NoiseKen

INSTRUCTION MANUAL

VOLTAGE DIP AND UP SIMULATOR
MODEL VDS-2002

NOISE LABORATORY CO., LTD.

2.05 Edition
AED00100-00E-1

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1. IMPORTANT SAFETY PRECAUTIONS

Thoroughly understand the following precautions before use, as they are important matters for handling this unit in safety.

1. **This unit cannot be used in an explosive area, fire prohibited area, etc. Use of this unit in such an area is liable to cause combustion or ignition.**

2. **A person who has a pacemaker on should not operate this unit and also should not enter the area where it is operating.**

3. **For connection of supplies to the EUT, be sure to turn of all relevant supplies (instrument supply, EUT, supplies to EUT) beforehand and check to see there is no potential at the connectors and/or terminals you are going to work with. Otherwise, a serious shock hazard may arise.**

4. **A number of safety recommendations are listed in "Basic Safety Precautions" described in Section 5. Be sure to read them before setting a test environment, connection and starting a test.**

Memo

2. APPLICATION FORM FOR INSTRUCTION MANUAL

We place an order for an instruction manual.

Model: VDS-2002

Serial No.:

Applicant:

Company name: _____

Address: _____

_____

Department: _____

Person in charge: _____

Tel No.: _____

Fax No. _____

Cut off this page "APPLICATION FORM FOR INSTRUCTION MANUAL" from this volume and keep it for future use with care.

When an INSTRUCTION MANUAL is required, fill in the above Application Form and mail or fax it to the following sales department of our company.

To: Noise Laboratory Co., Ltd.
1-4-4 Chiyoda Sagamihara City,
Kanagawa Pref., 229-0037 Japan
Tel: +81-(0)42-712-2051 Fax: +81-(0)42-712-2050

Cut line

Memo

3. CONTENTS

4. INTRODUCTION

We thank you for purchasing the model VDS-2002 Voltage Dip and Up Simulator. Thoroughly read this manual before installing, setting-up and operating this instrument at full performance.

A ready made Windows software package is optionally available to remote-control this instrument test set-ups in a more convenient and extensive manner. When operating this instrument with this controls software, be sure to refer to the manual for the software program.

- **This Instruction Manual will help operators to handle and utilize the VDS-2002 Voltage Dip and Up Simulator safely.**
- **Keep this Instruction Manual in a place where it is readily available.**
- **It is optional in the IEC 61000-4-11 Ed2 (2004) voltage variations test and became required in the modified Ed3 (2020) voltage variations test.**

5. BASIC SAFETY PRECAUTIONS

5-1. Symbol of hazard

WARNING TO REDUCE THE RISK OF ELECTRIC SHOCK.
DO NOT REMOVE COVER.
NO USER-SERVICEABLE PARTS INSIDE.
REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.
感電の危険あり。カバーを外さないこと。

It expresses a WARNING.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in **death or serious injury.**

NOISE LABORATORY CO.,LTD. IS EXCLUDED ALL THE LIABILITY OF ANY FORMS OF DAMAGE, OF EQUIPMENT OR HUMANS, CAUSED BY USER'S MISHANDLING DURING OPERATION.

誤った操作による損害に対しては、一切責任を負いません。

It expresses a DANGER.

DANGER indicates an impending dangerous condition resulting in a serious **injury or death**, if such a condition is not avoided.

It expresses a WARNING.

WARNING indicates a potentially hazardous situation which, if not avoided, could result in **death or serious injury.**

It expresses a CAUTION.

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in **minor or moderate injury**.

Indicates components with potentials, which may be hazardous.

Shows that the operator shall refer to the relevant part of this manual.

Indicates the frame ground.

Indicates the protective earth terminal.

5-2. Important Safety Precautions

1. **This instrument has a 3-pole AC inlet. Be sure to connect this instrument to an appropriately grounded AC outlet to a avoid shock hazard. 【Precautions for connections】**
2. **Use a proper AC cord according to the local AC supply voltage. 【Precautions for connections】**
3. **When replacing fuses, use ones with the same blow characteristics and rating. Before replacement, be sure to disconnect the instrument from AC supplies. 【Precautions for safety】**
4. **The PE terminal of the EUT INPUT is independent from the ground conductor of the 3-pole AC inlet of the instrument supply. When testing for EUT with PE, be sure to connect the PE terminal of the EUT INPUT to an appropriately grounded AC supply. 【Precautions for connections】**
5. **The EUT and relevant AC supply shall not exceed AC240V 16A. In-rush current shall be suppressed to <500A (10ms). In the event of a higher value, the instrument may be damaged. 【Precautions for connections and EUT】**
6. **In the event of Error No. 1, be sure to turn off the all-relevant supplies (instrument supply, EUT, supplies to EUT). The instrument turn on shall be allowed only after 2-minutes lapse and after eliminating the cause of the excessive in-rush current event. Turn-on within 2-minutes will result in a failure of the semiconductor switches in this instrument.**
7. **Use proper cables with sufficient voltage and current rating meeting the EUT. 【Precautions for connections and EUT】**
8. **For connection of supplies to the EUT, be sure to turn off all relevant supplies (instrument supply, EUT, supplies to EUT) beforehand and check to see there is no potential at the connectors and/or terminals you are going to work with. Otherwise, a serious shock hazard may arise. 【Precautions for human body and connection】**
9. **Fix the cover before providing power supply when taking off the cover to connect to the main unit. Otherwise, it should be caused short-circuit or electrically damaged to the person. 【Precautions for connections】**
10. **This unit is power supply voltage variation unit, which is slider type. Provide power supply for EUT input, which is lowest voltage variation and distortion because it will not adjust the waveform.**
11. **Use the accessories and optional equipment supplied by our company. 【Precautions for human body and connection】**

12. **When connecting a scope probe to the EUT INPUT or EUT OUTPUT, employ an isolation transformer for the scope and further disconnect the ground pin of the scope AC plug from the secondary to avoid short-circuit events. 【Precautions for connections】**
13. **Do not open the cover of this instrument since HV potential exist in it. 【Precautions for human body】**
14. **Do not block the ventilations 【Precautions on installation】**
15. **Avoid using or storing the unit in high or low temperature environment. (Operating temperature range: 15 ～35℃/ Operating humidity range: 25～75%) 【Precautions for environments】**
16. **Avoid using this unit in an extremely humid or dusty place. 【Precautions for environments】**
17. **If dewing or condensation occurs, thoroughly dry it before operating the unit. 【Precautions for environments】**
18. **Do not wipe this unit with thinner, alcohol or similar solvent. When the body is dirty, soak a cloth in detergent, squeeze the cloth and wipe the body with it. 【Precautions for maintenance】**
19. **This unit cannot be used in an explosive area, fire prohibited area, etc. Use of this unit in such an area is liable to cause combustion or ignition. 【Precautions for human body and environments】**
20. **Our company and sales agents shall have no responsibility for any accident resulting in injury or death, any breakage or resultant damages due to irresponsible handling.【Precautions for human body, operation, environments and connection】**
21. **Repair, maintenance and internal adjustment of this unit should be performed by a qualified service engineer.【Precautions for handling and safety】**
22. **This unit is very heavy so it will be needed to install at substantial place. And when moving the unit, transport with few parsons taking attention to the round. After moving, fix to the ground holding casters. Otherwise it may be caused damage to the person by moving and falling down the unit.【Precautions for installation】**

5-3. When warning label is missing

1. When warning label is lost, or peeled off or dirty, put up a new one for extra safety.
2. When warning label is lost, contact our company's sales dept. or maintenance dept. for issuance.

6. FEATURES AND FUNCTIONS

The model VDS-2002 can perform voltage dips, interruptions and variations test in a fully compliant manner with the IEC 61000-4-11 (1994) standard and its edition 2 (2004) /edition 3 (2020). The optional remote control software can expand the variation of the tests for AC as well as DC voltage interruption test in a more convenient and extensive manner.

6-1. Features and Functions

1. The automatic control double power supply consisting of two motors and two slide transformers realizes smooth conducting of voltage variation, interruption immunity test.
2. Easy setting for parameters of the tests prescribed in IEC61000-4-11.
3. Higher inrush current drive capability makes tests for high inrush current instruments more realistic.
4. EUT INPUT: AC90V-264V available
5. EUT OUTPUT: Multi-receptacle for easy connection to EUT.
6. Floated TRIG OUT for easy waveform observation.
7. Optional PC remote control software offers more complex and extensive AC mains voltage simulations and DC interruption test.
8. The optical interface between VDS-2002 and PC offers stable communication environment with less noise influence.
9. Output current capability: 16Arms (continuous), 40Arms within 5 seconds when output voltage is 40% of input.
10. 500A peak inrush current is available (for 220-240V mains).
11. Base voltage: 100% output of input voltage. Sensing mode (keeping 100% output of the input voltage in the initial setting) or Direct mode (outputting 100% of the input voltage on that moment) is selectable.
12. Parameter settings available with this instrument (control software not required) are 0.5, 1, 5, 10, 12, 25, 30, 50, 250, 300 cycles and 10 seconds for voltage dip/interruption durations, 0, 40, 70, 80 and 120% for test levels.
13. For voltage variations test, transition time from normal to a changed voltage and from a changed voltage to the normal is 2s. The changed voltage is for 1s. Test levels (changed voltages) are 0%, 40%, 70%, 80% and 120% of the EUT supply voltage.
14. Memory: Can memorize 5 settings (Saved for a certain period time with an internal backup battery even after power off).

6-2. General of VDS-2002

Refer to [Fig 1] on Page 13. With this schematic, the function of each part is being explained as follows.

■ST11, ST12: Auto slide transformers (parallel driven, 2 outputs) set BASE VOLTAGE (SW1) and TEST LEVEL (SW2).

■POWER OFF, EUT LINE OFF: MG11, MG21, SW1, SW2 open. L1 LINE cut off. L2 LINE not cut off (If L2 OFF necessary, turn off power supply of EUT input). Connect EUT's HOT to L1, COM to L2.

■Fuse: To protect the circuit detecting the input of voltage of the VDS-2002.

■TB16: AC/DC SELECT terminals: Convert AC (DC) to DC (AC) of EUT INPUT by short bars. Since the short bars and TB16 are part of EUT LINE, they may give you an electric shock. In position change of the short bars, POWER OFF and disconnect the whole connection.

■MG21, MG22: Contactors to switch open mode and short mode when EUT OUTPUT 0V. The open and short mode will be changeable by the optional remote control software. In local setting, the mode is fixed to short mode.
The next table shows the contactors status of each mode.

