

Voltage Dip & Swell Simulator

VDS-2002

Features

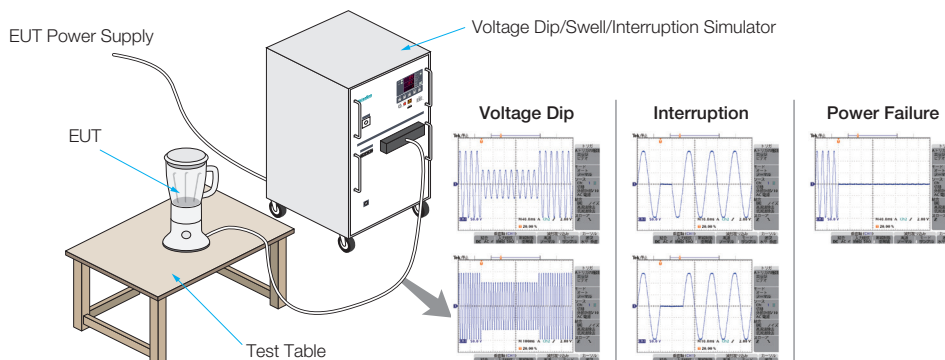
Used to evaluate performance such as malfunctions and functional deterioration due to power supply voltage fluctuations in electronic and electrical equipment.
 Simulates the phenomenon of voltage variations and momentary power failures in commercial power supplies (AC100/200V) and evaluates the resistance of electronic equipment.
 In addition to the requirements of the international standard IEC61000-4-11, it is tested in all industries as a tolerance evaluation against voltage variations and instantaneous interruptions for electronic equipment.

- Voltage dip & swell simulator conforming to EN/IEC61000-4-11 Ed.3 (2020) Standard
- Multiple types AC plug receptacle on the front panel for easy connection of the EUT
- Easy settings for the test parameters on the front panel (Voltage variations test is performed by software.)
- Realize flexible test conditions setting beyond the Standard with a PC remote control
- Allows to conduct the interruption test in DC (DC 125 V / 16 A max)



Specifications

Parameter		Specification		
Compliant Standard		IEC 61000-4-11 (1994) 、IEC 61000-4-11 (2004) at Output voltage 0 to 100%		
Number of Phases		Single Phase		
Test Modes	AC/DC Voltage Interruption test Sensing, direct mode	Cycle synchronous/asynchronous setting	PC setting	Short/Open modes selection during interruption
		Cycle synchronous setting	Main Unit setting	Short mode during interruption
	AC voltage dip and swell test Cycle synchronous/asynchronous setting	Cycle synchronous/asynchronous setting	PC setting	
		Cycle synchronous setting	Main Unit setting	
EUT	Input voltage range	AC90~264V 50/60Hz, DC0~125V ※3		
	Output voltage range	AC0V~input voltage+20%, DC0V~input voltage AC290Vmax ※2		
Output VA rating		4.224kVA (continuous)		
Output current capability	AC	100% of input voltage	16Arms (continuous)	
		80% of input voltage	20Arms (<5s)	
		70% of input voltage	23Arms (<5s)	
		40% of input voltage	40Arms (<5s)	
	DC	16A (continuous)		
MAX Output current capability	AC100~120V	250A peak Output voltage 100%, <10ms in direct mode		
	AC220~240V	500A peak Output voltage 100%, <10ms in direct mode		
Load regulated Output voltage variation	100% of input voltage 0-16 Arms	<5%		
	70% of input voltage 0-23 Arms	<5%		
	70% of input voltage 0-23 Arms	<5%		
	100% of input voltage 0-40 Arms	<5%		
Overshoot / undershoot		<5% 100 ohm loaded in the Sensing Mode		
Rise time / fall time		1~5 μs 100 ohm loaded		



