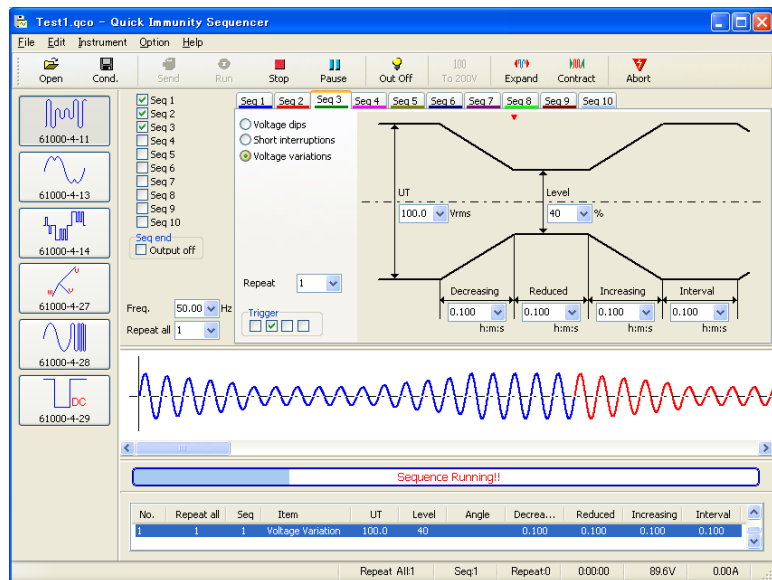# USER'S MANUAL

PCR-LA Series
Application Software
SD003-PCR-LA

Quick Immunity Sequencer

Ver. 1.0

KIKUSUI

Use of This Manual

Please read through and understand this User's Manual before operating the product. After reading, always keep the manual nearby so that you may refer to it as needed. When moving the product to another location, be sure to bring the manual as well.

If you find any incorrectly arranged or missing pages in this manual, they will be replaced. If the manual it gets lost or soiled, a new copy can be provided for a fee. In either case, please contact Kikusui distributor/agent, and provide the "Kikusui Part No." given on the cover.

This manual has been prepared with the utmost care; however, if you have any questions, or note any errors or omissions, please contact Kikusui distributor/agent.

Contents

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⚠ **Safety Precautions**

Before performing an immunity test using this application software, carefully read the operation manuals for the following products and the specific hardware descriptions found therein to avoid improper connections or incorrect handling. Incorrect connection or handling of any equipment/device in the following configuration may result in serious accidents involving EUT damage or fire.

AC Power Supply PCR-LA Series

AC Power Supply PCR-L Series (Conventional)

GPIB interfaces IB03-PCR-LA and IB11-PCR-L

Three-phase drivers 3P03-PCR-LA and 3P02-PCR-L

Immunity tester IT01-PCR-L

Definition of Symbols

⚠ CAUTION **Indicates the possibility of damage to the test system or DUT, if you neglect the CAUTION statement and perform improper operation. Make sure to follow the operating procedure.**

Arrangement of this manual

This Manual is made up of the following sections.

Preface

Provides an outline of the product and the required operating conditions.

Chapter 1   Setup

Describes how to install the Quick Immunity Sequencer application software.

Chapter 2   Overall Picture of Test Sequences

Describes how to launch Quick Immunity Sequencer and provides an overall picture of test sequences.

Chapter 3   IEC 61000-4-11

Describes Voltage dip, Short interruption, and Voltage variation immunity tests according to the IEC 61000-4-11 standard.

Chapter 4   IEC 61000-4-13

Describes Harmonics and interharmonics immunity tests according to the IEC 61000-4-13 standard.

Chapter 5   IEC 61000-4-14

Describes the Voltage fluctuation immunity test according to the IEC 61000-4-14 standard.

Chapter 6   IEC 61000-4-27

Describes the Unbalance immunity test according to the IEC 61000-4-27 standard.

Chapter 7   IEC 61000-4-28

Describes the Power frequency variation immunity test according to the IEC 61000-4-28 standard.

Chapter 8   IEC 61000-4-29

Describes Voltage dip, Short interruption, and Voltage variation immunity tests for DC power inputs according to the IEC 61000-4-29 standard.

Appendix

Guides users to the appropriate standard depending on the nature of the testing desired.

Preface

P.1   About This Manual

This Manual describes the Quick Immunity Sequencer application software for the AC Power Supply PCR-LA Series.