Mode	MG21	MG22	Note
Short Mode	Open	Short	Local setting PC Remote setting
Open Mode	Open	Open	PC Remote setting
Ordinary Dip / Up Mode	Short	Open	Local setting PC Remote setting

■SW1, SW2
SW1 ON: BASE VOLTAGE is output to EUT OUTPUT.
SW2 ON: TEST LEVEL is output to EUT OUTPUT.
Both SW1 and SW2 cannot be ON status at the same time. Setting BASE VOLTAGE or setting TEST LEVEL is output alternatively.
LINE OFF, STOP, POWER OFF: Both SW1 and SW2 are OFF.

■Inputting AC through AC EUT INPUT (AC/DC SELECT: All AC)

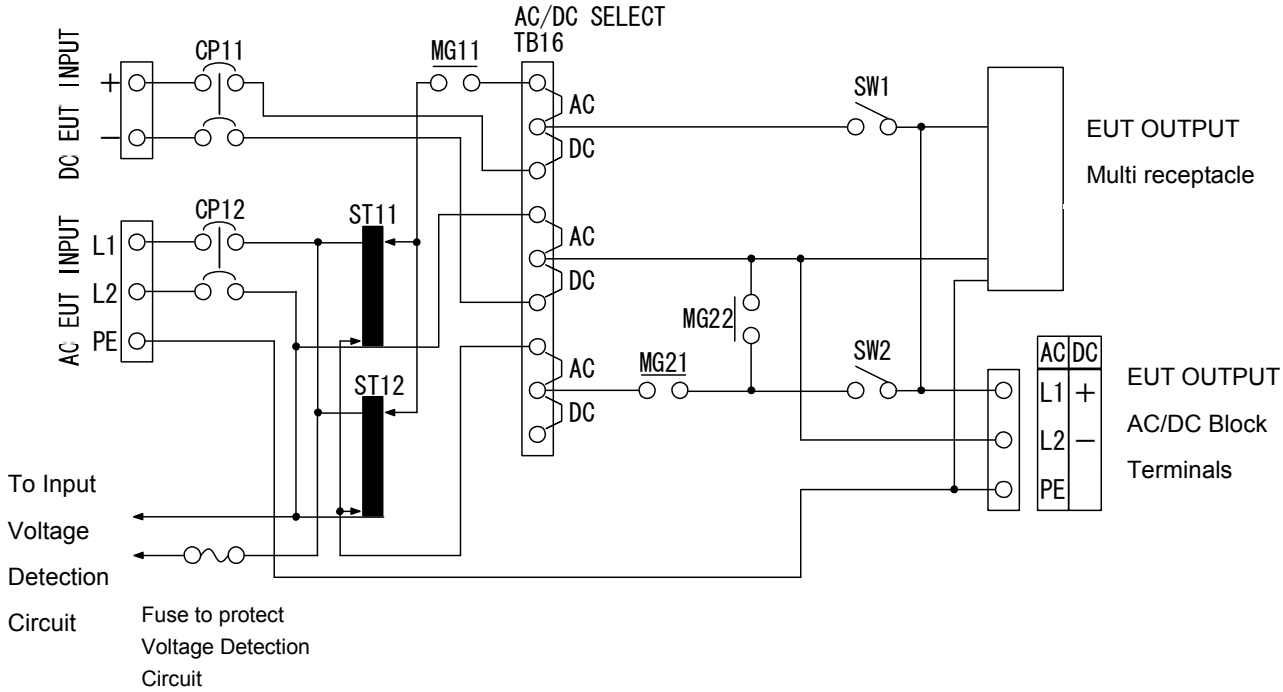
AC from AC EUT INPUT goes through the circuit protector CP12 and is input to ST11, ST12 (parallel driven auto slide transformers). The transformers have two outputs which are automatically controlled respectively. BASE VOLTAGE goes through MG11 and TB16 and is turned ON/OFF by SW1. TEST LEVEL goes through TB16 and MG21 and is turned ON/OFF by SW2. With switching SW1 and SW2 as setting beforehand, VDS-2002 conducts voltage dip/up and interruption tests. In the interruption test set locally, MG21 is open and MG22 is short (short mode). The optional remote control software makes open mode and short mode selectable.

■Inputting DC through DC EUT INPUT (AC/DC SELECT: All DC)

– With the optional remote control software

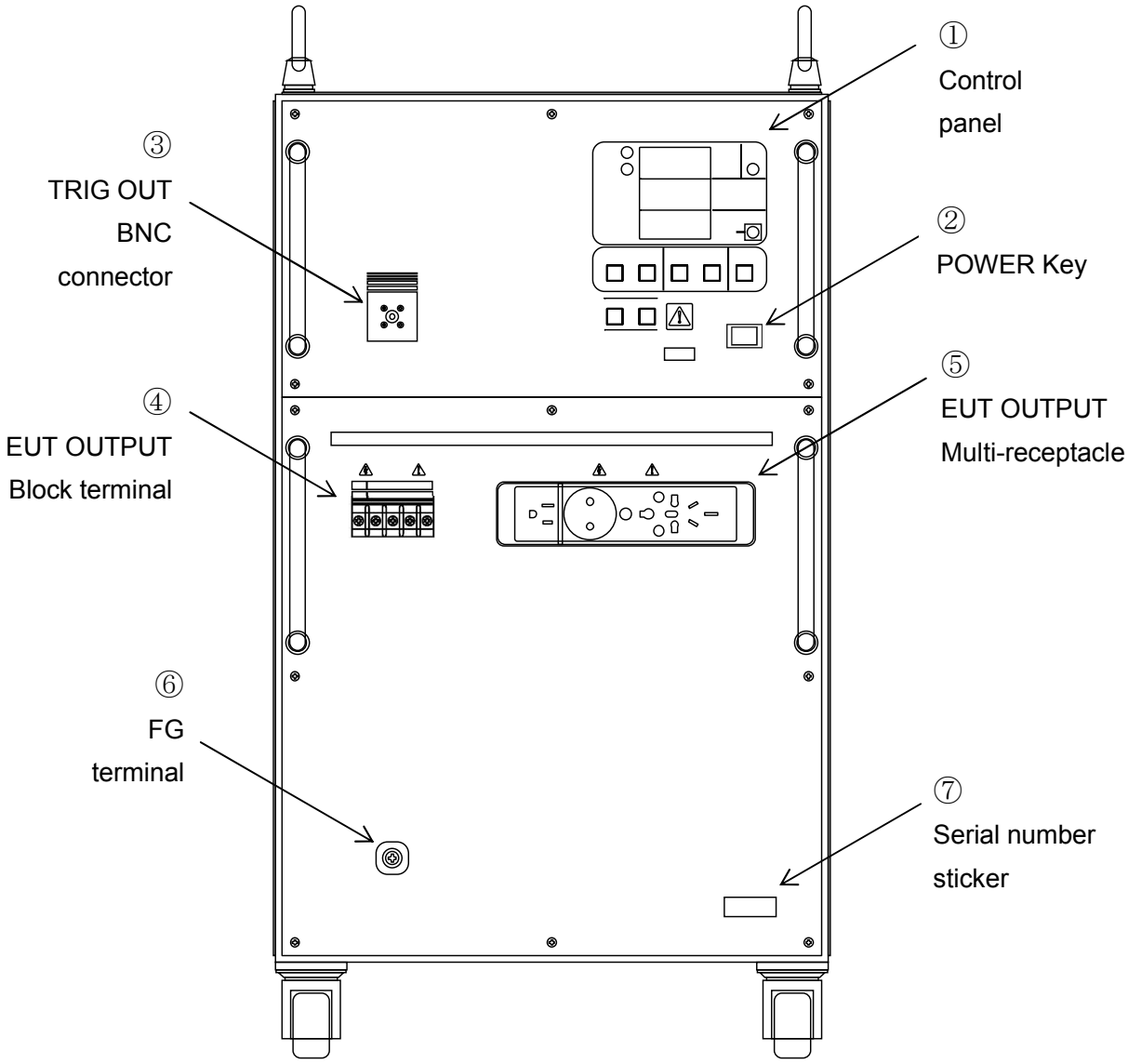
DC from DC EUT INPUT goes through the circuit protector CP11 and TB1. The positive (+) side is connected to SW1 of BASE VOLTAGE and the negative (-) side is directly connected to the negative of EUT OUTPUT. The type of DC test is just the interruption test. Therefore SW2 of TEST LEVEL side is 0V. The test is conducted with selecting short mode or open mode. Even though DC voltage is injected to the multi receptacle connected parallel, the multi receptacle cannot be used in DC tests.

