNET MASK from DHCP server.</li> </ul>	—
	• ADDRESS	<ul style="list-style-type: none"> <li>• DEFAULT: 010.102.102.102</li> <li>* Numerical value setting: Set IP address of this instrument. If DHCP is ON, obtained IP address is displayed and cannot be changed.</li> </ul>	
	• GATEWAY	<ul style="list-style-type: none"> <li>• DEFAULT: 010.102.102.100</li> <li>* Numerical value setting: Set IP address of gateway server. If DHCP is ON, obtained IP address of gateway server is displayed and cannot be changed.</li> </ul>	
	• SUBNET MASK	<ul style="list-style-type: none"> <li>• DEFAULT: 255.255.255.000</li> <li>* Numerical value setting: Set subnet mask. If DHCP is ON, obtained subnet mask is displayed and cannot be changed.</li> </ul>	
	• DELIMITER	<ul style="list-style-type: none"> <li>• LF: To set delimiter to LF.</li> <li>• CR+LF: To set delimiter to CR+LF.</li> </ul>	
	• ENTER	<ul style="list-style-type: none"> <li>• OK: To apply changes of DHCP, ADDRESS, GATEWAY, and SUBNET MASK to LAN interface. After pressing ENTER in this menu, the Isolation Amplifier reboots automatically.</li> </ul>	
PANEL LOCK		<b>To display and set ON/OFF of panel lock.</b>	
	• ON	To disable all the keys and switches on the front panel except the POWER switch and the M2 key.	—
BEEP & DISPLAY		<b>To display and set ON/OFF of beep sound and backlight brightness of LCD screen.</b>	6.1.2
	• BEEP	<ul style="list-style-type: none"> <li>• OFF: BEEP sound at operation is off.</li> <li>• ON: BEEP sound at operation is on.</li> </ul>	—
• BACK LIGHT	<ul style="list-style-type: none"> <li>• HIGH: To brighten backlight of LCD screen.</li> <li>• LOW: To darken backlight of LCD screen.</li> </ul>		
RANGE		<b>To display and select input/output voltage range and value displayed in the RANGE screen.</b>	6.1.2
	• OUTPUT	<ul style="list-style-type: none"> <li>• <math>\pm 1V</math> (50<math>\Omega</math>) and <math>\pm 2V</math> (1M<math>\Omega</math>) To set output to <math>\pm 1V</math> (50<math>\Omega</math>), <math>\pm 2V</math> (1M<math>\Omega</math>).</li> <li>• <math>\pm 0.8V</math> (50<math>\Omega</math>) and <math>\pm 1.6V</math> (1M<math>\Omega</math>) To set output to <math>\pm 0.8V</math> (50<math>\Omega</math>), <math>\pm 1.6V</math> (1M<math>\Omega</math>).</li> </ul>	—
	• SCALE	<ul style="list-style-type: none"> <li>• 1/1: Voltage full-scale is displayed in RANGE.</li> <li>• 1/8DIV: 1/8 of voltage full-scale is displayed in RANGE.</li> </ul>	—
MISC		<b>To display and set date and time, update firmware, and initialize all the settings.</b>	6.1.2
	• DATE TIME	<ul style="list-style-type: none"> <li>• ENTER: To finalize set values.</li> <li>• CANCEL: To close input field menu of DATE TIME.</li> <li>* Numerical value setting: Use rotary knob and arrow keys to set numerical values.</li> </ul>	—
	• FIRMWARE UPDATE	<ul style="list-style-type: none"> <li>• SE-6000: To update firmware of Isolation Amplifier.</li> <li>• CHn: To update firmware of Isolation Unit connected by optical fiber cable.</li> </ul>	4.4.1
	• RESET ALL	<ul style="list-style-type: none"> <li>• To initialize settings to factory default settings. Internal memory will not be initialized. Note) Save necessary settings before performing RESET ALL.</li> </ul>	—
ABOUT		<b>To display version information of Isolation Amplifier. See 4.4.2 for example screen.</b>	4.4.2, 6.1.2

## Function setting

---

### 4.4.1 MISC/FIRMWARE UPDATE menu

In this section, firmware updating procedures of the Isolation Amplifier and Isolation Unit are explained. Read the Preparations and Caution! below when you perform firmware updates.

#### ○ Preparations

Stop supplying any signals to the terminals of the front and back panels of the instrument, and remove test leads, cables, adaptors, etc., except optical fiber cable(s) connected to Isolation Unit(s) when you are going to update the Isolation Unit(s).

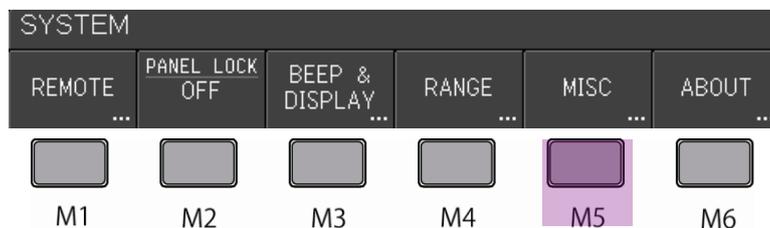
#### Caution!

- 1) **Never turn the power off or remove USB memory or optical fiber cables during firmware update.**
- 2) Update of firmware of internal hardware may begin after the reboot of the Isolation Amplifier at the completion of firmware update of the Isolation Amplifier. Never turn the power off during the update of firmware of internal hardware.
- 3) Contact our salesperson or visit our website for firmware update. (<http://www.iti.iwatsu.co.jp>)
- 4) Save necessary settings to USB memory using the SAVE function in the SAVE menu (see 4.2) before the firmware update.
- 5) When saving firmware files to USB memory, save under the “FIRMWARE” folder. Otherwise, files will not be recognized.

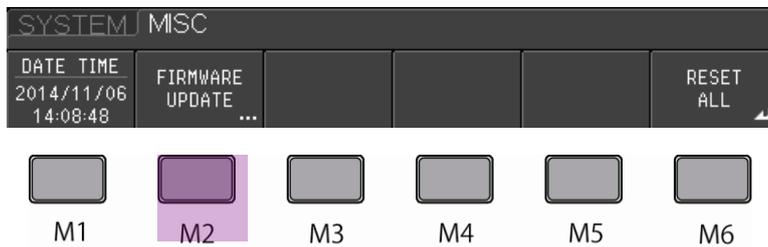
#### 4.4.1.1 Firmware update of Isolation Amplifier

##### Operation Procedures

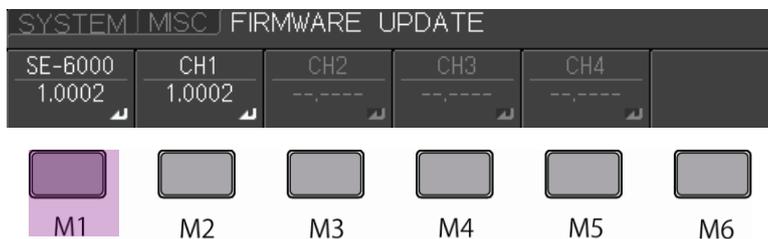
- 1) Save update file to FIRMWARE folder of USB memory.
- 2) Insert the USB memory with the update file to the USB port of the front panel.
- 3) Press the [SYSTEM] key to open the SYSTEM menu.
- 4) Press the M5 key in the SYSTEM menu to open the MISC menu shown in 5) below.