For information on the PCR-LA series hardware, please refer to the AC Power Supply PCR-LA Series Operation Manual.

Using the product with the conventional PCR-L series

Quick Immunity Sequencer can also be used for the conventional AC Power Supply PCR-L Series. In this case, read "PCR-LA" as "PCR-L." For information on the PCR-L series hardware, please refer to the AC Power Supply PCR-L Series Operation Manual.

Versions of the AC power supplies for which this manual is valid

PCR-LA series	Ver. 3.10 or later
PCR-L series	Ver. 2.04 or later

P.2   Product Outline

The Quick Immunity Sequencer application software for the AC Power Supply PCR-LA Series allows you to simulate various phenomena in the AC power supply environment. It can be used to perform immunity tests for electric or electronic equipment connected to low-voltage power distribution systems under the conditions stipulated in the following standards. Since test conditions may be set to exceed the ranges specified by the standard, the product can be used in preliminary tests conducted before actual testing for the standard, immunity allowance tests, and stress tests.

- IEC61000-4-11 (2001-03) Edition1.1: Voltage dips, Short interruptions, and Voltage variations
- IEC61000-4-13 (2002-03) 1st.Edition:Harmonics and Interharmonics
- IEC61000-4-14 (2002-07) Edition1.1: Voltage fluctuation
- IEC61000-4-27 (2000-08) 1st.Edition:Unbalance
- IEC61000-4-28 (2002-07) Edition1.1: Power frequency variations
- IEC61000-4-29 (2000-08) 1st.Edition:Voltage dips, Short interruptions, and Voltage variations for DC power inputs
- *   The following discussions give only the standard number. The issue date and standard version are omitted.

The equipment and devices to which each standard is applied are those whose rated current per phase is 16 A or less, with the exception of IEC 61000-4-29. Note that Quick Immunity Sequencer was not designed with above maximum current limitation in mind. Thus the product is used at the user's discretion.

Parts of Quick Immunity Sequencer do not conform to certain standards. For more information, please refer to ■ Items not conforming to the standard's requirements in each chapter.

P.3 Required Operating Conditions

Quick Immunity Sequencer requires the following PC environments:

OS version

Windows 98 SE, Windows Me, Windows 2000, or Windows XP

VISA driver supporting the VISA COM software

One of the following is required:

- KI-VISA 2.2.x or later (latest version may be downloaded from the Kikusui website.)
- NI-VISA 2.6 or later
- Agilent VISA 2.x (separate Agilent VISA COM setup is required.)

ActiveX instrument driver

pcrldrv Ver. 2.91 or later (latest version may be downloaded from the Kikusui website.)

I/O interface

One of the following is required:

- RS-232C
- GPIB (National Instruments, Agilent Technologies, CONTEC, or Interface)

| NOTE | • Please disable any PC system features such as Advanced Power Management (APM) or Suspend modes. Interrupts known as SMIs that are periodically issued to the CPU in these modes will prevent normal operation of the product. |

Personal computer

CPU	Pentium 233 MHz or better
OS	Windows 98 SE, Windows Me, Windows 2000, or Windows XP
Memory	Minimum of 128 MB
HDD	Free space of at least 100 MB is recommended for installation, and additional free space of 10 GB or more for data.
CD-ROM drive	Required for product installation
Mouse	Required
Display	1024 x 768 or larger
Color	16-bit High Color or better

P.4   Required Hardware

AC power supplies

PCR-LA and PCR-L series of the following versions:

PCR-LA series	Ver. 3.10 or later
PCR-L series	Ver. 2.04 or later

IT01-PCR-L immunity tester

The IT01-PCR-L immunity tester is recommended for IEC 61000-4-11 (Voltage dips, Short interruptions, and Voltage variations) (in single phase).

The IT01-PCR-L immunity tester enables the following:
*   The standard's performance specifications relating to voltage rise and fall time of a test voltage generator (1 µs to 5 µs) are met. The performance achieved without the IT01-PCR-L is approximately 30 µs.
*   The standard's performance specifications relating to the starting phase angle of Voltage dips or Short interruptions (setting accuracy within ±10°) are met. Without the IT01-PCR-L, the standard's performance specifications will be met at an angle of multiples of 18, such as 90°, 180°, etc., for 50 Hz. The setting accuracy at other phase angles is ±18° at 50 Hz or ±21.6° at 60 Hz.