[Fig 1] Schematic of VDS-2002

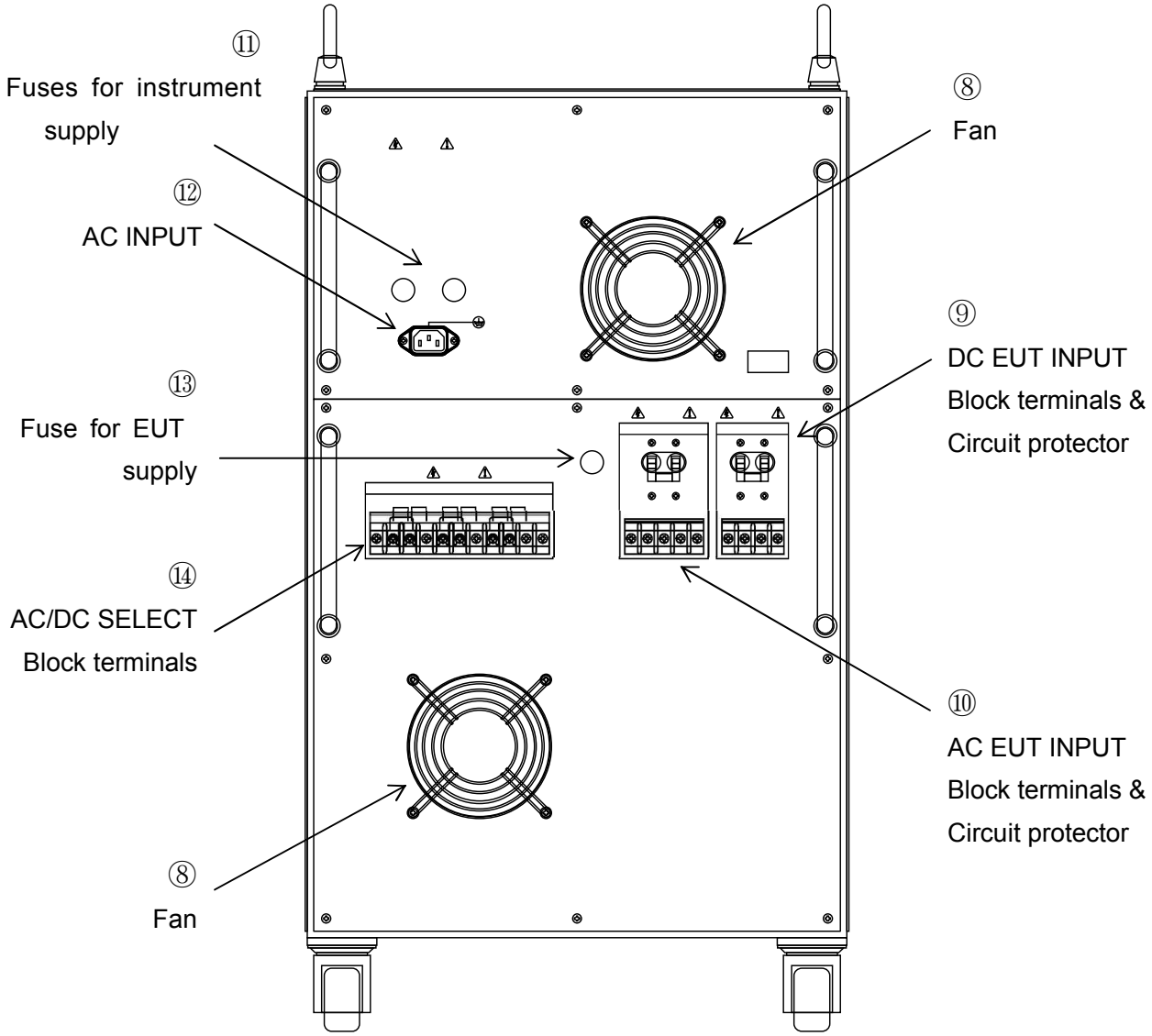


7. APPEARANCE AND FANCTION OF EACH PART

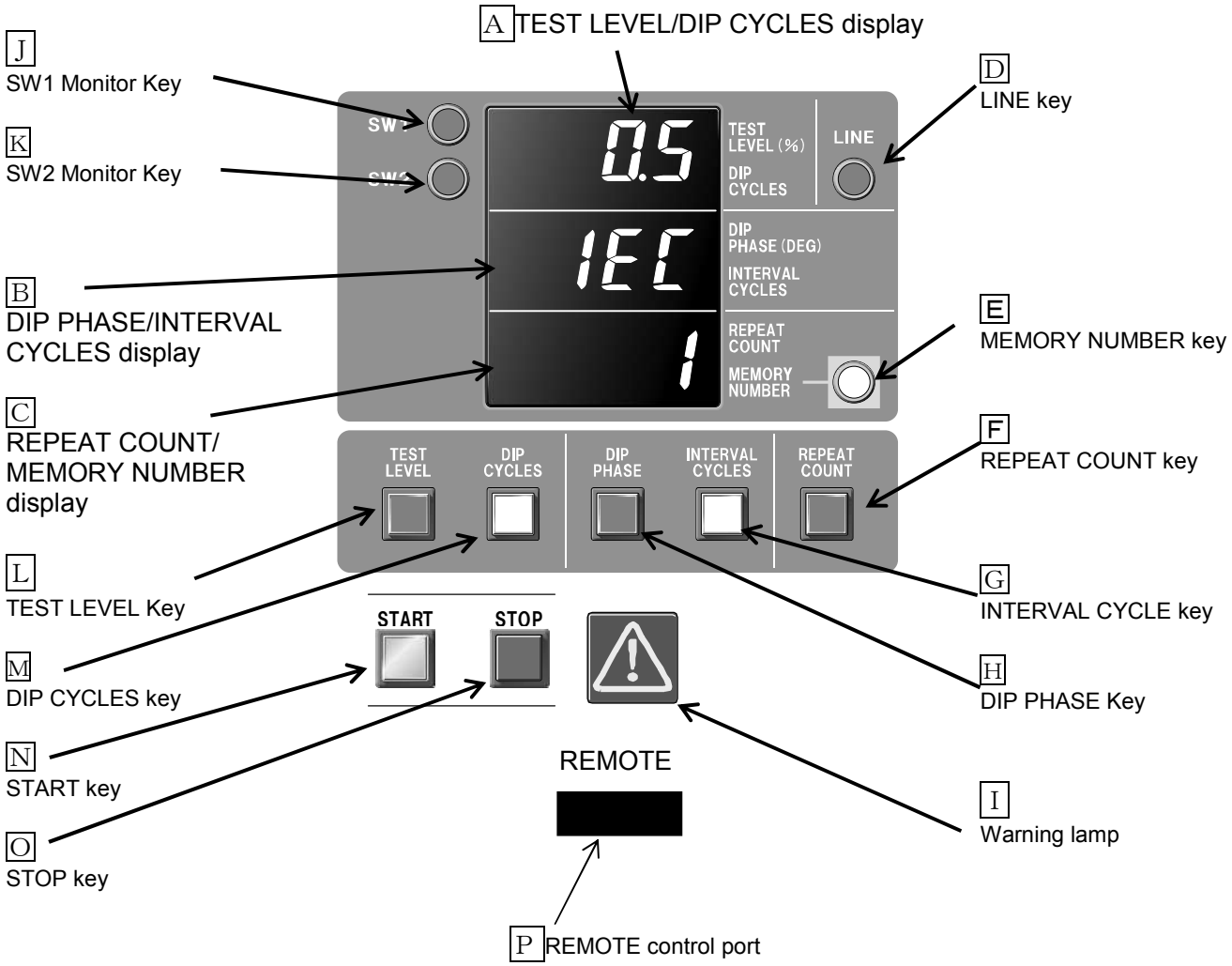
7-1. Front Panel Appearance



7-2. Rear Panel Appearance



7-3. Control Panel

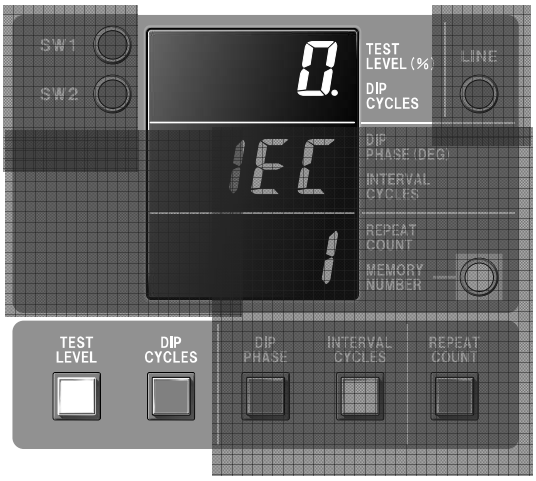


◇ VDS-2002 control

A TEST LEVEL/DIP CYCLES display

Indicates test level (unit: %) or dip cycle (unit: cycle).

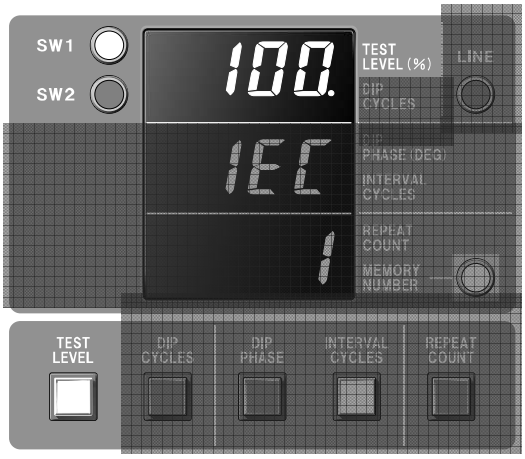
*In LINE OFF status



Indicates test level when TEST LEVEL key is alight.

Indicates dip cycle when DIP CYCLES key is alight.

*In LINE ON status



LINE ON status
(TEST LEVEL key alight)

Indicates dip cycle when DIP CYCLES key is alight. Indicates test level when TEST LEVEL key is alight.

When TEST LEVEL key is alight,

Indicates base voltage when SW1 (BASE VOLTAGE) monitor key is alight.

Indicates test level when SW2 (TEST LEVEL) monitor key is alight.

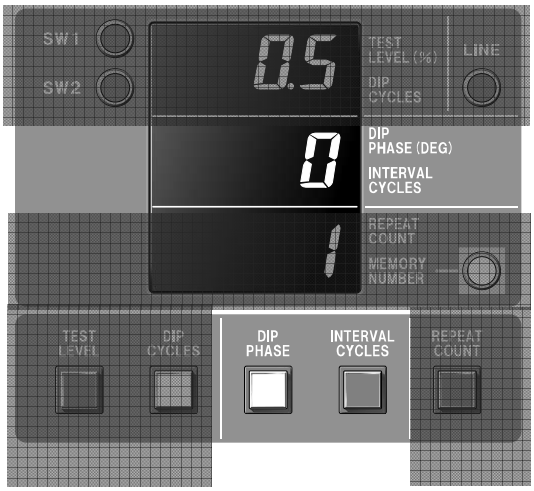
If TEST LEVEL key is pressed and test level is changed in SW1 monitor key alight status, the revised test level is being indicated with blinking for 3 seconds. During this period SW2 monitor key does not turn on, SW1 monitor key keeps alight.

Ⓑ DIP PHASE/INTERVAL CYCLES display

Indicates dip phase (unit: degree) or interval cycle (unit: cycle or second).

Indicates dip phase when DIP PHASE key is alight.

Indicates interval cycle when INTERVAL CYCLES key is alight.

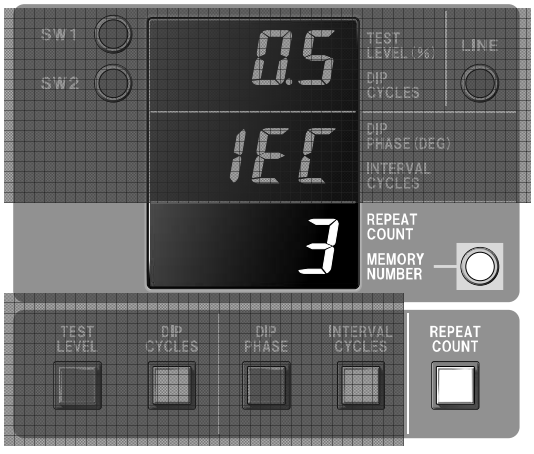


Ⓒ REPEAT COUNT/MEMORY NUMBER display

Indicates repeat count (unit: time) or memory number (1-5).

Indicates repeat count when REPEAT COUNT key is alight.

Indicates memory number when MEMORY NUMBER key is alight.