- 5) Press the M2 key in the MISC menu to select the FIRMWARE UPDATE menu, and open the FIRMWARE UPDATE screen shown in 6) below.



- 6) Press the M1 key in the FIRMWARE UPDATE menu, in which current version of firmware is displayed, to select the SE-6000 menu and open the confirmation menu shown in 7) below.

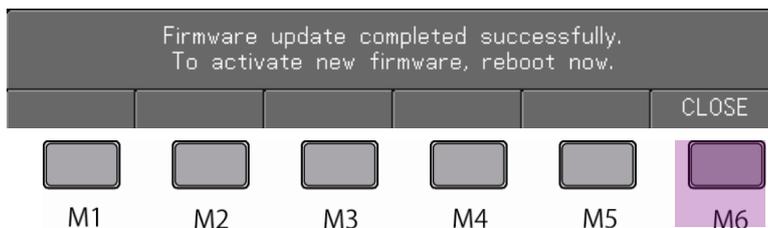


- 7) Press the M1 key to select YES in the confirmation menu displaying "Are you sure you want to update firmware?"



- 8) Color of message area changes to blue, and message showing progress is displayed during the update, which should take several minutes. If the update is successfully completed, the menu shown in 9) below will be displayed.

- 9) Press the M6 key to close the menu.



- 10) Turn the POWER switch off before turning it on again to reboot.

## Function setting

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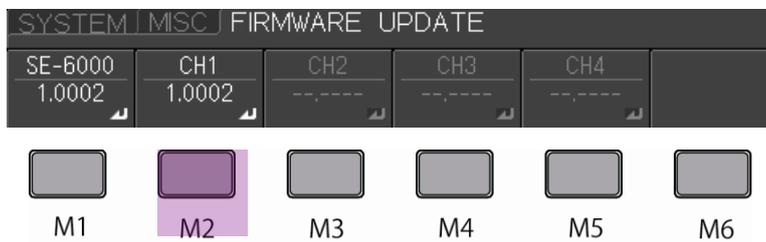
### 4.4.1.2 Firmware update of Isolation Unit

Update the firmware of each Isolation Unit by the same procedures to update the Isolation Amplifier.

(See 4.4.1.1)

When you update the Isolation Unit, however, instead of selecting SE-6000 by pressing the M1 key as explained in the step 6 of the previous section, press one of the M2 to M5 keys to select the CH menu of the Isolation Unit you want to update, as shown in the figure below, after confirming the current firmware version of the Isolation Amplifier in the firmware update menu.

\* In this example, the Isolation Unit is connected to CH1 only and recognized. If the Isolation Unit or Units are connected to other channels; i.e., CH2 to CH4, menu(s) of the corresponding channels will be displayed.

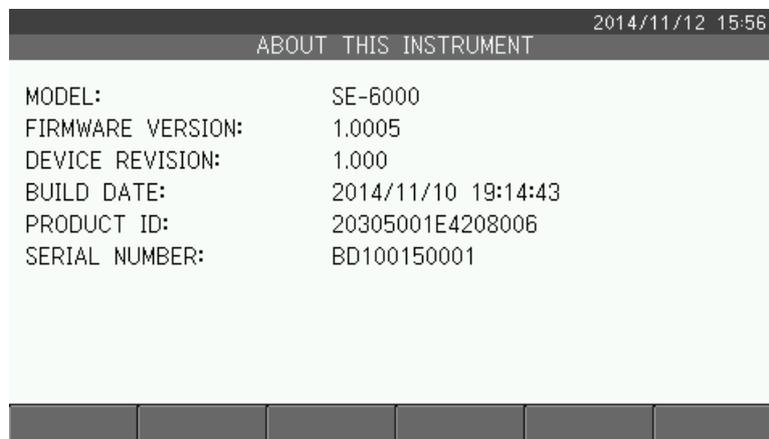


In the case of the Isolation Unit, reboot is not necessary after update.

#### 4.4.2 ABOUT menu

To display version information of the Isolation Amplifier.

When you select SYSTEM/ABOUT, the menu screen such as shown in Figure 4.7 opens.



The screenshot shows a menu screen titled 'ABOUT THIS INSTRUMENT' with a timestamp '2014/11/12 15:56' in the top right corner. The screen displays the following information:

MODEL:	SE-6000
FIRMWARE VERSION:	1.0005
DEVICE REVISION:	1.000
BUILD DATE:	2014/11/10 19:14:43
PRODUCT ID:	20305001E4208006
SERIAL NUMBER:	BD100150001

\* Version information, etc., below are displayed.

- MODEL : Model name
- FIRMWARE VERSION : Firmware version number

**Figure 4.7 Example of ABOUT THIS INSTRUMENT screen**

# 1234 5 67

## Chapter 5 Daily check and calibration

In this chapter, procedures of checking, maintenance, and calibration of this instrument are explained.

### 5.1 Daily maintenance

#### Caution!

To avoid electrical shock, note the following before cleaning

- Be sure to turn off the power switch of the Isolation Amplifier.
- Be sure to turn the power switch of the Isolation Unit to stand-by.

To clean stains on the outer case, polish lightly with a soft cloth moderately moistened with water or diluted neutral detergent.

Do not use solvent or detergent that is not suitable for cleaning, as it may change color or cause unexpected trouble.

Refer to the following for the selection of solvent or detergent.

- Solvent or detergent suitable for cleaning : Water or neutral detergent (diluted)
- Solvent or detergent not suitable for cleaning : Alcohol, gasoline, acetone, lacquer, ether, thinner, and detergent with ketone

### 5.2 Maintenance

#### ○ Battery pack

For maintenance of the battery pack, read “2.2.2 Battery pack” and “2.2.3 Charging battery pack” carefully.

#### ○ Optical fiber cable

Handle carefully so that you do not scratch end faces of the optical fiber cable. Never touch the end faces directly with your hand. When optical fiber cables are not in use, protect the end faces with caps.

If the end face is stained, clean with gauze or the like moistened with pure water or methanol.

### 5.3 Calibration

To maintain the precision of the measurement of this instrument, regular calibration and adjustment, which we undertake with charge, and self-calibration, which the customer can perform, are necessary.

#### 5.3.1 Regular calibration

For regular calibration of the whole system, contact Iwatsu office or our sales distributors. We recommend that **regular calibration be performed once a year**.

### 5.3.2 SELF CALIBRATION menu

The SELF CALIBRATION menu is provided to maintain the precision of the measurement by performing calibration in accordance with changes of environment such as temperature.

For reliable measurements, we recommend regular checking and calibration of this instrument. In this section, calibration using the SELF CALIBRATION menu, which can be performed by the customer, is explained.

#### 5.3.2.1 Overview

Self-calibration can be performed by the customer via the CHn/STATUS/SELF CALIBRATION menu of this instrument.

Calibration is performed on internal circuits of the Isolation Unit of each channel such as the attenuator, amplifier, and A/D converter and those of the Isolation Amplifier such as D/A converter. Perform with the CHn/STATUS/SELF CALIBRATION menu for each connected CH.

#### 5.3.2.2 Precautions

Note the following in relation to preparations and precautions.