GPIB

For the GPIB interface, the IB03-PCR-LA (GPIB interface) is required for AC Power Supply PCR-LA Series or the IB11-PCR-L (GPIB interface) for AC Power Supply PCR-L Series.

Three-phase operations

In three-phase operations, the 3P03-PCR-LA (three-phase driver) is required for AC Power Supply PCR-LA Series or the 3P02-PCR-L (three-phase driver) for AC Power Supply PCR-L Series.

1

Chapter 1   Setup

Describes how to install the Quick Immunity Sequencer application software.

1.1 Package Contents

The Quick Immunity Sequencer package contains the following:

Item name	Quantity
Program CD-ROM	1
User's Manual (this manual: Z1-003-152)	1

1.2 Installation

1.2.1 Preparing for Installation

The ActiveX instrument driver specially designed for the PCR-LA series requires a VISA driver. You must first install a VISA driver.

The VISA driver required depends on the I/O interface. Refer to Table 1-1 below to choose the necessary VISA driver.

NOTE
• Use of the wrong VISA driver with the GPIB interface may disable the GPIB interface. Installing multiple VISA drivers may prevent any of the VISA drivers from operating properly.

VISA

VISA (Virtual Instrument Software Architecture) is a standard specification for instrument-connecting software established by the VXIplug&play Systems Alliance.

VISA driver

Driver software implemented in accordance with VISA specifications

KI-VISA

VISA driver originally developed by Kikusui Electronics in compliance with VXIplug&play VISA specification 2.2

Table 1-1   Required VISA Drivers and How to Obtain Them

I/O interface	VISA driver required	How to Obtain
RS-232C[*1],[*2]	KI-VISA Ver. 2.2.x or later	Program CD-ROM or KIKUSUI website
Interface GPIB[*3]		
CONTEC GPIB[*3]		

(Continues on the next page.)

National Instruments GPIB[*4]	NI-VISA Ver. 2.6 or later	CD-ROM supplied with GPIB or National Instruments website
Agilent GPIB	Agilent IO Libraries K01.00 or later	CD-ROM supplied with GPIB or Agilent Technologies website

*1. For use with the RS-232C interface, there is no need to install KI-VISA if a VISA driver from another manufacturer is already installed.

*2. The RS-232C interface supports a standard PC communications port provided and virtual serial communications port via USB-RS-232C converters. However, for virtual communications port provided by a converter or similar configuration, the VISA driver may not run properly, depending on the specific device driver provided.

*3. KI-VISA supports the following GPIB models:
CONTEC: GP-IB(PCI)L, GP-IB(PM), GP-IB(PCI)F, and GP-IB(CB)F (API-GPIB driver Ver. 4.01 or later recommended)
Interface: PCI-4301 (LabVIEW-compliant GPC-4301N driver Ver. 1.21 or later recommended)
When using a CONTEC GPIB board, install an ordinary API-GPIB driver rather than API-GPLV driver (LabVIEW-compliant, NI-488.2M API-compatible). When using an Interface GPIB board, install GPC-4301N (LabVIEW-compliant, NI-488.2M API-compatible) instead of an ordinary GPC-4301 driver.

*4. We recommend that users holding a National Instruments license use NI-VISA.