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Parameter			Specification
BASE VOLTAGE	Percent Setting	PC setting	(4%)~120% percentage with a minimum value of 10V ※1 ※2
		main unit setting	100% ※1
	Voltage Setting	PC setting	10~290V (0V~input voltage+20%) 5Vstep ※2 arbitrary setting 1V step
		Accuracy	±5V Output current 0 to 16A
TEST LEVEL (Interruption, dip, swell)	Percent Setting	PC setting	Short/Open selectable for 0% 0~120% ※1
		main unit setting	Short/Open selectable for 0% 0, 40, 70, 80, 120% 5V step ※1
	Voltage Setting	PC setting	Short/Open selectable for 0% 0~290V (0V~5V step+20%) 5V step ※2 arbitrary setting 1V step
		Accuracy	±5V Output current 0 to 16A
REPEAT COUNT	No. of Events setting	PC setting	1-1000 or continuous (0) 1 event step
		main unit setting	1, 3, 5, 10, 30, 50, 100, or continuous(Cnt) 8 steps
INTERVAL CYCLES	CYCLE Setting	Synchronous	PC setting main unit setting
		Asynchronous	PC setting
	s Setting	Synchronous	PC setting
	m s Setting	Asynchronous	PC setting
DIP CYCLES (voltage interruptions, dip cycles)	CYCLE Setting	Synchronous	PC setting main unit setting
		Asynchronous	PC setting
	m s Setting	Synchronous	PC setting
	s Setting	Asynchronous	PC setting

Parameter			Specification
DIP PHASE (voltage interruptions, dip starting phase)	Phase Angle setting	Synchronous	PC setting
			main unit setting
	Time Setting	Synchronous	PC setting
			main unit setting
Voltage Variations Test	PC setting	Asynchronous	PC setting
Memory capacity			PC setting
			main unit setting
Input voltage from EUT			AC100~240V±10% 50/60Hz
Interface			Optical interface Optional optical converter RS-232 or USB selection
Operating temperature			15~35°C
Operating humidity			25~75%R.H. (no condensation)
External dimensions / Weight			(W)430×(H)745×(D)600mm (excluding protrusions) / approx.150kg
Power consumption			120VA (AC100~240V 50/60Hz)

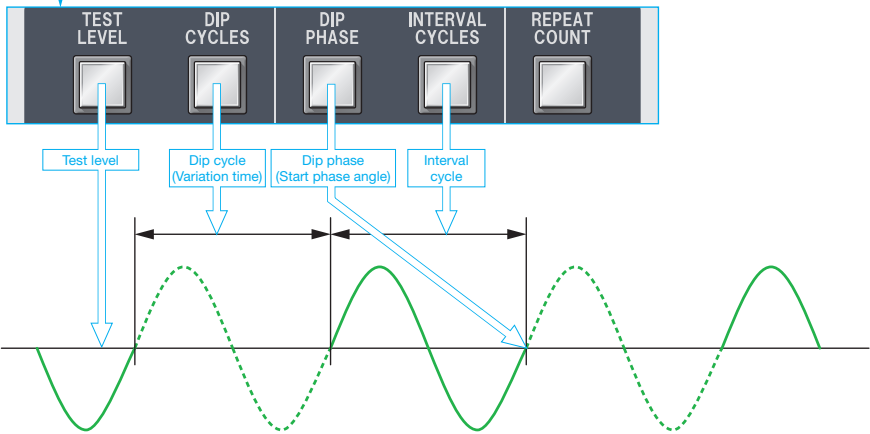
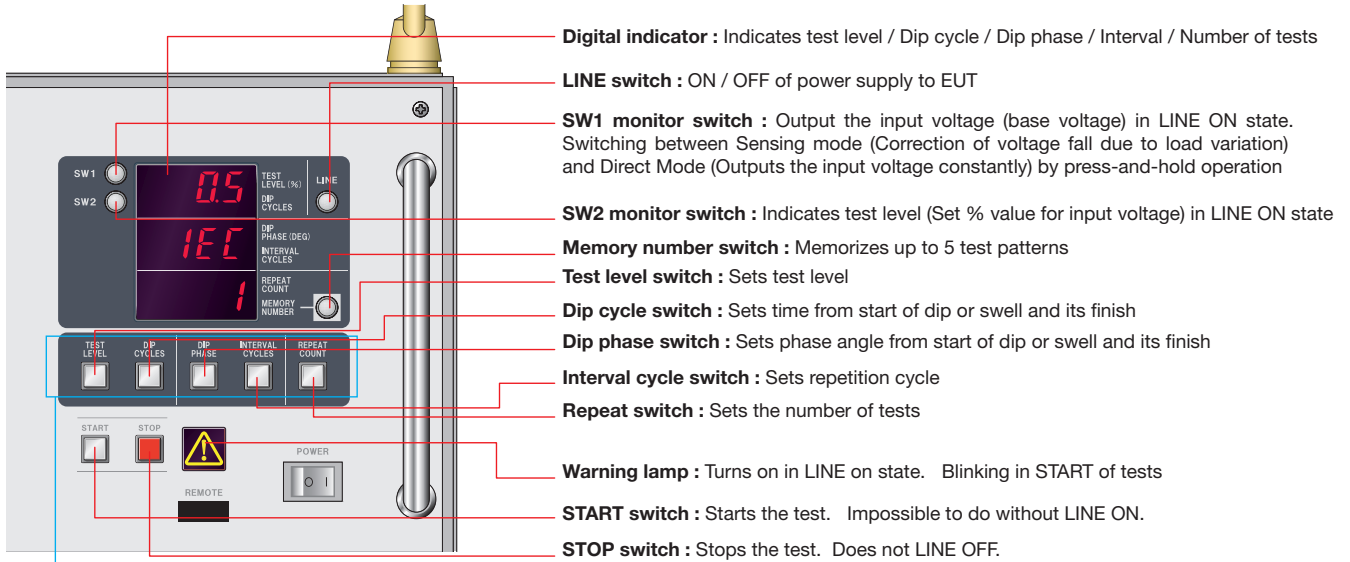
※ 1 : percent against input voltage