##### Caution!

- 1) Confirm that voltage of power supply of Isolation Amplifier is within  $\pm 10\%$  of the value shown on the rear panel and that frequency of the power supply is either 50Hz or 60Hz.
- 2) Confirm that the available capacity of the battery pack in the Isolation Unit is sufficient.
- 3) Perform the calibration under the actual operation temperature and with humidity of no more than 80%RH.
  - \* If operation temperature is not specified, use  $23\pm 5^{\circ}\text{C}$  as operation temperature.
- 4) Warm-up time of 30 minutes or more after the power on is necessary before the calibration.
- 5) **Be sure to connect the Isolation Unit and Isolation Amplifier using optical fiber cable** for calibration (adjustment) of this instrument.
  - \*1 Connection is necessary for self-calibration. For actual measurements, combination of CHn and optical fiber cable can be arbitrary.
  - \*2 Do not connect the BNC input terminal of the Isolation Unit.  
Output connection of the Isolation Unit has nothing to do with the calibration.
- 6) **Never turn the power off or disconnect optical fiber cables during calibration.**

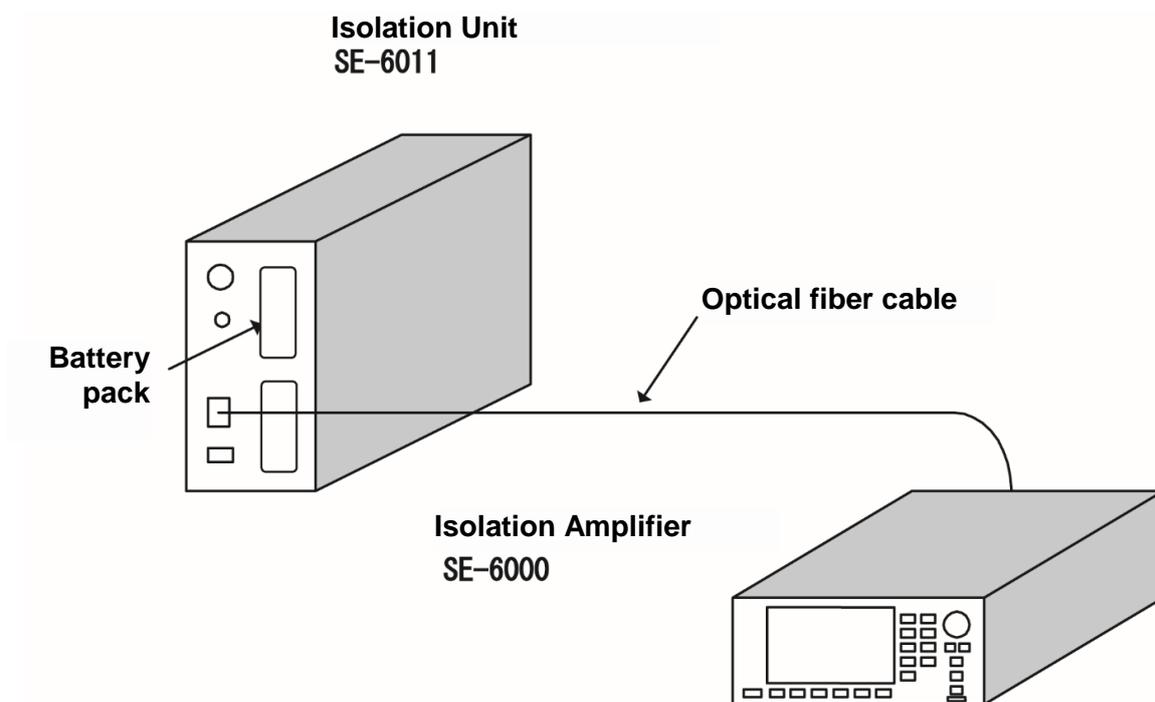
## Daily check and calibration

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### 5.3.2.3 Calibration

See (1) and (2) below for the preparation.

#### (1) Connection



**Figure 5.1 Connection for calibration**

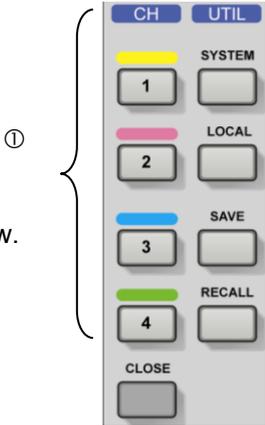
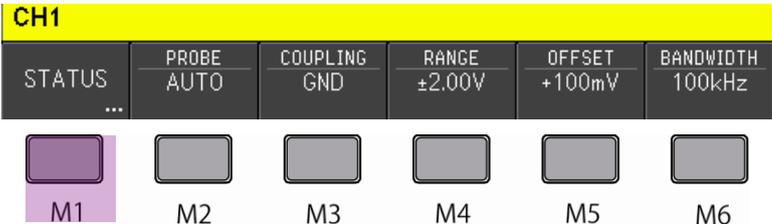
#### (2) Warm-up

Warm up for 30 minutes or more before the calibration (adjustment).

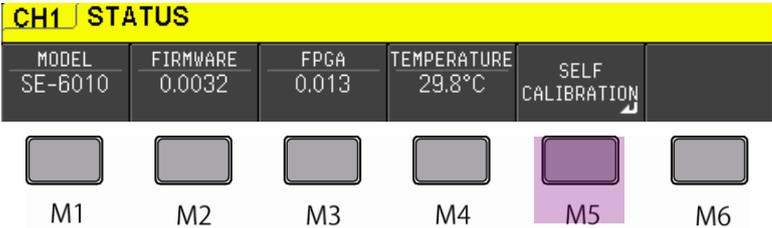
(3) Perform calibration with the SELF CALIBRATION menu

**Operation Procedures**

1) Open the CH menu shown below by pressing the CH key to calibrate as shown in the right figure below.  
(Example: to calibrate CH1)

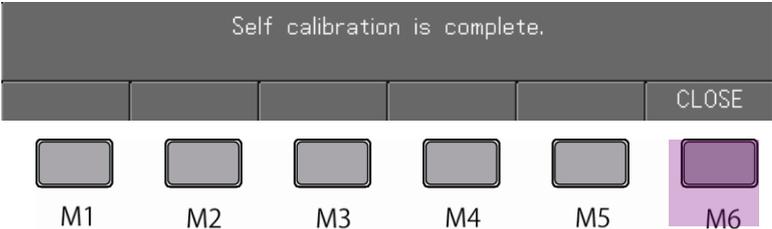


2) Press the M1 key in the above step to open the STATUS menu shown below.



3) Press the M5 key in the above step to perform SELF CALIBRATION.

Progress is displayed in the message display area by percentage. Calibration takes several minutes to complete before the menu is displayed as shown below.



Return to the STATUS menu of step 2) above by pressing the M6 key here.

4) Repeat 1) to 3) above for each connected CH.

### 5.4 Repair and sending product for repair

Contact Iwatsu office or our sales distributors in case of malfunctions. Unexpected malfunctions etc., that occur during warranty period due to our responsibility will be repaired free of charge.

When sending the instrument for repair, attach an invoice stating such information as product name, serial number, description of the failure, and name, affiliation, and telephone number of the person in charge.

To avoid trouble during transportation, use the corrugated cardboard box used for delivery or a box with equivalent cushioning material. Consult Iwatsu office or our sales distributors if you cannot find proper packaging.