1.2.2   Installing the KI-VISA Driver

1.   Load the Quick Immunity Sequencer setup CD into the CD-ROM drive.
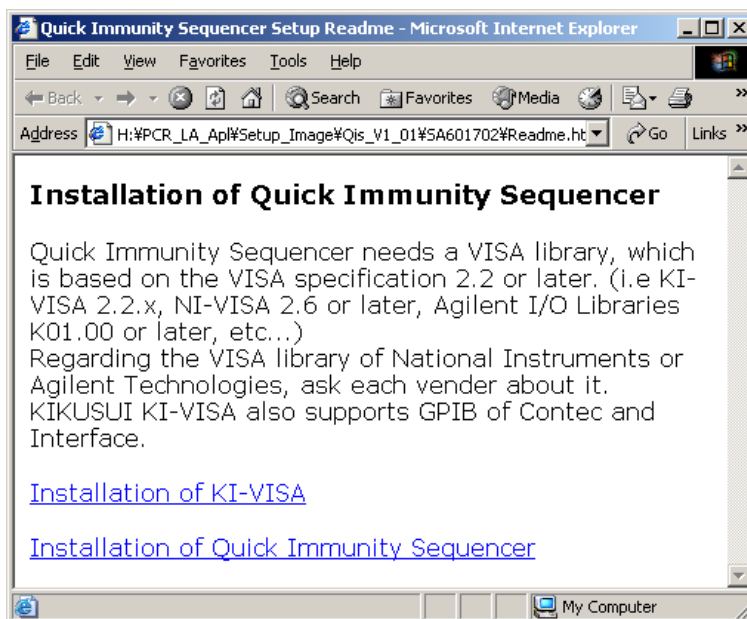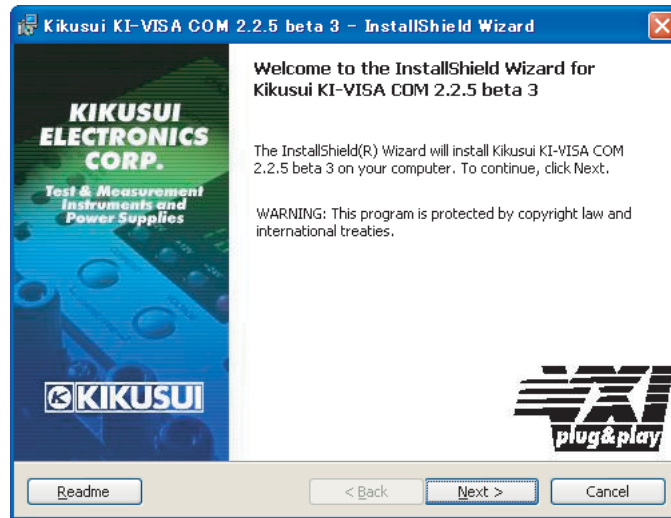The following Setup window is displayed.

Fig. 1-1   Setup Start Window

2. Click on Installation of KI-VISA.

The KI-VISA Installation window is displayed.

3. Follow the prompts displayed in the window.
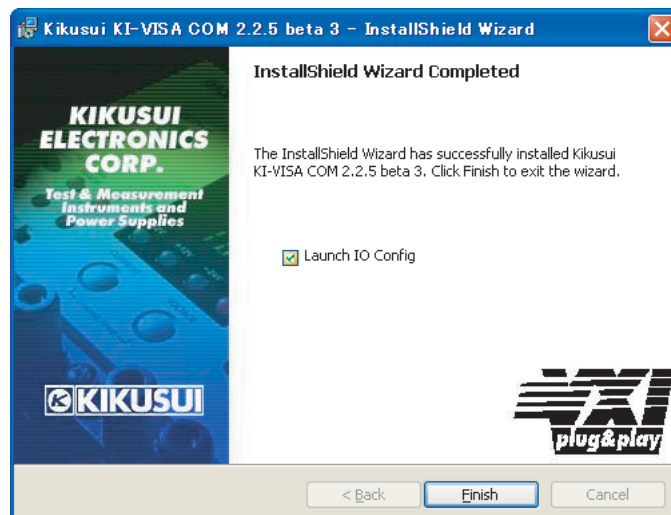
4. Check the Launch IO Config checkbox.

5. Click the Finish button.

This completes installation of the KI-VISA driver. KI-VISA Setup window then launches.

■ When using the RS-232C Interface

6. Click on the ASRL tab.

KI-VISA I/O Config

USBTMC | ASRL | GPIB (CONTEC) | GPIB (NI-488.2M)

☑ Use ASRL (Serial) instruments
☑ Enable dynamic search for available serial ports

☑ Enable Multiple Session
This option enables multiple sessions for the same ASRL resource to be opened from different processes. Using this option makes I/O operations bit slower. Mind that multiple open is always possible from the same process even if this option is unchecked.

Enable VISA C API...   OK   Cancel

7. Check the Use ASRL (Serial) instruments checkbox.

8. Click the Enable VISA C API ... button.

9. Follow the prompts displayed in the window.
The KI-VISA Setup window shown in step 6 is displayed once again.

10. Click the OK button. This completes the setup process.

■ When using a CONTEC GPIB

6. Click on the GPIB (CONTEC) tab.

KI-VISA COM I/O Config

USBTMC | ASRL | GPIB (CONTEC) | GPIB (NI-488.2M)

☐ Use GPIB instruments (CONTEC API-GPIB ver4.01+ required)
GPIB Board
Index   GPIB0
Model
☐ Use this board

KI-VISA does not automatically search for I/O Resources on CONTEC GPIB when FindRsrc() method is invoked. You must configure the resources by clicking [Auto Search] or [Add] button.