※ 2 : not compliant to IEC 61000-4-11(1994) and IEC 61000-4-11 Ed2 (2004) , ed.3 (2020) Standards when voltage output is >100%

※ 3 : The input voltage must be free of distortion and voltage variations.

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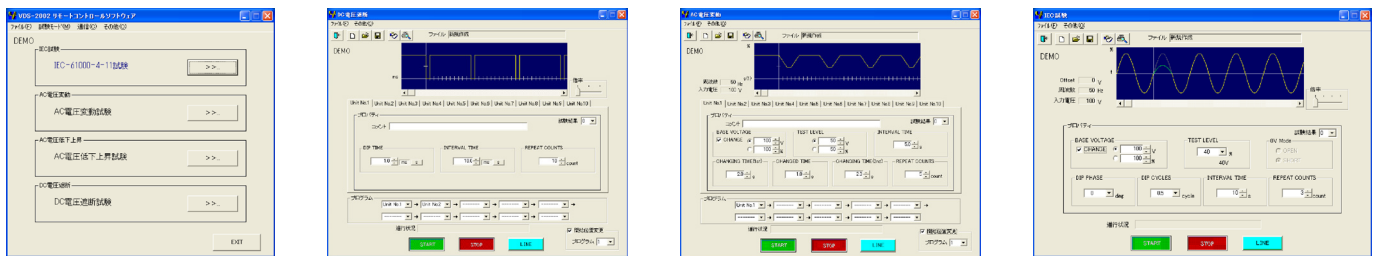
Front Panel



Options

Software (VDS-2002-PC) MODEL : 14-00036A

Allows standardized test settings and user-defined test settings. In addition to the IEC test level, there are various setting items such as dip-up cycle, repetition cycle, interval cycle, etc., which greatly supports voltage fluctuation testing.



USB Optical Module Kit MODEL : 07-00022A



Connection adaptor used for PC remote control of the simulator. USB optical conversion, equipped with 5m optical fiber cable

IEC61000-4-11 Ed.3 Test Standard Overview

1. General

Immunity test standard for electrical / electronic equipment which are connected to low voltage power supplies networks whether they are malfunctioned or resistible against voltage dips, short interruptions or voltage variations.

Power capacity of equipment under the test (EUT) shall be 16A per phase. This standard applies to equipment connected to 50/60 Hz AC supply network and does not apply to equipment operating on 400Hz AC.

2. Test Level

- The voltages in this standard use the rated voltage for the equipment (UT) as a basis for voltage test level specification.
- if the voltage range does not exceed 20 % of the lower voltage specified for the rated voltage range, a single voltage within that range may be specified as a basis for the test level specification (U_T).

1. Voltage dips and short interruptions

Table 1 – Preferred test level and durations for voltage dips

Class ^a	test level and durations for voltage dips (ts) (50 Hz / 60 Hz)				
Class 1	Case-by-case according to the equipment requirements				
Class 2	0% during 1 / 2 cycle	0% during 1 cycle	70% during 25 / 30 ^c cycles		
Class 3	0% during 1 / 2 cycle	0% during 1 cycle	40% during 10 / 12 ^c cycle	70% during 25 / 30 ^c cycle	80% during 250 / 300 ^c cycle
Class X ^b	Special	Special	Special	Special	Special

a. Classes as per IEC 61000-2-4 ; see Annex B

b. Class x can be any level determined by consent between the EUT manufacturer and the simulator supplier

c. "25 / 30 cycle" means "25 cycles for 50 Hz test" and "30 cycles for 60 Hz test"