### 5.5 Storage and transportation

Do not store this instrument in the places below.

- Exposed to direct sunlight
- Dusty place
- Place with corrosive gas

Storage conditions of this instrument are as follows.

<Isolation Amplifier>

- Storage temperature:  $-20^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$
- Storage humidity: No more than 90%RH and without dew condensation (no more than  $30^{\circ}\text{C}$ )

<Isolation Unit>

- Storage temperature:  $-20^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$
- Storage humidity: 5% to 80%RH and without dew condensation (no more than  $30^{\circ}\text{C}$ )

To transport this instrument, use the packaging material used for delivery, or the equivalent or better.

# 1234567

## Chapter 6 Specifications

# Specifications

## 6.1 Specifications

### 6.1.1 Isolation Unit (SE-6011)

Specifications as a system of Isolation Amplifier and Isolation Unit are marked #.

Number of channels 1

Input range (full scale)

Output ranges of  $\pm 1V$  ( $50\Omega$ )  $\pm 50mV, \pm 100mV, \pm 200mV, \pm 500mV, \pm 1V, \pm 2V, \pm 5V,$   
and  $\pm 2V$  ( $1M\Omega$ )  $\pm 10V, \pm 20V, \pm 50V$

Output ranges of  $\pm 0.8V$  ( $50\Omega$ )  $\pm 40mV, \pm 80mV, \pm 200mV, \pm 400mV, \pm 800mV, \pm 2V, \pm 4V, \pm 8V,$   
and  $\pm 1.6V$  ( $1M\Omega$ )  $\pm 20V, \pm 40V$

(Actual upper and lower limit of input voltage range can be calculated by “upper (lower) input range setting value”–“offset setting value.” The above values are for the probe attenuation ratio of 1/1.)

Maximum input voltage

Between BNC center contact and BNC shell 400Vpeak

Between BNC shell (casing) and earth 1kVpeak

Offset voltage range

Up to  $\pm 500mV$  full scale  $\pm 1V$

$\pm 800mV$  to  $\pm 5V$   $\pm 10V$

$\pm 8V$  to  $\pm 50V$   $\pm 100V$

Offset accuracy # ]

After self-calibration at operation temperature

$\pm 0.5%$  (Setting value)  $\pm 0.3\%FS \pm 0.05mV$  (Converted to input voltage value)

$-15^\circ C$  to  $+50^\circ C$   $\pm 0.5%$  (Setting value)  $\pm 1\%FS \pm 1mV$  (Converted to input voltage value)

DC gain accuracy #

Condition	1M $\Omega$	50 $\Omega$
After self-calibration at operation temperature	$\pm 0.3\%$	$\pm 0.3\% + \frac{\{50\Omega \text{ terminator error (\%)}\}}{2}$ $-\frac{\{SE-6000 \text{ output impedance error (\%)}\}}{2}$ <sup>Note</sup>
$-15^\circ C$ to $+50^\circ C$	$\pm 40mV/50mV$ range: $\pm 1.5\%$ Other range: $\pm 1\%$	$\pm 1\% + \frac{\{50\Omega \text{ terminator error (\%)}\}}{2}$ $-\frac{\{SE-6000 \text{ output impedance error (\%)}\}}{2}$ <sup>Note</sup>

Note) Formulae for 50 $\Omega$  termination in the above table are approximated expressions.

Nonlinearity #

$\pm 40mV/50mV$  range  $\pm 0.06\%FS$

Other range  $\pm 0.05\%FS$

Frequency bandwidth # 30MHz,  $-3dB$

Frequency response flatness (with 50 $\Omega$  termination) #

DC to 5MHz  $\pm 0.3dB$

5MHz to 10MHz  $\pm 1dB$

Rise time (with 50 $\Omega$  termination) # 13.3ns (This is a typical value, not guaranteed)

Input impedance 1M $\Omega$  ( $\pm 1\%$ )/20pF ( $\pm 2pF$ )

Input coupling DC, AC, GND

Lower cutoff frequency of AC coupling ( $-3dB$ )

10Hz or less

Bandwidth # 10MHz $\pm 3MHz, 1MHz \pm 0.3MHz, 100kHz \pm 30kHz$

	Attenuation characteristics: -6dB/oct
Probesense	
Auto detection	1:1, 10:1, 100:1, 1000:1
Manual setting	1:1, 20:1, 50:1, 100:1, 200:1, 500:1, 1000:1, 2000:1
CMRR	100dB (at 80Hz)
Noise (RMS)	0.05%FS
ADC	14 bit 100MS/s
Self-calibration	Amplitude and offset
Calibration output	
Waveform	Square wave
Frequency	1kHz±0.5%
Output signal amplitude	3V±2%
Auto-range	Range and offset
LED display	Connected CH, battery pack in use/available battery pack capacity
Power supply	Li-ion battery (Up to two battery packs can be mounted)
Operating duration	With fully charged new battery at 25°C
With one battery pack	15 hours
With two battery packs	30 hours
	Note) When operating at the low temperature, the operation time might become short.
Propagation delay #	+5ns/m* Within 1.089µs±0.020µs *Optical fiber cable delay (Reference value)
CH skew #	Less than 30ns* *Excluding difference in cable delays.
Protection function	Power off when internal temperature falls outside the temperature range between -15°C and +65°C.
Optical interface	
Optical connector	Dual LC type (×1)
Optical transceiver	
Light source	Semiconductor laser Class 1
Transmission speed	2.5Gbps
Optical fiber	Single mode
Environment	
Warm-up period	30 min.
Operating temperature	-15°C to +50°C
Operating humidity	5 to 80%RH without dew condensation (30°C or less)
Storage temperature	-20°C to +60°C
Storage humidity	5 to 80%RH without dew condensation (30°C or less)
Altitude	2000 m
Dimensions	89(W) × 203(H) × 298(D) mm

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## Specifications

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Weight	(Excluding protruding parts such as feet, handgrip, and knob) Approx. 2.4kg
Accessory	(Excluding battery pack) Battery pack (×1)

### 6.1.2 Isolation Amplifier (SE-6000)

DAC	14 bit, 100MS/s
Output channel	BNC type × 4
Output filter	5th-order Bessel filter
Output voltage	
When output range of ±1V (50Ω) or ±2V (1MΩ) is selected	
1MΩ termination	±2V
50Ω termination	±1V
When output range of ±0.8V (50Ω) or ±1.6V (1MΩ) is selected	
1MΩ termination	±1.6V
50Ω termination	±800mV
Output impedance	50Ω±1.5%
Self-calibration	Amplitude and offset
Display	4.3 inch color LCD
LED display	Lights up around the rotary knob when rotary knob operation is enabled.
Interface	
Optical interface	
Optical connector	Dual LC type (×4)
Optical transceiver	
Light source	Semiconductor laser Class 1
Transmission speed	2.5Gbps
Optical fiber	Single mode
USB	USB2.0 host (for save/recall)
LAN	100Base-TX (for remote control)
Output connector	BNC × 4
SE-6011 control	
Items written in below right can be controlled through optical interface.	
	Probesense, input coupling, input range, offset, bandwidth, self-calibration, auto-range
Status written in below right can be displayed through optical interface.	
	Internal temperature, available battery pack capacity, slot number of battery pack currently used
Save/Recall	
Destination	USB memory, internal memory (up to 10 files)
Target data	Setup
Other functions	
Beep sound	On/Off
Backlight brightness	HIGH/LOW

## Specifications

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Output range selection	±1.00V (50Ω)/±800mV (50Ω)
Scale display selection	1/1, 1/8DIV
Panel lock	On/Off
Clock function	Yes
Power supply	
Input	100 to 240VAC rms ±10% (47 to 63Hz)
Power consumption	Max. 30VA
Overvoltage category	II
Dimensions	226(W) × 100(H) × 366(D) mm (Excluding protruding parts such as feet, handle, and knob)
Weight	Approx. 2.5kg (Including handle and protector)
Environment	
Warm-up period	30 min.
Temperature range to guaranteed specifications	10°C to 35°C
Operating temperature	0°C to +40°C
Operating humidity	5 to 80%RH without dew condensation (30°C or less)
Storage temperature	-20°C to +60°C
Storage humidity	No more than 90%RH without dew condensation (30°C or less)
Altitude	2000 m
Accessory	See Components on page x.