Auto Search...   Add...   Remove

Enable VISA C API...   OK   Cancel
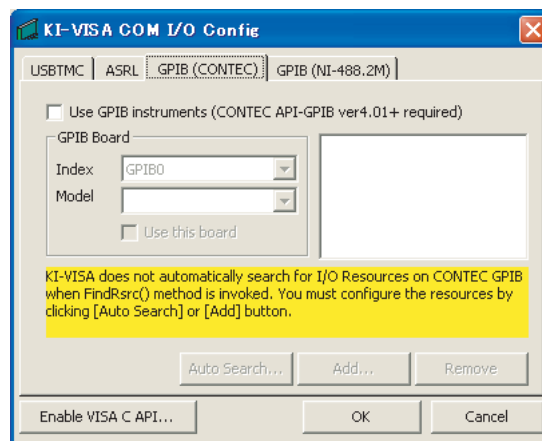
7. Check the Use GPIB instruments (CONTEC API-GPIB Ver. 4.01 + required) checkbox.

8. Enter (for example) "GPIB0" in the Index box and "GP-IB(PCI)F" in the Model box. Check the Use this board checkbox.

9. Click the Enable VISA C API ... button.

10. Follow the prompts displayed in the window.
The KI-VISA Setup window shown in step 6 is displayed once again.

11. Click the OK button. This completes the setup process.

■ When using an Interface GPIB

6. Click on the GPIB (NI-488.2M) tab.
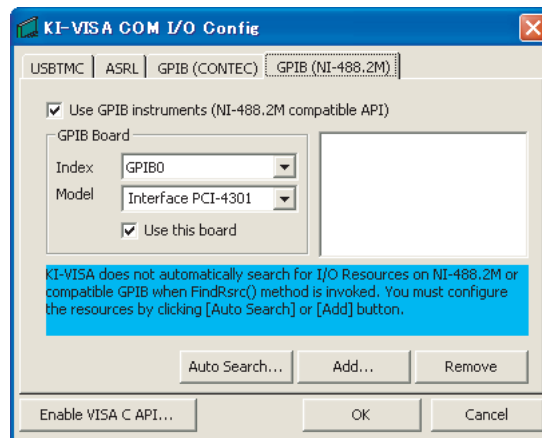
7. Check the Use GPIB instruments (NI-488.2M compatible API) checkbox.

8. Enter (for example) "GPIB0" in the Index box and "Interface PCI-4301" in the Model box. Check the Use this board checkbox.

9. Click the Enable VISA C API ... button.

10. Follow the prompts displayed in the window.

    The KI-VISA Setup window shown in step 6 is displayed once again.

11. Click the OK button. This completes the setup process.

1.2.3 Installing Quick Immunity Sequencer

1. Click on Installation of Quick Immunity Sequencer in the Setup Start Window in Fig. 1-1 (on page 1-3).

   This launches the Installation window. The installer program installs Quick Immunity Sequencer and the ActiveX driver for the PCR-LA series.
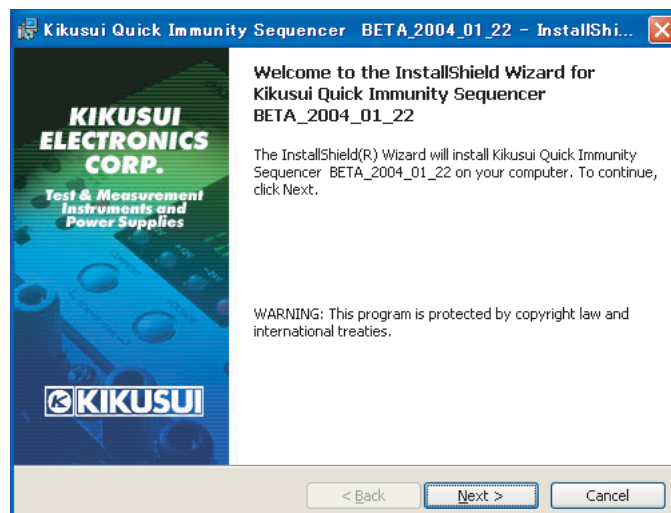
2. Follow the prompts displayed in the window.