D LINE key

Turns EUT OUTPUT line on and off. When LINE key is pressed, warning sound informing "EUT OUTPUT LINE ON" starts beeping and I Warning lamp turns on, showing switching into LINE ON status. BASE VOLTAGE (100% of EUT INPUT voltage) is being output to EUT OUTPUT.

When LINE key is pressed in LINE ON status, warning sound informing "EUT OUTPUT LINE OFF" starts beeping and I Warning lamp turns off, showing switching into LINE OFF status. Even when the test is being started, switching into LINE OFF status is available. In this case the test is finished forcibly.

E MEMORY NUMBER key

Used for saving settings, changing them, and switching into local setting from PC remote control setting. When MEMORY NUMBER key is pressed, memory number (1.2…or 5) and its setting are indicated. Five types of test settings can be saved. When you change the setting of number 5, press MEMORY NUMBER key until "5" appears on the display and then set the contents of the test. When the setting is changed, MOMORY NUMBER key blinks. Press MOMORY NUMBER key longer (than 2 seconds) and the contents of the test is being saved under the indicated number. Beep sound informs the completion of saving. The saved setting can be kept with a backup battery even after turning off the main power.

MEMORY NUMBER key is used for switching from PC remote control setting into local setting. In PC remote control setting, "PC" is indicated on A TEST LEVEL/DIP CYCLES display.

F REPEAT COUNT key

Sets repeating times of dip/up cycle. Eight steps (1, 3, 5, 10, 30, 50, 100, Cnt—repeating limitlessly) are available.

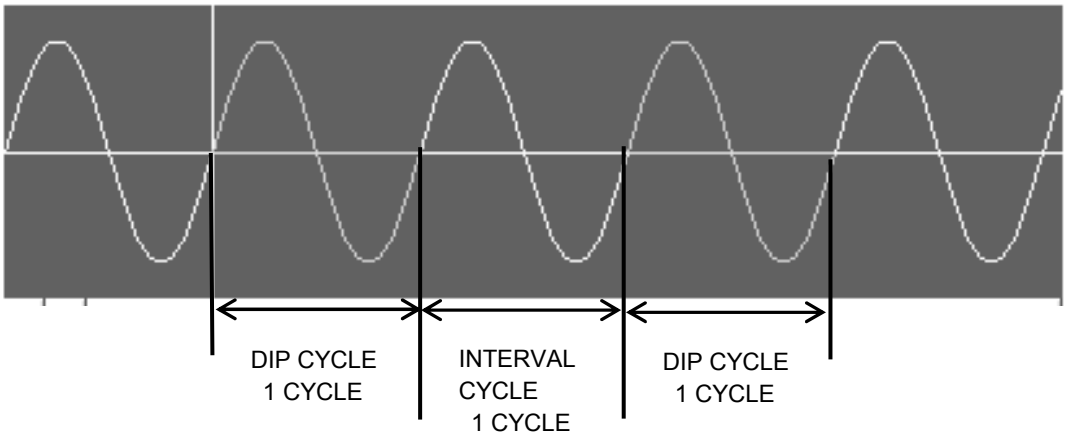
G INTERVAL CYCLES key

Sets interval cycles for various kinds of tests.

*In voltage dip/up and interruption tests

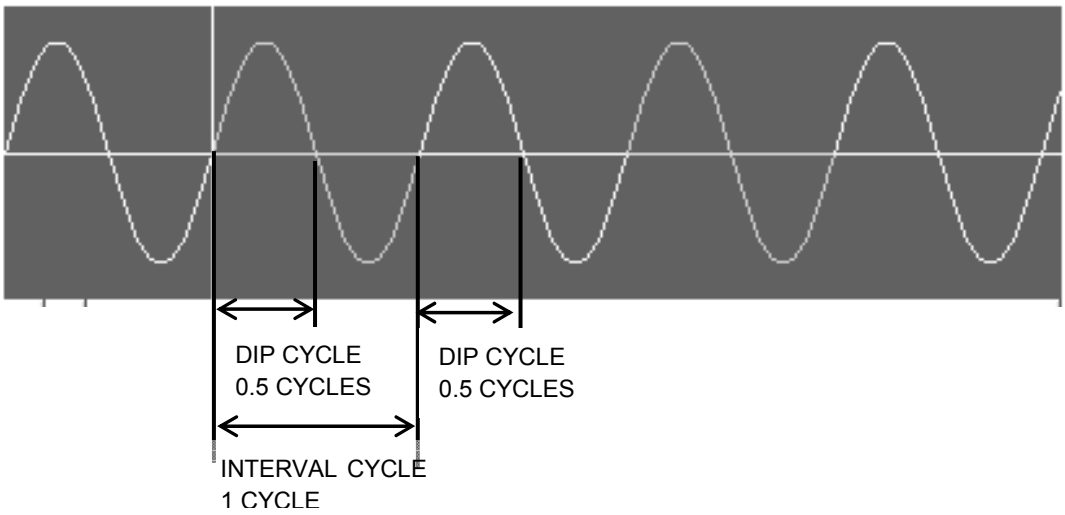
"INTERVAL CYCLES" means the number of cycles from the end of the dip/up cycle to the beginning of the next dip/up. Refer [Fig 2]. Ten steps of INTERVAL CYCLES —1, 3,5,10, 30, 50, 100, 300, 500 (cycle) and IEC (10 seconds)—are available.

[Fig 2] Case of DIP CYCLE 1 and INTERVAL CYCLE 1



**Note: DIP CYCLE 0.5 case is the exception of the above. INTERVAL CYCLE is including DIP CYCLE.

[Fig 3] Case of DIP CYCLE 0.5 and INTERVAL CYCLE 1



*In voltage variation tests

In voltage variation tests (Press M DIP CYCLES key and "vAr" appears on A TEST LEVEL/DIP CYCLES display), the unit of INTERVAL CYCLES becomes second (not cycle). The number more than "100" on B DIP PHASE/INTERVAL CYCLES display means 100 seconds.

*In voltage variation tests of IEC61000-4-11 Ed.2 (2004) /Ed.3 (2020)

Press M and "oPt" on A. The unit of INTERVAL CYCLES becomes second. The number more than "100" on B means 100 seconds, less than "3" on B means 3.

It is optional in the IEC 61000-4-11 Ed2 (2004) voltage variations test and became required in the modified Ed3 (2020) voltage variations test.

"oPt" on A is displayed on both Ed2 (2004) voltage variations test and Ed3 (2020) voltage variations test.

H DIP PHASE key

Sets dip/up starting phase angle. Nine steps (0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°, 360°) are available. In voltage variation tests ("vAr" or "oPt" on A), DIP PHASE key is ineffective.

I Warning lamp

Alight in LINE ON status after pressing D LINE key.

Blinks TEST START status after pressing N START key.

While Warning lamp is alight or blinks, voltage is output to EUT OUTPUT. Be careful.

J SW1 Monitor Key

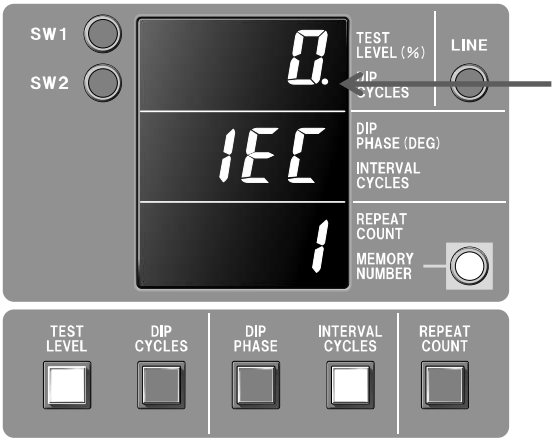
Monitors BASE VOLTAGE (SW1) and sets sensing mode or direct mode.

*SW1 (BASE VOLTAGE) Monitor

While SW1 Monitor key is alight (LINE ON status), BASE VOLTAGE (SW1) is output to EUT OUTPUT. BASE VOLTAGE is 100% of EUT INPUT. In this situation, when TEST LEVEL is indicated on A TEST LEVEL/DIP CYCLES display, "100" is indicated, which shows BASE VOLTAGE is 100%. During tests SW1 or SW2 Monitor key is alight according to DIP and INTERVAL timing set previously to the tests.

*Sensing mode / Direct mode switching

Switches the mode in LINE OFF status by pressing SW1 Monitor key longer (than 2 seconds) when TEST LEVEL is indicated.



Sensing mode: Dot is alight.
Direct mode: Dot is not alight.

**Sensing mode

In the sensing mode, a feed back circuit works and maintains the output voltage measured at the instance when the LINE key is pressed. This will minimize possible voltage changes due to the load (EUT) starting. This function is operative only in the STOP status. Even if the EUT supply input is switched from, for example, 100v to 240V, this instrument outputs 100V when placed in this mode.

**Direct mode

In the Direct mode, EUT supply input just goes through the instrument with no feedback. Therefore input voltages changes directly affect the output from the instrument. So does it for intentional input changeover.

K SW2 Monitor key

Monitors TEST LEVEL (SW2). In LINE ON status, when switching from SW1 into SW2, TEST LEVEL value (percentage to input voltage value, 0, 40, 70, 80, or 120) is indicated and the voltage based on the value is output to EUT OUTPUT. During tests SW1 or SW2 Monitor key is alight according to DIP and INTERVAL timing set previously to the tests.

L TEST LEVEL key

Sets TEST LEVEL (SW2) (0%, 40%, 70%, 80%, or 120%). TEST LEVEL is output when SW2 monitor key is alight. By pressing TEST LEVEL key, the value on A TEST LEVEL/DIP CYCLES display changes as “0”, “40”, “70”, “80”, “120”, which indicates change of setting.

**In the voltage variation test of IEC61000-4-11 Ed2 (2004)/Ed3 (2020), 0% or 40% setting is to be 50% setting.

M DIP CYCLES key

Sets dip/up cycle, and switches into the voltage valuation test mode. Twelve steps (0.5, 1, 5, 10, 12, 25, 30, 50, 250, 300 cycles, oPt and vAr) are available. Both “vAr” and “oPt” are for the voltage variation test mode — “oPt” is for the voltage variation test of IEC61000-4-11 Ed2 (2004)/Ed3 (2020).

**In LINE ON status, switching between dip/up cycle mode (0.5, 1…) and variation mode is unavailable (changeable within cycle numbers even in LINE ON status).

N START key

Starts test. Without turning line on, test cannot be started.

O STOP key

Stops test. Line is still on after this STOP operation.

P REMOTE control port

Used for connecting to PC by an optical cable. The optional remote control software can expand the variation of the test.