### 6.1.3 Options

#### Optical fiber cable (SE-605/SE-606/SE-607)

##### Shape

Connector	Dual LC type
Cable length	3m (SE-605)/10m (SE-606)/50m (SE-607)
Outdoor operation	Possible
Battery pack (NH2054)	1

#### Battery charger (CH5050A)

Number of bays	2
Charging/Calibration	Charging only/Charging and calibration
Charging time (Charging only)	5 hours
Charging time (Charging and calibration)	18 to 24 hours

Dimensions	122(W) × 58(H) × 180(D) mm
Accessories	See Components on page x.

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## 6.2 Certification standards

CE

EMC Directive

EN61326-1:2013

(Group1,Class A and industrial immunity test requirements)

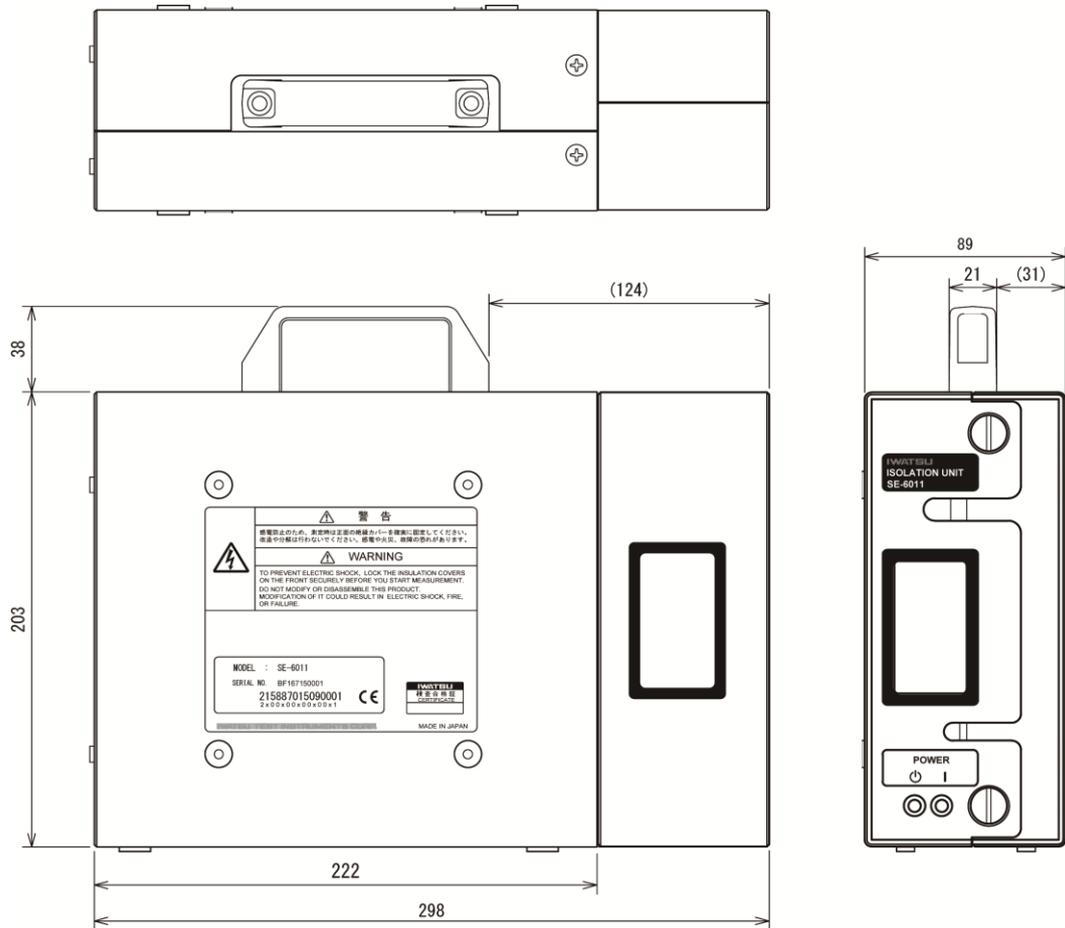
Low Voltage Directive

EN61010-1:2010(3rd Edition)

# Specifications

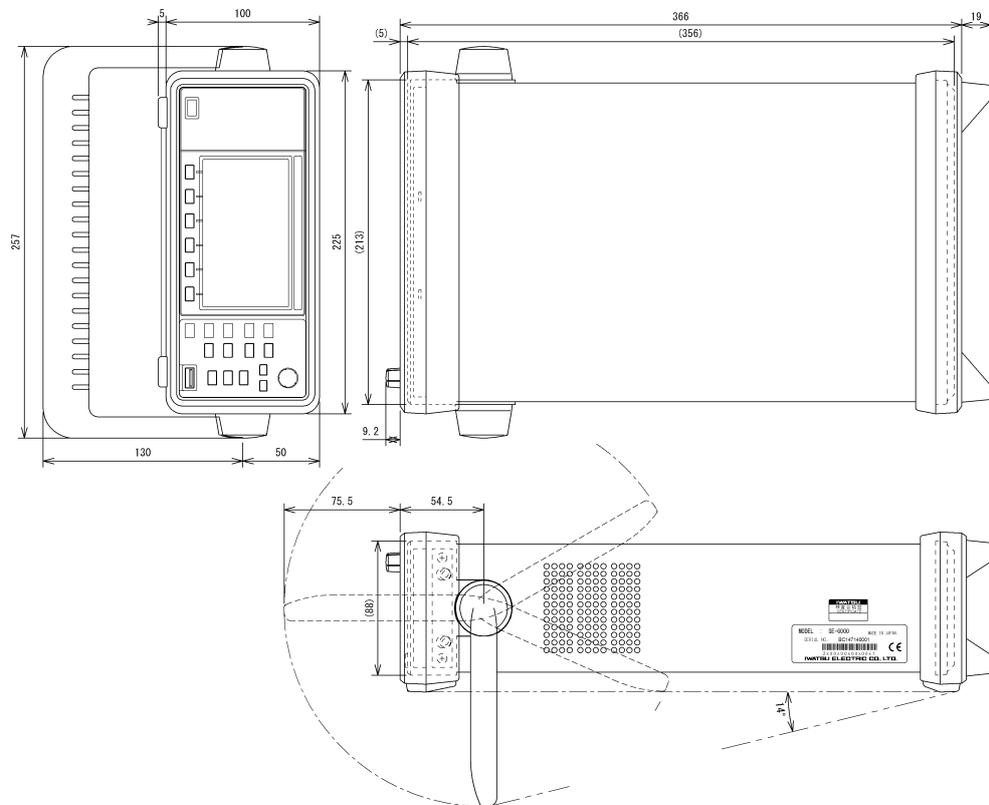
## 6.3 Appearance

### 6.3.1 Isolation Unit (SE-6011)



Unit: mm

6.3.2 Isolation Amplifier (SE-6000)



Unit: mm

# 123456 7

## Chapter 7 Measurements

## 7.1 Precautions when using probes during floating measurement

It is possible to perform floating measurement with this instrument, but be sure to check the relationship between input withstanding voltage, and measuring voltage and reference potential, and consider the ratings of outer sheaths of coaxial cables and GND leads.