Shortcut

Kikusui Quick
Immunity Se...
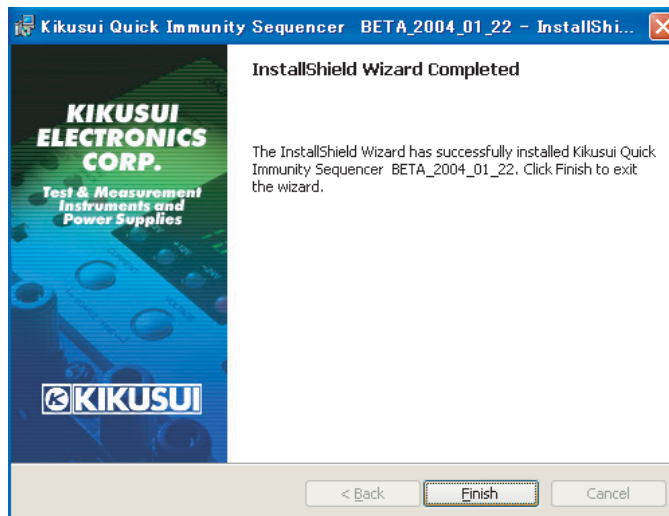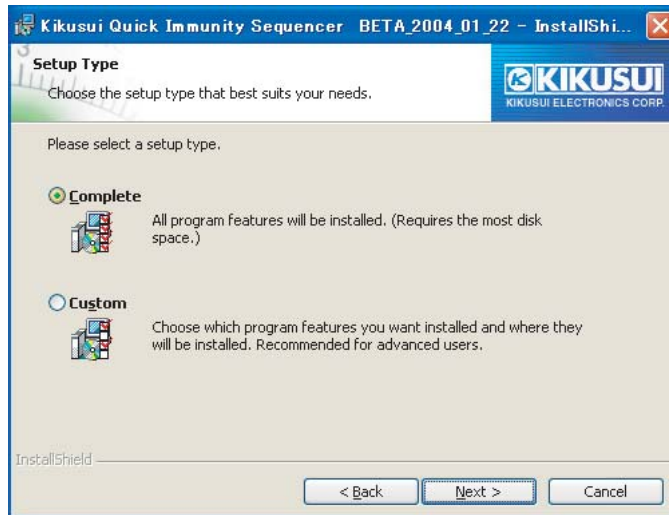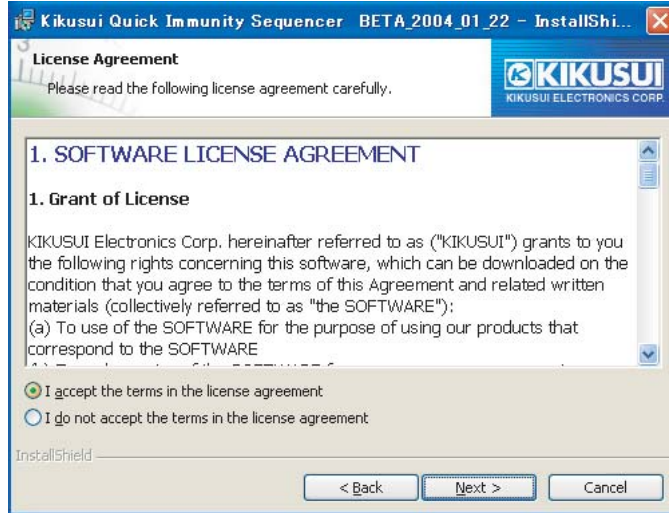
3. Click the Finish button. This completes installation of Quick Immunity Sequencer.

   When installation is complete, a Quick Immunity Sequencer shortcut is created on the desktop.

2

Chapter 2 Overall Picture of Test Sequences

Describes how to launch Quick Immunity Sequencer and provides an overall picture of test sequences.

2.1 Outline of Immunity Test

An immunity test generates a test signal using a voltage generator, applying it to the equipment under test (EUT). EUT operations are classified into the following four performance levels in terms of functional loss or performance degradation in order to assess the test results.

The classification criteria are the performance levels specified by the agreement between the equipment manufacturer and a test requester, or between the equipment manufacturer and a purchaser.

a) Normal performance within the specification limits specified between the manufacturer and a test requester or purchaser
b) Temporary functional loss or performance degradation resolved after interference has been removed. EUT automatically regains normal performance without operator intervention.
c) Temporary functional loss or performance degradation that requires adjustment with operator intervention
d) Unrecoverable functional loss, performance degradation, or data loss caused by hardware failure or software corruption

Quick Immunity Sequencer can be used for testing according to the standard. Since it allows test conditions to be extended and set, it can also be used for preliminary tests conducted before actual testing for the standard, immunity allowance tests, or stress tests.