7-4. Each Part on Front Panel

② POWER Key

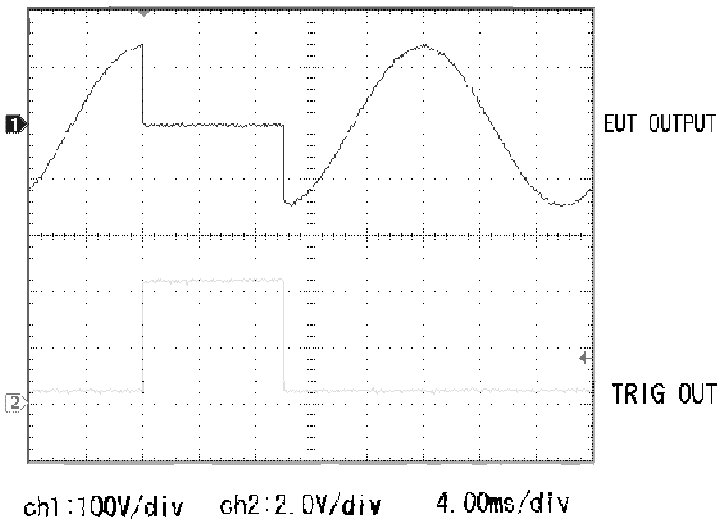
Turns the VDS-2002 on or off. When the instrument is on, MEMORY NO., INTERVAL CYCLE and DIP CYCLE lamps are alight and the current settings are shown on the relevant displays. When the instrument is OFF, EUT INPUT LINE cannot be cut off completely. Turn off power supply of EUT INPUT for safety –to avoid an electric shock--.

③ TRIG OUT BNC terminal

This terminal outputs TTL signals synchronized with the events of switching between BASE VOLTAGE and TEST LEVEL.

As the BNC ground is of floating design, LINE voltage and TRIG OUT signals can be input to your oscilloscope at the same time.

To avoid a short-circuit event, insert an isolation transformer between the oscilloscope and its AC source. Do not connect the oscilloscope AC plug ground pin to the transformer secondary.



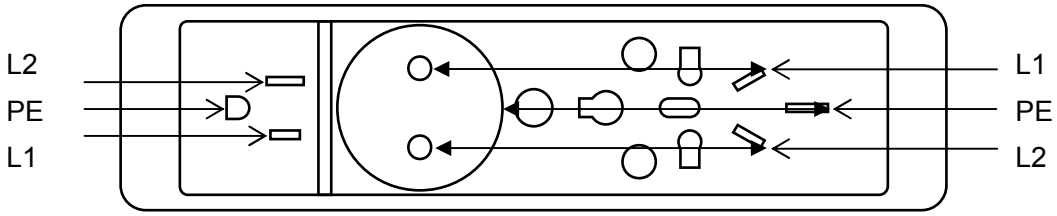
Low : EUT output is normal voltage.
Hi : EUT output is test voltages either in dip, swell or interruption

④ EUT OUTPUT Block terminals

AC and DC output terminals. Check the correct connection according to the L1, L2, PE, + or – markings. Use proper cables with sufficient current rating meeting the EUT. These terminals are parallel connected to ⑤EUT OUTPUT multi-receptacle.

⑤ EUT OUTPUT multi-receptacle

Multi-receptacle dedicatedly to be used for AC output only. Use proper cables with sufficient current rating meeting the EUT. Never connect a load exceeding the instrument rating of AC290V/16A. As these receptacles are parallel connected to ④ EUT OUTPUT Block terminals, DC voltages can be present. But do not use these receptacles for testing with DC.



⑥ FG terminal

Chassis ground of the instrument

⑦ Serial number sticker

The serial number of the instrument is shown.

7-5. Each Part of Rear Panel

⑧ Fan

Ventilation to cool the internal circuit. Do not block air outlet.

⑨ DC EUT INPUT circuit protector (upper) and terminals (lower)

(**For DC test, the optional PC remote control software and opt-link set is necessary.)

To input DC for the EUT, switch the relevant short-bars (3 pieces) to the DC side on ⑭ AC/DC SELECT terminals.

*Do not input AC to ⑩AC EUT INPUT at the same time.

Circuit protector (upper) (CP11)

Lifting the lever turns on the DC EUT LINE. In case of an over-current, this protector functions and cuts the DC EUT LINE. Before turning on the LINE, eliminate the cause of the over-current event.

Terminals (lower)

DC EUT input terminal. Check the correct connection according to the + and - markings. Use proper cables with sufficient voltage and current rating meeting the EUT.

*Use a DC supply with over-current protection circuitry to avoid a failure of the

supply.

⑩ AC EUT INPUT circuit protector (upper) and terminals (lower)

To input AC for the EUT, switch the relevant short-bars (3 pieces) to the AC side on ⑭AC/DC SELECT terminals.

Do not input DC to ⑨ DC EUT INPUT at the same time.

Circuit protector (upper) (CP12)

Lifting the lever turns on the AC EUT LINE. In case of an over-current, this protector functions and cuts the AC EUT LINE. Before turning on the LINE, eliminate the cause of the over-current event.

Terminals (lower)

AC EUT input terminal. The hot side of the EUT supply shall be connected to the L1 and the cold side shall be connected to the L2. Check the correct connections. PE terminal is for the EUT earth connection and separated from the PE of 11 AC INPUT. Use proper cables with sufficient voltage and current rating meeting the EUT.

*An AC source with less distortion and output voltage variation is a better choice. An excessive level of distortion and variation may result in incorrect output (test) voltage from the instrument.

⑪ Fuses for instrument supply

Fuses for the VDS-2002 mains supply blow out in the event of an over-current and other abnormality. Immediately turn off all the related power inputs (the instrument, EUT, LINE) and disconnect the associated cables and investigate the cause of the blowout. Only the specified fuse of 250V M 3A (M: slow/medium) can be used as a replacement. When the instrument failure is suspected, consult the Noise Laboratory's distributor.

⑫ AC INPUT

AC input for this instrument. Operate it on the correct voltage range of AC100V～240V. User a proper cord according to local supply voltage. Operation without earth connection is forbidden.

⑬ Fuse for input voltage detection circuit of the instrument

This fuse blows out in the event of an abnormality. Immediately turn off all the related power inputs (the instrument, EUT, LINE) and disconnect the associated cables and investigate the cause of the blowout. Only the specified fuse of 250V M 1A (M: slow/medium) can be used as a replacement. When the instrument failure is suspected, consult the Noise Laboratory's distributor.

⑭ AC/DC SELECT terminals

These terminals are provided to offer selection between ⑨ DC EUT INPUT and ⑩ AC EUT INPUT terminals. For selection, switch the 3 short-bars to either AC or DC. When AC is selected, input AC supplies to ⑩AC EUT INPUT. When DC is selected, input DC supplies to ⑨DC EUT INPUT.

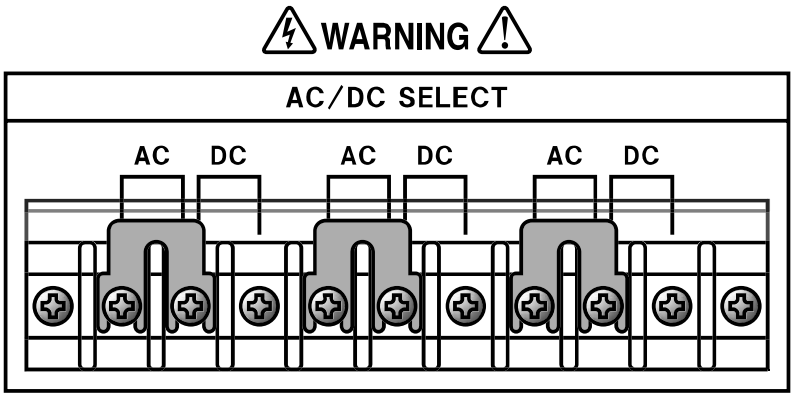
*Never input to these two supply inputs at the same time.

*When selecting AC or DC, move short bars in no residual electricity status.

8. OPERATION

8-1 AC/DC SELECT

Select DC or AC and check 3 pieces of short bars are fixed firmly to your desirable position (AC or DC). If they are not on your desirable position, confirm there is no residual electricity, disconnect all connections, move and fix them firmly to your desirable position.



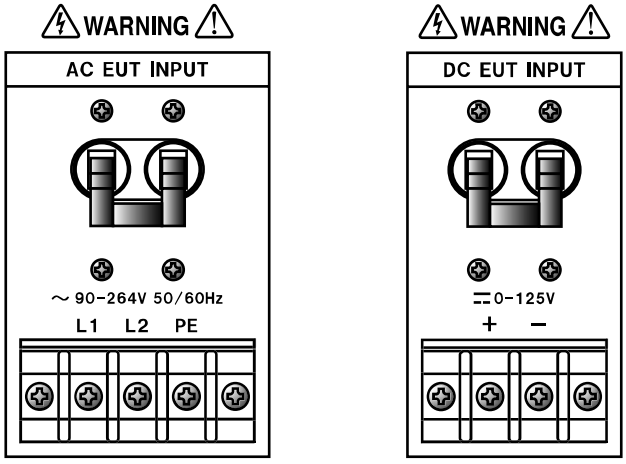
8-2. EUT INPUT Connection

Connect EUT power supply (AC or DC) to AC EUT INPUT or DC EUT INPUT.

*AC EUT INPUT: Connect the hot side of EUT power supply to L1 and the cold side to L2. Make sure the connection right and electrify it. Connect PE if necessary.

*DC EUT INPUT: Use a DC supply with over-current protection circuitry to avoid a failure of the supply. Make sure the connection right and electrify it.

*Never input to these two supply inputs at the same time.

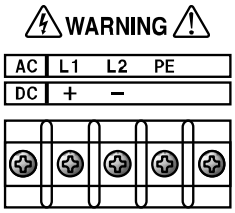


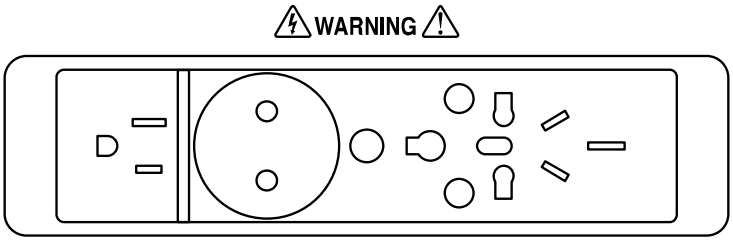
8-3. EUT OUTPUT Connection

EUT OUTPUT Block terminal and EUT OUTPUT Multi-receptacle are connected in parallel.