When performing floating measurement using the voltage probe, it is not necessarily possible to raise reference potential to the input withstanding voltage. Reference potential in floating configuration is determined by the voltage rating of the outer sheaths of coaxial cables and ground leads.

Rating voltages of the recommended probe of this instrument are as follows.

- PHV Series High-voltage probe (PMK)  
Coaxial cable: 1000V  
GND lead: 900V
- Voltage probe SS-101R (Iwatsu Test Instruments)  
Coaxial cable: 600V  
GND lead: 300V

Measurement voltage (withstanding input voltage) specified to voltage probe is the voltage between probe tip (measurement potential) and GND lead with alligator clip (reference potential).

Refer to cases in (1) to (4) and examples 1 to 3 written below for actual criteria.

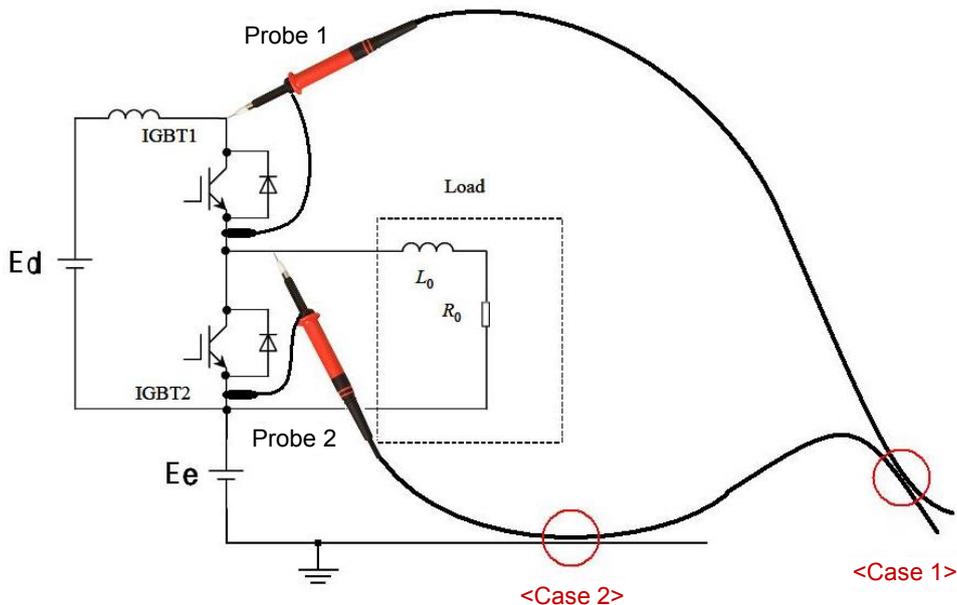


Figure 7.1 Example of floating measurement

### (1) Case 1

When two IGBTs are measured as shown in Figure 7.1 “Example of floating measurement,” voltage between the reference voltages of probe 1 and probe 2 can reach  $E_d$  (V). Therefore, if coaxial cables of these two probes touch, voltage difference between these two ground sheaths can be  $E_d$  (V), and numerically, it must be twice or less the rating voltage of the outer sheaths of coaxial cables.

Example 1:

In the case of PHV probe (PMK),  $E_d$  must be 2000V or less, because rating voltage of the outer sheath of the coaxial cable of the PHV probe is 1000V.

However,  $E_d$  in Example 1 needs to be 1000V or less, because maximum input voltage of the isolation unit of this instrument is 1000V.

### (2) Case 2

If the coaxial cable of probe 2 in the above Figure 7.1 touches conducting material with ground potential, the outer sheath of the coaxial cable must withstand voltage of  $E_e$  (V), since the circuit voltage is equal to  $E_e$  (V). In this case,  $E_e$  (V) needs to be below the rating voltage of the outer sheath of the coaxial cable.

Example 2:

In the case of PHV probe (PMK),  $E_e$  must be 1000V or less, because rating voltage of the outer sheath of the coaxial cable of the PHV probe is 1000V. If the coaxial cable of probe 1 in Figure 7.1 touches the conducting material with ground potential,  $E_d + E_e$  must be 1000V or less.

### (3) Case 3

Rating voltage of the outer sheath of the GND lead for the reference potential needs to be considered as well. Touching of GND leads with different potential, or that of GND lead and coaxial cable, requires attention.

Example 3:

If two PHV probes (PMK) touch, difference of reference potentials of the two probes must be 1800V or less, because rating voltage of the GND lead of the PHV probe is 900V.

However, difference of reference potential of the probes in Example 3 must be below the maximum input voltage of the isolation unit of this instrument, which is 1000V.

### (4) Other

Other than the Cases 1 to 3 described above, similar considerations are necessary when coaxial cables or GND leads of voltage probes touch a measured circuit.

### 7.2 Message display

If any error arises with USB memory or internal memory during data saving or recalling, error messages described in Table 7.1 (a), (b) and status messages described in Table 7.2 (a) to (c) are displayed in the message display area, the read out display area, and menu display area of the isolation amplifier screen.

Contact Iwatsu office or our sales distributors for consultation if error persists even after the dispositions written in Table 7.1 (a), (b) are carried out.

**Table 7.1 (a) Error messages and the details in message display area**

<b>Error messages</b>	<b>Details (conditions, factors, etc.)</b>	<b>Dispositions</b>
Error: No USB memory	USB memory is not inserted. Displayed when SAVE or RECALL command is carried out.	<ul style="list-style-type: none"><li>• Insert USB memory.</li></ul>
Error: Read-only file	This file is read-only. Displayed when SAVE command is carried out to try to overwrite a read-only file.	<ul style="list-style-type: none"><li>• Check if the file is normal.</li><li>• Carry out SAVE command to a normal file.</li></ul>
Error: File access	Failed to access files. Displayed when USB memory is write protected, etc.	<ul style="list-style-type: none"><li>• Remove the read and write protection of USB memory.</li><li>• Check if there is a proper directory (folder) and file.</li></ul>
Error: [Internal memory number] is invalid.	Specified [Internal memory number] is invalid. Displayed when RECALL command is carried out to an internal memory with no setup data.	<ul style="list-style-type: none"><li>• Save proper setup data to a file under proper directory (folder) in the USB memory.</li></ul>
Error: Invalid parameter.	Parameter is invalid. Displayed when RECALL command is carried out to the invalid setup data.	<ul style="list-style-type: none"><li>• Save proper setup data to a file under proper directory (folder) in the USB memory.</li></ul>