* Each dip% shall be voltages against the rated voltages

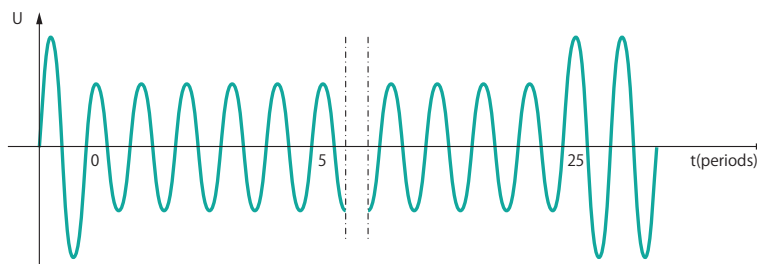
Table 2 – Preferred test level and durations for short interruptions

Class	Test level and durations for short interruptions (ts) (50 Hz / 60 Hz)
Class 1	Case-by-case according to the equipment requirements
Class 2	0% during 250 / 300* cycle
Class 3	0% during 250 / 300* cycle
Class X	Special

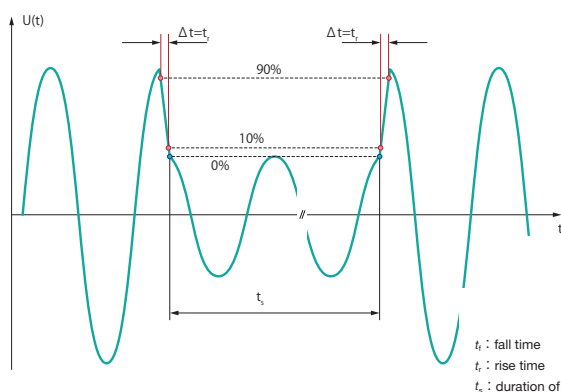
a. Classes as per IEC61000-2-4 ; see Annex B

b. Class x can be any level determined by consent between the EUT manufacturer and the user

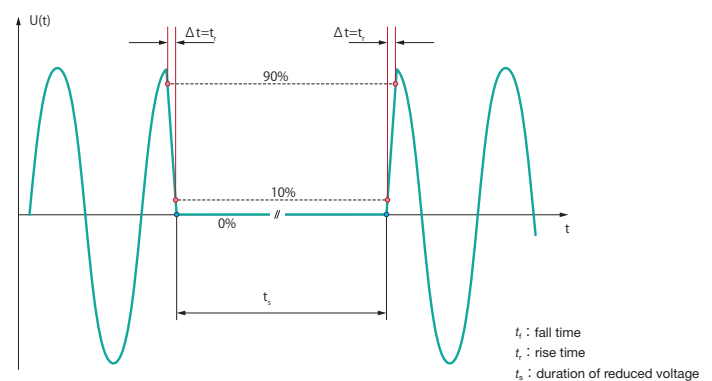
c. "250/300 cycle" means "250 cycles for 50 Hz test" and "300 cycles for 60Hz test"



Voltage dip - Example: 70% voltage dip sine wave graph



Voltage dip - Example: 40% voltage dip sine wave graph at 90°



Short interruption

IEC61000-4-11 Ed.3 Test Standard Overview

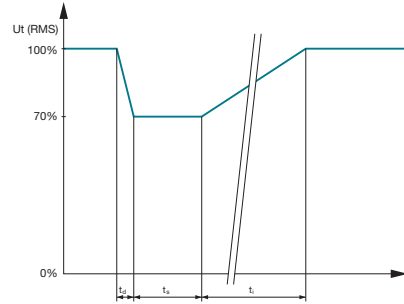
2. Voltage variations (Optional)

Table 3 – Timing of short-term voltage variations

Voltage test level	Time for decreasing voltage (td)	Time at reduced voltage (ts)	Time for increasing voltage (ti)
70%	Abrupt	1 cycle	25/30 cycles
X	Special	Special	Special

* Class X can be any level determined by consent between the EUT manufacturer and the simulator supplier

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

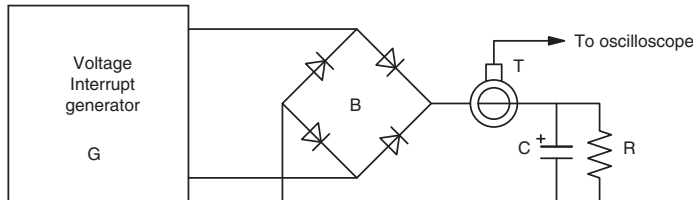


t_d : Time for decreasing voltage
 t_s : time at reduced voltage
 t_i : time for increasing voltage