*AC EUT OUTPUT: Select Block terminal or Multi-receptacle according to convenience of EUT. Do not use Block terminal and Multi-receptacle at the same time. If EUT current capability is exceeding 16A, use Block terminal (Multi-receptacle unavailable).
When using Block terminal, make sure the connection (L1-the hot side, L2-the cold side, and PE) right and electrify it.

*DC EUT OUTPUT: Use Block terminal (Multi-receptacle unavailable). Make sure the connection right and electrify it.

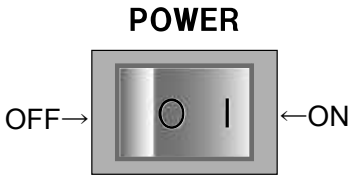




8-4. Instrument POWER ON/OFF

Pressing the | side of the POWER key on the front panel turns on the instrument. When the instrument is on, MEMORY NO., INTERVAL CYCLE and DIP CYCLE lamps are alight and the current settings are shown on the relevant displays.

Pressing the ○ side of the POWER key on the front panel turns off the instrument. When the instrument is off, all lamps and displays are off.

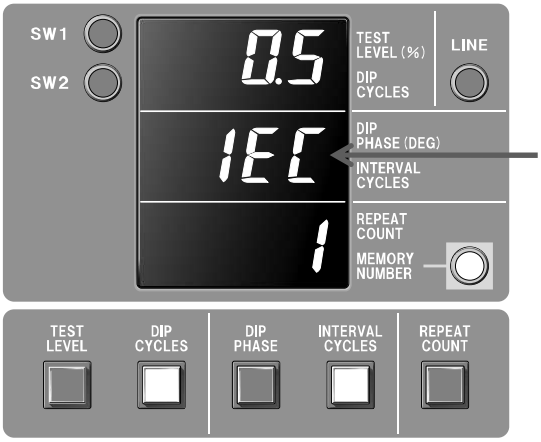


8-5. How to Set Interruption Test

When the instrument turned on, the default values and indications are as follows.

Key	Default Value	Key's Light and Indication
TEST LEVEL	0% Sensing mode	Not alight / No indication
DIP CYCLES	0.5 cycles	Alight / "0.5" on A
DIP PHASE	0°	Not alight / No indication
INTERVAL CYCLES	10s	Alight / "IEC" on B
REPEAT COUNT	3 times	Not alight / No indication
MEMORY NUMBER	1	Alight / "1" on C
LINE	OFF	-
SW1	OFF	Alight / No indication
SW2	OFF	Alight / No indication

For interruption test, set 0% for TEST LEVEL. As for other parameters, set them according to your test contents.



When the INTERVAL CYCLES display shows "IEC", voltage dip or variation tests are done at 10 seconds interval irrespective of the frequency of the EUT supply input.

8-6. How to Start Test

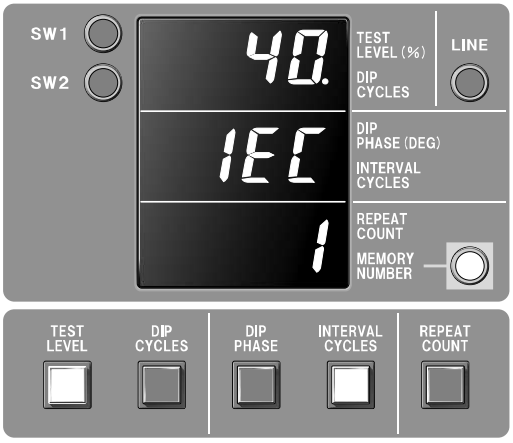
Press LINE key to make the instrument LINE ON status. Warning sound beeping, the automatic slide transformer sets BASE VOLTAGE. In LINE ON status, SW1 Monitor key and Warning lamp are alight.
Press START key to start test. When test starts, Warning lamp starts blinking, which shows conducting a test.
During test, switching operation between SW1 (BASE VOLTAGE) and SW2 (TEST LEVEL) can be observed. Either SW1 or SW2 lamp is alight, showing which is electrified.
When test completes, Warning lamp becomes alight again, showing LINE ON status.

8-7 How to Monitor OUTPUT Voltage of BASE VOLTAGE / TEST LEVEL

In LINE ON status, BASE VOLTAGE (SW1) is usually output to EUT OUTPUT with SW1 key alight. Pressing SW2 key makes TEST LEVEL (SW2) output to EUT OUTPUT. With this operation both BASE VOLTAGE and TEST LEVEL can be monitored.

8-8. How to Set Dip/Up Test

Press TEST LEVEL key and set it. The example, setting 40%, is as below.

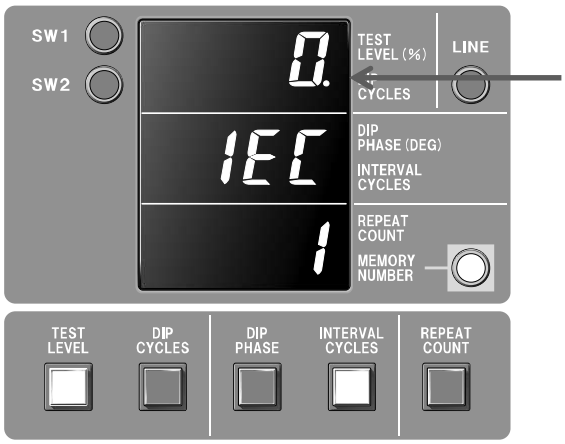


Select TEST LEVEL from 0%, 40%, 70%, 80%, and 120% and set it. As for other parameters, select and set them according to your test contents. The table below shows selectable parameters and their available values.

Parameter (Key)	Settable Values
TEST LEVEL	0%, 40%, 70%, 80%, 120%
DIP CYCLES	0.5, 1, 5, 10, 12, 25, 30, 50, 250, 300 cycles
DIP PHASE	0°, 45°, 90°, 135°, 180°, 225°, 270°, 315°, 360°
INTERVAL CYCLES	1,3,5,10,30,50,100,300,500 cycles and IEC (10 seconds)
REPEAT COUNT	1, 3, 5, 10, 30, 50, 100 times and Cnt—repeating limitlessly
MEMORY NUMBER	1, 2, 3, 4, 5

8-9. How to Set Sensing Mode or Direct Mode

In the initial screen, a dot is alight at the lower right of [A] TEST LEVEL/DIP CYCLES display, showing the instrument in sensing mode status. Pressing SW1 Monitor key longer (than 2 seconds) when TEST LEVEL is indicated in LINE OFF status switches the mode one another.



Sensing mode: Dot is alight.

Direct mode: Dot is not alight.

**Sensing mode

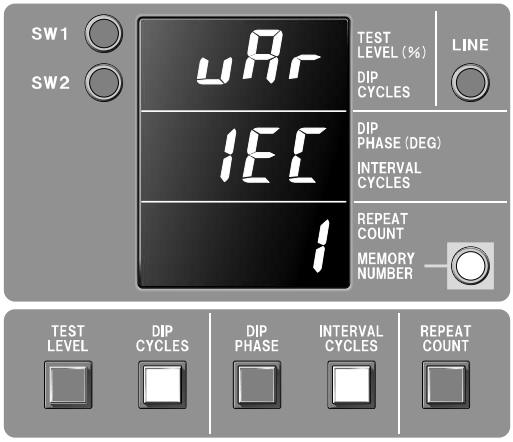
In the sensing mode, a feed back circuit works and maintains the output voltage measured at the instance when the LINE key is pressed. This will minimize possible voltage changes due to the load (EUT) starting. This function is operative only in the STOP status. Even if the EUT supply input is switched from, for example, 100v to 240V, this instrument outputs 100V when placed in this mode.

**Direct mode

In the Direct mode, EUT supply input just goes through the instrument with no feedback therefore input voltages changes directly affect the output from the instrument. So does it for intentional input changeover.

8-10. How to Set Voltage Variation Test

Press DIP CYCLES key times until “vAr” appears on DIP CYCLES display, which indicates voltage variation test mode selected. The screen as below shows the voltage variation mode status.



Voltage dips and short interruption test, output voltage varies from 100% of the rated voltage to 0%, 50%, 70%, 80% or 120% of abruptly and returns to the rated voltage for 0.5 seconds. The 0.5 seconds are fixed values. The table below shows selectable parameters and their available value.

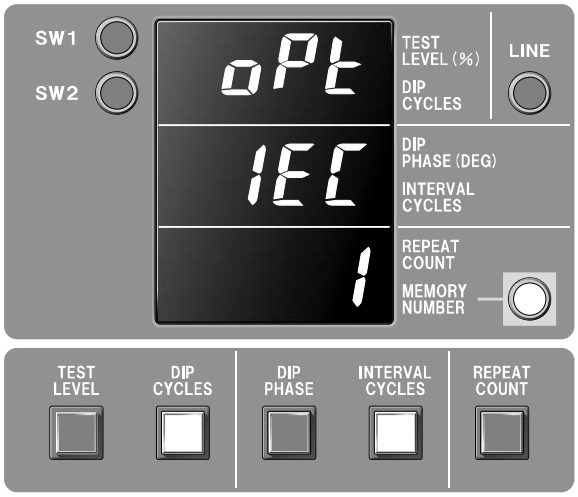
Parameter (Key)	Settable Values	Note
TEST LEVEL	0%, 40%, 70%, 80%, 120%	
DIP CYCLES	Indicate “vAr”	
INTERVAL CYCLES	1,3,5,10,30,50,100s and IEC (10s)	“300””500” are 100s
REPEAT COUNT	1,3,5,10,30,50,100 times and Cnt	
MEMORY NUMBER	1, 2, 3, 4, 5	

**Setting DIP PHASE is ineffective.

**Setting Direct mode is ineffective (Always Sensing mode).

8-11. How to Set Voltage Variation Test of IEC61000-4-11 Ed2 (2004)

Press DIP CYCLES key times until “oPt” appears on DIP CYCLE display, which indicates the voltage variation (optional) test mode (for IEC61000-4-11 Ed2/Ed3) selected. The screen as below shows the voltage variation (optional/required) mode status.



In the voltage variation test, output voltage varies from 100% of the rated voltage to 40%, 70%, or 120% of it for 2 seconds and keeps the reduced value for 1 second, and returns to the rated voltage for 2 seconds. The above 2, 1, 2 seconds are fixed values. The table below shows selectable parameters and their available value.