Table 7.1 (b) Error messages and details in menu display area

Error messages	Details (conditions, factors, etc.)	Dispositions
<ul style="list-style-type: none"> <li>• SE6000.bin is not found on USB memory.</li> <li>• SE6011.bin is not found on USB memory.</li> </ul>	Failed to read USB memory.	<ul style="list-style-type: none"> <li>• Re-insert the USB memory.</li> <li>• Check if the file is normal.</li> <li>• Check if SE6000.bin or SE6011.bin file exists in the FIRMWARE folder in the USB memory, and if not, save one.</li> </ul>
<ul style="list-style-type: none"> <li>• SE6000.bin is invalid file.</li> <li>• SE6011.bin is invalid file.</li> </ul>	Content of the file is invalid.	<ul style="list-style-type: none"> <li>• Re-insert the USB memory.</li> <li>• Check if the file is normal.</li> </ul>
<ul style="list-style-type: none"> <li>• Writing error. Do not turn off the power. Try firmware update again.</li> <li>• Writing error. Failed to update firmware.</li> </ul>	Failed updating firmware.	<ul style="list-style-type: none"> <li>• Update the firmware once again without turning off the isolation amplifier.</li> </ul>
<ul style="list-style-type: none"> <li>• Verification error. Do not turn off the power. Try firmware update again.</li> <li>• Verification error. Failed to update firmware.</li> </ul>	Verification results of firmware update are not correct.	<ul style="list-style-type: none"> <li>• Update the firmware once again without turning off the isolation amplifier.</li> </ul>
Unable to start updating the firmware. Battery remaining level of at least 10% is needed to start updating.	Available capacity of battery is too low.	<ul style="list-style-type: none"> <li>• If you have battery pack with enough available capacity, replace the battery pack with it.</li> <li>• Charge the battery pack.</li> </ul>
Link is lost. Failed to update firmware.	Link between isolation amplifier and isolation unit is disconnected.	<ul style="list-style-type: none"> <li>• Check if optical fiber cable is properly connected.</li> <li>• Re-insert optical fiber cable.</li> </ul>

## Measurements

Status messages described in Table 7.2 (a) to (c) are displayed corresponding to key operations, etc.

**Table 7.2 (a) Status messages and details in message display area**

Status messages	Details (conditions, factors, etc.)
USB memory is connected.	USB memory is properly inserted.
USB memory is disconnected.	USB memory is removed.
Self calibrating X%	Self-calibration is proceeding. Progress is displayed by X%.
Remote setup is saved. Rebooting ...	Remote settings are saved. Now rebooting.
Setup initialization completed.	Initialization of setup has been finished.
Creating save data...	Creating data to save. (when SAVE command is carried out)
Setup is saved to [file name].	Setup is saved to a file with [file name].
Setup is saved to [internal memory number].	Setup is saved to internal memory with [internal memory number].
Default setting is recalled.	Default setting is recalled.
Setup is recalled from [file name].	Setup is recalled from a file with [file name].
Setup is recalled from [internal memory number].	Setup is recalled from an internal memory with [internal memory number].

**Table 7.2 (b) Status messages and the details in readout display area**

Status messages	Details (conditions, factors, etc.)
No link	Link is not yet detected.
Initializing...	Initialization is under way after detection of linkage. When initialization completes, instrument turns into normal status.
Outside of the operating temperature Range.	Internal temperature of transmission unit is out of the temperature range between $-15^{\circ}\text{C}$ and $+65^{\circ}\text{C}$ .

**Table 7.2 (c) Status messages and the details in menu display area**

Status messages	Details (conditions, factors, etc.)
Self calibration is complete.	Displayed when self-calibration completes.
Self calibration is failed.	Displayed when self-calibration fails.
To apply new remote setting, you need to reboot.	Reboot is necessary to control remotely with new settings. Displayed when contents of REMOTE menu is changed or REMOTE/ENTER menu is activated.
Firmware update completed successfully. To activate new firmware, reboot now.	Update of the firmware of isolation amplifier completed successfully. Reboot isolation amplifier to operate with new firmware.
Firmware update completed successfully.	Update of the firmware of isolation unit completed successfully.

# **Remote Control Manual**

# Contents

<b>Chapter 1 Remote control .....</b>	<b>1-1</b>
1.1 Communication settings .....	1-1
<b>Chapter 2 Remote command .....</b>	<b>2-1</b>
2.1 Commands/Queries.....	2-1
2.2 *IDN query .....	2-2
2.3 *SAV command.....	2-2
2.4 *RCL command .....	2-2
2.5 RMODE command/query .....	2-3
2.6 RANG command/query .....	2-3
2.7 ARANG query .....	2-4
2.8 PROBE command/query .....	2-4
2.9 OFST command/query .....	2-5
2.10 BWL command/query .....	2-5
2.11 CPL command/query .....	2-6
2.12 BATT query.....	2-6

## Chapter 1 Remote control

Communication settings for remote control of isolation probe SE-6000/SE-6011 (referred to as this instrument hereinafter) are explained.

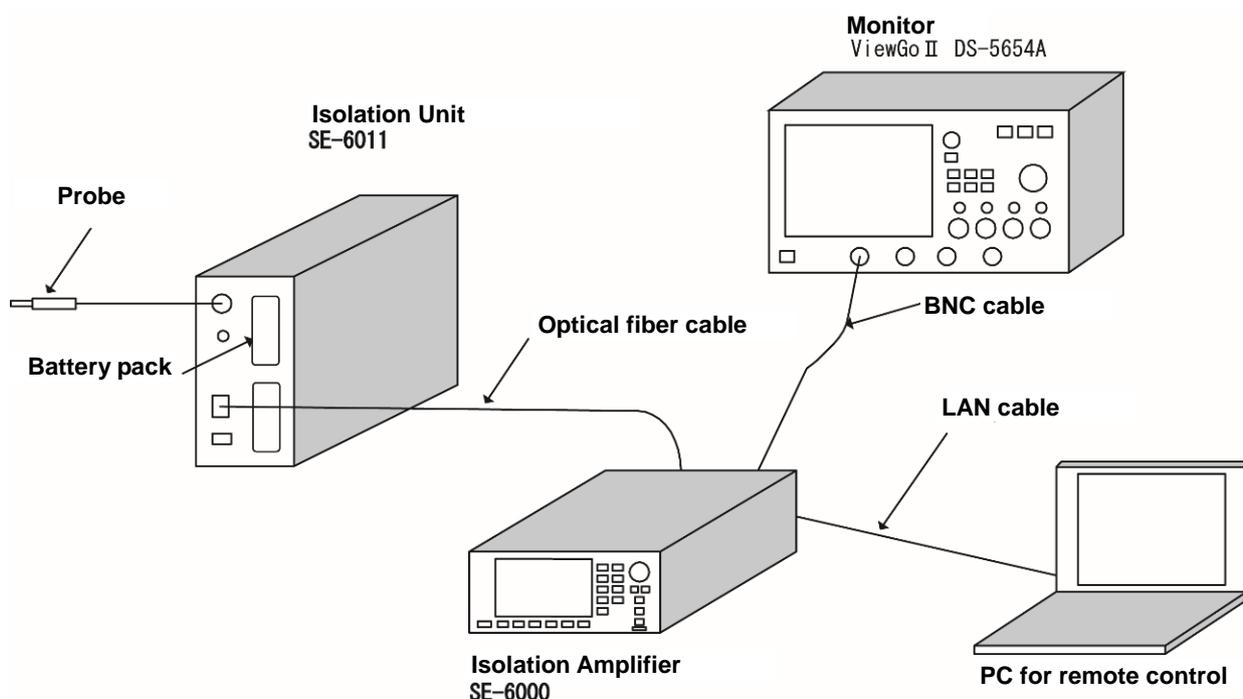
### 1.1 Communication settings

This instrument can be controlled from a PC connected or a PC on the same network as shown in Figure 1.1. Interface is compatible only with LAN (TCP/IP).