3. Characteristics and performance of the generator

Output voltage at no load	As required in Table 1, $\pm 5\%$ of residual voltage value
Voltage change with load at the output of the generator	
100% output, 0 A to 16 A	Less than 5% of U_T
80% output, 0 A to 20 A	Less than 5% of U_T
70% output, 0 A to 23 A	Less than 5% of U_T
40% output, 0 A to 40 A	Less than 5% of U_T
Output current capability	16A r.m.s per phase at rated voltage. The generator shall be capable of carrying 20A at 80% of rated value for a duration of 5s. It shall be capable for carrying 23A at 70% of rated voltage and 40A at 40% rated voltage for a duration of 3s. (This requirement may be reduced according to the EUT rated steady-state supply current. See Clause A. 3).
Peak inrush current capability (no requirement for voltage variation tests)	Not to be limited by the generator. However, the maximum peak capability of the generator need not exceed 1000 A for 250 V to 600 V mains, 500 A for 200 V to 240 V mains, or 250 A for 100 V to 120 V mains.
Instantaneous peak overshoot / undershoot of the actual voltage, generator loaded with 100 Ω resistive load	Less than 5% of U_T
Voltage rise (and fall) time t_r (and t_f) see Figures 1b) and 2, during abrupt change, generator loaded with 100 Ω resistive load	Between 1 μ s and 5 μ s
Phase shifting (if necessary)	0° to 360°
Phase relationship of voltage dips and interruptions with the power frequency	Less than $\pm 10^\circ$
Zero crossing control of the generators	$\pm 10^\circ$

■ EUT Peak Inrush Current requirement



Circuit for determining the inrush current drive capability of the short interruptions generator

Components

- G voltage interrupt generator, switched on at 90° and 270°
- T current probe, with monitoring output to oscilloscope
- B rectifier bridge
- R bleeder resistor, not over 10000 Ω or less than 100 Ω
- C 1700 μ F $\pm 20\%$ electrolytic capacitor

In order to be able to use a low-inrush drive current capability generator to test a particular EUT, that EUT’s measured inrush current shall be less than 70% of the measured inrush current drive capability of the generator.

IEC61000-4-11 Ed.3 Test Standard Overview

4. Test Setup

The test shall be performed with the EUT connected to the test generator with the shortest power supply cable as specified by the EUT manufacturer. If no cable length is specified, it shall be the shortest possible length suitable to the application of the EUT.

5. Test Procedure

■ Execution of the test

- The EUT shall be tested for each selected combination of test level and duration with a sequence of three dips / interruptions with intervals of 10s minimum (between each test event).
- Each representative mode of operation shall be tested.
- For voltage dips, changes in supply voltage shall occur at zero crossings of the voltage, and at additional angles considered critical by product committees or individual product specifications preferably selected from 45°, 90°, 135°, 180°, 225°, 270° and 315° on each phase. For short interruptions, the angle shall be defined by the product committee as the worst case. In the absence of definition, it is recommended to use 0° for one of the phases.
- For voltage variations (Optional), the EUT is tested to each of the specified voltage variations, three times at 10s interval for the most representative modes of operations.

■ Climatic and Electromagnetic Conditions

Ambient temperature	15°C ~ 35°C
Relative humidity	25% ~ 75%
Atmospherical pressure	86 kPa ~ 106 kPa (860 hPa (mbr) ~ 1060 hPa (mbr))
Electromagnetic environment	Level which does not affect the test result

6. Evaluation of Test Results and Test Report

The test results shall be classified in terms of the loss of function or degradation of performance of the equipment under test, relative to a performance level defined by its manufacturer or the requestor of the test, or agreed between the manufacturer and the purchaser of the product. The recommended classification is as follows:

- 1) Normal performance within limits specified by the manufacturer, requestor or purchaser;
- 2) Temporary loss of function or degradation of performance which ceases after the disturbance ceases, and from which the equipment under test recovers its normal performance, without operator intervention;
- 3) Temporary loss of function or degradation of performance, the correction of which requires operator intervention;
- 4) Loss of function or degradation of performance which is not recoverable, owing to damage to hardware or software, or loss of data.

Generally, as far as the EUT can be immune to the surges which is injected in the all specified period and it satisfy the functional requirements according to the product specification, the test result can be judged as “Good”.

The test report shall contain the test conditions and the result.

Notes: This test set-up is quoted from IEC61000-4-11 Ed.3.0 (2020) Standard.
Please refer to the Standard if more details are required.