Parameter (Key)	Settable Values	Note
TEST LEVEL	70%, 80%, 120%	“0””40” are 50%
DIP CYCLES	Indicate “oPt”	Ed2 (2004) is optional Ed3 (2020) is required
INTERVAL CYCLES	3,5,10,30,50,100s and IEC (10s)	“300””500” are 100s “1” is 3s
REPEAT COUNT	1,3,5,10,30,50,100 times and Cnt	
MEMORY NUMBER	1, 2, 3, 4, 5	

**Setting DIP PHASE is ineffective.
**Setting Direct mode is ineffective (Always Sensing mode).

9. SPECIFICATIONS

9-1 Specifications

Parameters				Specifications			Remarks
Compliant standard				IEC 61000-4-11 (1994)(2004)(2020)			At 0-100%
Number of lines				Single phase			
Test mode	Interruption AC/DC			Synchronous	PC/local	Short circuit	
				Asynchronous	PC		
				Synchronous/Asynchronous	PC	Open circuit	
	Dip and swell			Synchronous	PC/local		
				Asynchronous	PC		
	Variation			Asynchronous	PC/Local Only 2s-1s-2s standard defined test available in local mode		
Input voltage range				AC 90 - 264V, 50/60 Hz DC 0- 125V			**3
Output voltage range				AC 0V - 120% of input voltage DC 0V - input voltage			AC 290 V max **2
Output VA				4.224kVA			Continuous
Output current capability	AC	100% of input voltage		16A rms			Continuous
		80% of input voltage		20A rms			<5S
		70% of input voltage		23A rms			<5S
		40% of input voltage		40A rms			<5S
	DC			16A			Continuous
Peak inrush current drive capability		AC 100-120V		>250A			at 100% output, in the Direct mode <10ms
		AC 220 - 240V		>500A			
Load regulation	100% of input voltage 0 –16A rms			<5%			
	80% of input voltage 0 –20A rms			<5%			
	70% of input voltage 0 –23A rms			<5%			
	40% of input voltage 0 –40A rms			<5%			
Overshoot / undershoot				<5%			100 ohm loaded in the Sensing and CHANGE modes
Rise time/fall time				1 - 5 uS			100 ohm loaded
BASE VOLTAGE (Normal voltage setting)	Setting by percent		PC	(4%) -120%			10V minimum *1, *2
			Local	100%			**1
	Setting by voltage		PC	10V - 290V			5V step
	Accuracy			+/-5V			0-16A output
TEST LEVEL (Dip/Swell level)	Setting by percent		PC	Short/Open selectable for 0% (interruption)	0 -120%		**1
			Local	Short circuit for 0% (interruption) setting	0/40/70/80/120%		5 steps
	Setting by voltage		PC	Short/Open selectable for 0V (interruption)	0-290V (0-120%)		5V step **1
	Accuracy			+/-5V			0-16A output
Repetition of events	No. of events		PC	1 - 1000 or continuous			1 event step
			Local	1, 3, 5, 10, 30, 50, 100 or continuous			8 steps

Interval cycle	Setting by cycle		Synchronous	PC	0.5- 5000.5 cycles	0.5 cycle step
				Local	1,3,5,10,30,50,100,300,500 cycles, 10s	10 steps
	Setting by time	Setting for short duration	Synchronous	PC	1-100s	1s step
			Asynchronous		10ms - 100s (50Hz) 8.3ms – 100s (60Hz)	0.1 ms step
		Setting for long duration	Asynchronous		1s - 10h	1s step
Dip cycle	Setting by cycle		Synchronous	PC	0.01 – 5000 cycles	0.01 cycle step
				Local	0.5, 1, 5, 10, 12, 25, 30, 50, 250,300cycles	10 steps
	Setting by time	Setting for short duration	Synchronous	PC	0.1ms – 100s	0.1ms step
			Asynchronous		0.1 ms-100s	0.1ms step
		Setting for long duration	Asynchronous		1s - 10h	1 s step
Dip phase (Starting phase angle of events)	Setting by phase angle		Synchronous	PC	0 – 360 degrees	1 degree step
				Local	0, 45, 90, 135, 180, 225, 270, 315, 360°	9 steps (45 degrees step)
	Setting by time			PC	0- 19.9 ms for 50Hz	0.1ms step
					0 -16.6 ms for 60Hz	
Voltage variation test	Setting by time	Changing time	Asynchronous	PC	0.1s - 10 s at least 0.1s required for 10% change of input	0.1s step
		Changed time			0 – 10s	0.1s step
		Interval			0 – 100s	0.1s step
	Test level			PC	0 – 120%	
Memory				Local	5 tests	Test sequencing of up to 10 steps when controlled by PC
				PC	10 steps	
Equipment input	AC100-115V/200-240V±10%, 50/60Hz, 120VA					
External interface	optical RS-232					
Operating temperature	15-35℃					
Operating humidity	25-75%R.H. (No dewing)					
Dimensions	(W)430×(H)745×(D)600mm(projection excluded)					
Weight	Approx.150 kgs.					

**1 : percent against input voltage

**2 : For >100% voltage output, the instrument specifications are to be exempted from IEC 61000-4-11(1994), IEC 61000-4-11 Ed(2004) and IEC 61000-4-11 Ed(2020)

**3 : No distortion or voltage variation shall not be allowed for AC source (EUT supply input)

9-2 Local / PC operation comparison

The following table shows the comparison between the parameters settings available with this instrument only (local) and those which can be programmed on an optional Windows control software.

9-2-1 Voltage dip/short interruptions/swell

Parameters	VDS-2002	Remote control by PC
EUT voltage	100％ fix	1V to 120% of input
Test level	0, 40, 70, 80, 120% of input	0v to 120% of input
OV status	Fixed to low impedance	Low or high impedance selectable
DIP start phase angle	0° to 315° at a step of 45° plus 360°	0° to 360° at a step of 1°
DIP start setting by time	Not selectable	0.1ms to time equivalent to 360°
DIP cycle	0.5, 1, 5, 10, 12, 25, 30, 50, 250, 300 cycles	0.01 to 5000 cycles at a step of 0.01 cycle
DIP duration Setting by time	Not selectable	0.1ms to duration equipment to 5000 cycles
Interval	1,3,5,10,30,50,100,300,500 cycles, 10s	0.5 to 5000.5 cycles or 1s to 100 s
Repetition of events	1,3,5,10,30,50,100 events or continuous	1 to 1000 events or continuous
Test sequencing	Not available	Up to 10 tests

9-2-2 Voltage variation test

Parameters	VDS-2002	Remote control by PC
EUT voltage	100% fixed	1V to 120% of input
Test level	0, 40, 70, 80, 120% of input	0V to 120% of input
Voltage fall time	2s fixed	0.1 to 10s
Time for changed voltage	1s fixed	0 to 10s
Voltage increase time	2s fixed	0.1 to 10s
Interval	1,3,5,10,30,50,100s	1 to 100s
Repetition of events	1,3,5,10,30,50,100 events or continuous	1to 1000 events or continuous
Test sequencing	Not available	Up to 10 steps

9-2-3 Voltage Variation Test described in IEC61000-4-11 Ed2 (2004) /Ed3 (2020)

Parameters	VDS-2002	Remote control by PC
EUT voltage	100% fixed	1V to 120% of input
Test level	50, 70, 80, 120% of input	50%-120% of input
Voltage increase time	0.5s fixed	0.1 to 0.5s 0.1s step (10% per 0.1s)
Interval	3,5,10,30,50,100s	3 to 100s 0.1s step
Repetition of events	1,3,5,10,30,50,100 events or continuous	1to 1000 events or continuous
Test sequencing	Not available	Up to 10 steps

9-2-4 DC interruption test

Parameters	VDS-2002	Remote control by PC
Availability	No	Yes
Interval	---	0.5ms to 100000.0ms or 1 to 36000s
Duration of interruption	---	0.1ms to 100000.0ms or 1to 36000s
Repetition of events	---	1 to 1000 events or continuous
Test sequencing	---	Up to 10 steps

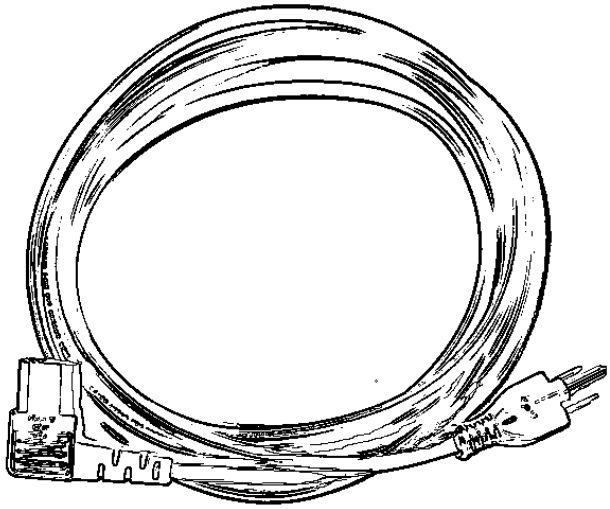
※ Remote control software is optionally available.

※ The above table shows the full range of each setting. Some combinations are not available.

10. INCLUDED ACCESSORY

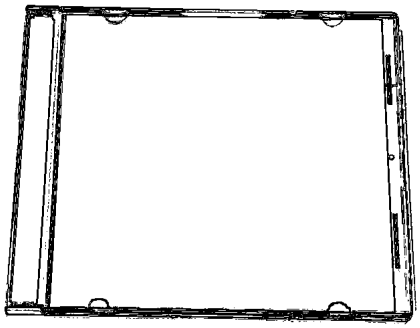
AC cord 1 piece.

AC cord

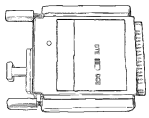


11. OPTIONS

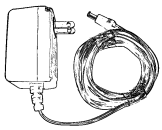
Remote Control Software 14-00029A



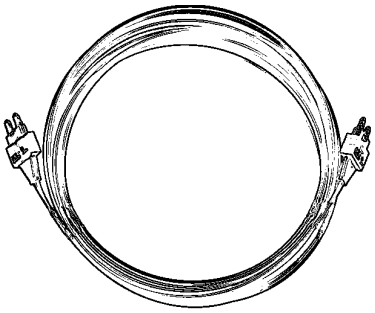
Optical Conversion Adaptor (Set) 07-00017A



Optical Modem



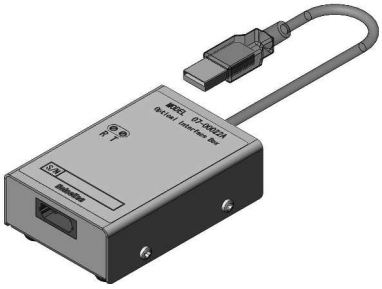
AC Adaptor



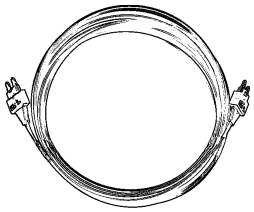
Optical Cable (5m)

USB Optical Conversion Unit 07-00022A

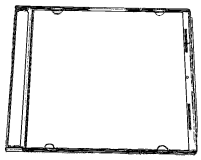
Main Unit



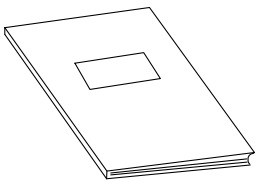
Optical Cable (5m)



CD



Instruction Manual



12. ERROR DISPLAY

When the input or output voltage or current exceeds the instrument ratings or over voltage or over current protection circuit functions, the following error number is shown.