When a PC is connected to this instrument as shown in Figure 1.1, configure communication settings of remote control software as shown in Table 1.1.

**Table 1.1 Communication settings of PC**

Items	Settings
Interface	LAN (TCP/IP) only
DHCP	Settings with and without DHCP are both possible. ○When DHCP is used, IP address, gateway server address, and subnet mask are acquired from DHCP server. ○When DHCP is not used, set IP address, gateway server address, and subnet mask by REMOTE in SYSTEM menu.
IP address	000.000.000.000 - 255.255.255.255
Port number	5198
Gateway	000.000.000.000 - 255.255.255.255
Subnet mask	000.000.000.000 - 255.255.255.255
Delimiter	LF or CR+LF
Buffer	Input: 255 bytes, Output: 255 bytes



**Figure 1.1 Example of remote control system**

[Memo]

---

## Chapter 2 Remote command

Commands and queries to control this instrument by remote control are explained.

### 2.1 Commands/Queries

Table 2.1 List of commands and queries

Commands/Queries	Functions	See also
*IDN?	To acquire information of isolation amplifier.	2.2
*SAV	To save settings to internal memory.	2.3
*RCL	To recall settings from internal memory.	2.4
RMODE/RMODE?	To set or acquire range mode.	2.5
RANG / RANG?	To set or acquire range.	2.6
ARANG?	To perform auto-range.	2.7
PROBE / PROBE?	To set or acquire probe attenuation ratio.	2.8
OFST / OFST?	To set or acquire offset.	2.9
BWL / BWL?	To set or acquire filter.	2.10
CPL / CPL?	To set or acquire coupling.	2.11
BATT?	To acquire available capacity of battery pack.	2.12

## 2.2 \*IDN query

To acquire instrument information of isolation amplifier.

Response consists of four fields, which are manufacturer, model name, serial number, and firmware version number.

Query syntax

\*IDN?

Response format

IWATSU,SE-6000,<serial>,<version>

<serial> : = serial number of isolation amplifier SE-6000

<version> : = version number of firmware of isolation amplifier SE-6000

## 2.3 \*SAV command

To save settings of isolation amplifier to internal memory.

Command syntax

\*SAV <num>

Parameter

<num> : = {1 to 10}

1 to 10: number of internal memory

## 2.4 \*RCL command

To recall settings from any one of the ten internal memories of the isolation amplifier.

Command syntax

\*RCL <num>

Parameter

<num> : = {0 to 10}

0: default setup

1 to 10: number of internal memory

---

## 2.5 RMODE command/query

To set or acquire mode of output range of isolation amplifier.

Command syntax

```
RMODE <range_mode>
```

Parameter

```
<range_mode>
```

```
<range_mode> := {1, 800M}
```

1: To set output range to  $\pm 1.00$  V (50  $\Omega$ )

800M: To set output range to  $\pm 800$  mV (50  $\Omega$ )

Query syntax

```
RMODE?
```

Response format

```
<range_mode>
```

```
<range_mode> := {1, 800M}
```

## 2.6 RANG command/query

To set or acquire input range of isolation unit by voltage value including probe attenuation ratio.

Command syntax

```
<channel>:RANG <range>
```

Parameter

```
<channel> := {C1, C2, C3, C4}
```

```
<range> is a voltage value in the format of <NR3 Numeric Response Data>.
```

Query syntax

```
<channel>:RANG?
```

Response format

```
<range>
```

```
<range> is a voltage value in the format of <NR3 Numeric Response Data>.
```

```
Returns +9.910000E+37 under the status of No link.
```

## 2.7 ARANG query

To perform auto-range of input range of isolation unit, and return the result.

Query syntax

<channel>:ARANG?

Parameter

<channel> : = {C1, C2, C3, C4}

Response format

<result>

<result> : = {+0, +1}

+0: Success

+1: Failure

-1: No link

## 2.8 PROBE command/query

To set or acquire probe attenuation ratio of input range of isolation unit.

Command syntax

<channel>:PROBE <mode>,<probe>

Parameter

<channel> : = {C1, C2, C3, C4}

<mode> : = {AUTO, MANUAL}

AUTO: To detects probe attenuation ratio automatically. It is possible only when a probe conforming to probesense is connected.

MANUAL: To set probe attenuation ratio to the value specified by <probe>.

<probe> : = {1, 5, 10, 20, 50, 100, 200, 500, 1000, 2000}

Query syntax

<channel>:PROBE?

Response format

<mode>,<probe>

Returns NOLINK under the status of No link.

---

## 2.9 OFST command/query

To set or acquire input offset of the isolation unit by voltage value including probe attenuation ratio.

Command syntax

<channel>:OFST <offset>

Parameter

<channel> : = {C1, C2, C3, C4}

<offset> is a voltage value in the format of <NR3 Numeric Response Data>.

Query syntax

<channel>:OFST?

Response format

<offset>

<offset> is a voltage value in the format of <NR3 Numeric Response Data>.

Returns +9.910000E+37 under the status of No link.

## 2.10 BWL command/query

To set or acquire bandwidth limitation (filter) of the specified input channel of the isolation unit.

Command syntax

<channel>:BWL <filter>

Parameter

<channel> : = {C1, C2, C3, C4}

<filter> : = {FULL, 10M, 1M, 100K}

FULL: No bandwidth limitation

10M: Bandwidth of 10MHz

1M: Bandwidth of 1MHz

100K: Bandwidth of 100kHz

Query syntax

<channel>:BWL?

Response format

<filter>

Returns NOLINK under the status of No link.

## 2.11 CPL command/query

To set or acquire coupling of the probe connected to the specified input channel of the isolation unit.

Command syntax

<channel> : CPL <coupling>

Parameter

<channel> : = {C1, C2, C3, C4}

<coupling> : = {DC, AC, GND}

Query syntax

<channel> : CPL?

Response format

<coupling>

Returns NOLINK under the status of No link.

## 2.12 BATT query

To acquire available capacity (percentage) and available operation time (minutes) of a battery pack mounted to the isolation unit.

Query syntax

<channel> : BATT?

Parameter

<channel> : = {C1, C2, C3, C4}

Response format

<time1>,<batt1>,<time2>,<batt2>

Available operation time (minutes)

<time1> : = {0 to 1020, NA}

<time2> : = {0 to 1020, NA}

1020: 17 hours or more

NA: Available operation time unknown

Available capacity (percentage)

<batt1> : = {1 to 100, NC, ND}

<batt2> : = {1 to 100, NC, ND}

NC: Battery pack not mounted

ND: Battery pack not detected

Returns NOLINK under the status of No link.

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