Error No.	Meaning
1	In-rush current over 500A flowed to the EUT ※1
2	Current over 40A flowed to the EUT.
3	16A or higher current flowed for 5s or a longer period.
4	During the test, EUT supply voltages dropped.
5	Input voltage to the EUT input exceeded the limit of this instrument
6	Output voltages to the EUT exceeded the limit of this instrument
7	Frequency of the EUT supply input was outside of the range of the instrument

In the event of any of the above errors, turn off the instrument supply and EUT supply first. Turn on again only after eliminating the cause of the error.

※1 In the event of Error No. 1, be sure to turn off the all-relevant supplies (instrument supply, EUT, supplies to EUT). The instrument turn on shall be allowed only after 2-minute lapse and after eliminating the cause of the excessive in-rush current event.

Turn-on within 2 minute will result in a failure of the semiconductor switches in this instrument.

13. STANDARD

13-1 IEC61000-4-11 Standard General

IEC 61000-4-11 standard defines immunity test to voltage dips, short interruptions and voltage variations. The latest edition (the 3rd edition) was issued in January 2020 (The 1st edition was issued in June 1994 and the 2nd edition was issued in March 2004.).

13-2 Scope of IEC61000-4-11

The standard applies to electrical and electronic equipment having a rated input current not exceeding 16A per phase, for connection to 50Hz or 60Hz AC networks (not applying to equipment for connection to 400Hz AC networks).

13-3 General of the test

Voltage dips and short interruptions are caused by faults in the network, in installations or by an abrupt large change of load. They are not always caused by one factor and in certain cases two or more consecutive dips and interruptions may occur. The phenomena may cause great damage occasionally.

Voltage variations are caused by continuously varying loads connected to the network. The phenomena can be characterized in terms of deviation from the rated voltage and duration. Falls of mains voltage are not always abrupt. If large mains networks are disconnected (no matter whether local within a plant or wide area within a region), the voltage will only decrease gradually due to the many rotating machines, which are connected to the mains networks, because for a short period the rotating machines will operate as generators sending power into the network.

Some instruments are more sensitive to gradual variation of voltage rather than abrupt change. Most data-processing equipment has built-in power-fail detectors to protect and save the data. Some power-fail detectors will react sufficiently fast on a gradual decrease of mains voltage. Therefore the DC voltage to integrated circuits will decrease to a level below the minimum operative voltage before the power-fail detector is activated. That will result loss of data and the data processing equipment cannot restart correctly even after the recovery of the mains voltage. Unfortunately, these kinds of phenomena of voltage variation are substantially unsteady and it is difficult to define them.

Consequently the IEC61000-4-11 standard specifies tests to simulate the effects of abrupt change of voltage, and for the reasons explained above it also specifies an optional test Ed2 (2004)／required test Ed3 (2020) for gradual voltage change.

13-4 Voltage Dip and Short Interruption Test of IEC61000-4-11 (1994)

A voltage dip is a sudden reduction of the voltage below a specified voltage threshold followed by its restoration after a short period, typically between half a cycles to a few seconds. A short interruption is a special kind of dips with no AC mains voltage (0V). This standard uses the rated voltages of the equipment under test as a basis for voltage test level specifications. Three test levels are defined: 0% (interruption), 40% and 70%. The table below shows test levels and durations in period.

Test level	Voltage dip and short interruption	Duration (in period)
0%	100%	0.5 cycle 1 5 10 25 50 X (open)
40%	60%	
70%	30%	

One or more of the above test levels and durations may be chosen. For 0.5 period duration, tests shall be repeated with the dip starting phase angle of 0 degree and 180 degrees. The standard requires 3 repetitions of a dip with interval of 10s.

13-5 Voltage Dip and Short Interruption Test of IEC61000-4-11 Ed2 (2004)/Ed 3 (2020)

When the standard revised in 2004, one more test level was added. Four test levels are defined in the edition 2: 0% (interruption), 40%, 70% and 80%. The table below shows test levels and durations in period.

Class	Test Level and Duration (50Hz/60Hz)					
	For Voltage Dips					For Short Interruptions
Class 1	Can prescribe according to the equipment requirement					
Class 2	0% during 1/2 cycle	0% during 1 cycle	70% during 25/30 cycles			0% during 250/300 cycles
Class 3	0% during 1/2 cycle	0% during 1 cycle	40% during 10/12 cycles	70% during 25/30 cycles	80% during 250/300 cycles	0% during 250/300 cycles

“25/30 cycles” means “25 cycles for 50Hz test” and “30 cycles for 60Hz test”.

Class 1 test is specified for electrical or electronic apparatus intended for use in protected power supply environments (for example, laboratories), Class 2 for generic commercial products intended for use in residential, commercial, and light industrial environments, Class 3 for the apparatus intended for use in industrial environments.

13-6 Voltage Variation Test of IEC61000-4-11 (1994) (Optional)

Voltage variations are gradual change of voltage, typically, in second unit.

Two kinds of variation test are specified: changing from 100% to 40% of the rated voltage and from 100% to 0%. The decreasing time is 2 seconds, the time at reduced voltage is 1 second, and the increasing time to the rated voltage is 2 seconds. The table below shows test levels and durations in period.

Voltage Test Level (Output voltage when reduced)	Time for Decreasing Voltage	Time at Reduced Voltage	Time for Increasing Voltage
40%	2 seconds ±20%	1 second ±20%	2 seconds ±20%
0%	2 seconds ±20%	1 second ±20%	2 seconds ±20%

13-7 Voltage Variation Test of IEC61000-4-11 Ed2 (2004) (Optional)/Ed3 (2020)(required)

The variation test of the edition 2 is specified as the test of abrupt falling and gradual recovering. It is described that the voltage change to 70% of the rated voltage (100%→70%) abruptly, keep the reduced value for 1 cycle, and return to the rated voltage for 0.5 seconds. The table below shows test levels and durations in period.

Test Level	Time for Decreasing Voltage	Time at Reduced Voltage	Time for Increasing Voltage
70%	Abrupt	1 cycle	25/30 cycles

13-8 Test results and test report

The test results shall be classified on the basis of the operating conditions and functional specifications of the equipment under test during or after testing.

The test results can be classified into the following:

a) Normal performance within the specification limit.
b) Temporary degradation or loss of function or performance, which is self-recoverable.
c) Temporary degradation or loss of function or performance, which requires operator intervention or system reset.
d) Degradation or loss of function, which is not recoverable due to damage of equipment (component) or software, or loss of data.

EUT shall not become dangerous or unsafe as a result of the application of the test defined in this standard.

14. WARRANTY

Servicing terms

The following terms are applicable to servicing by Noise Laboratory Co., Ltd., (hereafter referred to as the Company) provided to maintain the intended performance of its products.

1. Scope
   The following terms shall apply only to products made by the Company.
2. Technical servicing fee
   In the event of a failure of a product within the warranty period (see warranty section), the Company will repair a product without charge. After the warranty expires, repairs will be billed at a nominal cost.
3. Ownership of defective parts
   Any defective part exchanged under the Company's servicing belongs to it.
4. Limited liability
   In the event that damages resulting from servicing by the Company are intentional or caused by negligence, the Company will pay the cost but at the purchase value of the relevant product maximum. But, notwithstanding the foregoing, the Company shall not be responsible for any incidental or consequential damages of any nature, including without limitation thereof loss of would-be profit or compensation demanded from a third party
5. Refusal to offer servicing
   The company may not accept a repair order in the following cases:
   - More than 5 years have passed since manufacture of a product discontinued
   - More than 8 years have passed after delivery
   - Repair part for a custom-made product is not available due to discontinued production on the supplier and there is no equivalent available.
   - Product changed, repaired or remodeled without obtaining a prior permission from the Company.
   - Product which lost its original form

Limited warranty

Noise Laboratory Co., Ltd. (hereafter referred to as the Company) warrants its products to be free from defects in materials and workmanship under normal use and service for a period of one year from date of delivery. In the event of failure of a product covered by this warranty, the Company will repair the product or may, at its option, replace it in lieu of repair without charge.

Not withstanding the foregoing, the Company shall not be responsible for any incidental or consequential damages of any nature, including without limitation thereof loss of would-be profit or compensation demanded from a third party. This warranty is valid only in Japan.

1. Scope

   This warranty shall only apply to products made by the Company.

2. Period

   One year from date of delivery. The warranty may be valid in 6 months after servicing if the same failure on the same component has repeated.

3. Exclusions

   The followings are exclusions from this warranty:

- Consumable parts (including HV relay)
- Failure caused by misuse, neglect, accident or abnormal conditions of operation
- Failure caused by remodeling on the user side without prior permission from the Company
- Failure caused by servicing by unauthorized personnel by the Company
- Failure due to fore majeure including but not limited to, acts of God, fire, war, riot, rebellion and others
- Failure due to shock or drop in or after transit
- Failure due to operation in environment being out of ambient specifications.
- A unit shipped to overseas.

15. MAINTENANCE

1. When repair, maintenance or internal adjustment of the unit is required, a qualified service engineer takes charge of such work.
2. Maintenance on the user side is restricted to the outside cleaning and functional check of the unit.
3. When replacing the fuses, turn off the switch of this unit and the connected equipment and disconnect the plug socket beforehand.
4. When cleaning the unit, turn off the switch of this unit and the connected equipment and disconnect the plug socket beforehand.
5. Avoid using chemicals for cleaning. Otherwise, the coating of the unit may peel off or the sight glass may be broken.
6. Do not open the cover of this unit.

16. NOISE LABORATORY SUPPORT NETWORK

- If a symptom which seems a trouble is found, inform the model name and serial number of the product together with the symptom to Noise Laboratory or your nearest sales agent of Noise Laboratory.

- When the product is returned to Noise Laboratory, write the state of the trouble, contents of your request, mode name and serial number in a repair order, and pack the product and repair order sheet in the former package of equivalent suitable for transit and send them back.

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