■ Items not conforming to the standard's requirements

Certain Quick Immunity Sequencer items do not conform to the standard's requirements in the test configuration, including the hardware. For more information, please refer to the chapter relating to the standard in question.

■ Three-phase operations

The test conditions are all set in relation to phase U. Test signals change simultaneously in three phases on the basis of phase U. Note that for IEC 61000-4-27 (unbalance), although a test signal can be set on a phase basis, there is a time lag in the test signal between phases. For IEC 61000-4-29 (Voltage dips, Short interruptions, and Voltage variations for DC power inputs), there are no settings for the three phases.

NOTE
• The IT01-PCR-L immunity tester cannot be used in three-phase operations with Quick Immunity Sequencer.

2.2 Test Configuration

This section provides a brief discussion of single-phase and three-phase operations of AC Power Supply PCR-LA Series. For more information on connecting, please refer to the operation manuals for the following products.

⚠ **CAUTION** • Before performing an immunity test using this application software, carefully read the operation manuals for the following products and the specific hardware descriptions found therein to avoid improper connections or incorrect handling. Incorrect connection or handling of any equipment/device in the following configuration may result in serious accidents involving EUT damage or fire.

- AC Power Supply PCR-LA Series
- AC Power Supply PCR-L Series
- GPIB interfaces IB03-PCR-LA and IB11-PCR-L
- Three-phase drivers 3P03-PCR-LA and 3P02-PCR-L
- Immunity tester IT01-PCR-L

■ Single-phase operations 1
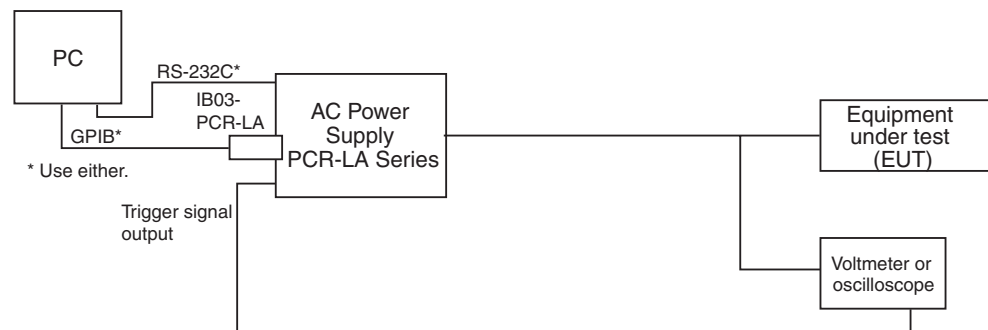
Fig. 2-1   Test Configuration for Single-phase Operations
(Example: Using AC Power Supply PCR-LA)

■ Single-phase operations 2
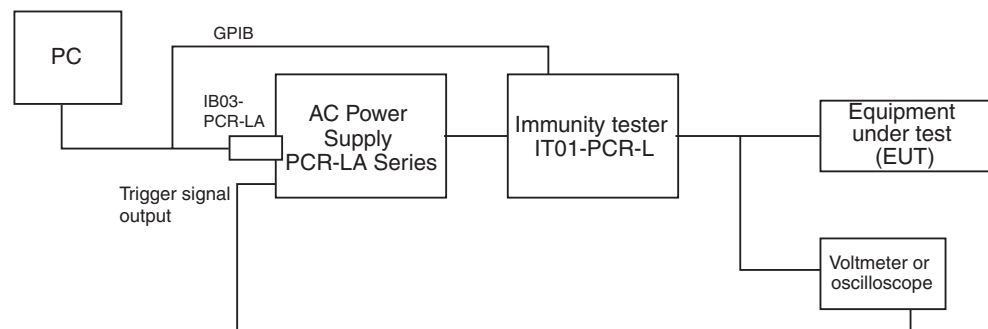
Fig. 2-2   Test Configuration for Single-phase Operations
(Example: Using AC Power Supply PCR-LA and IT01-PCR-L Immunity Tester)

⚠ CAUTION	• Before turning on/off the IT01-PCR-L immunity tester, always confirm that the AC Power Supply PCR-LA output is OFF to avoid damaging the equipment. For operating procedures, please refer to 2.8.1, Turning Power on/off in the Test Configuration.

■ Three-phase operations
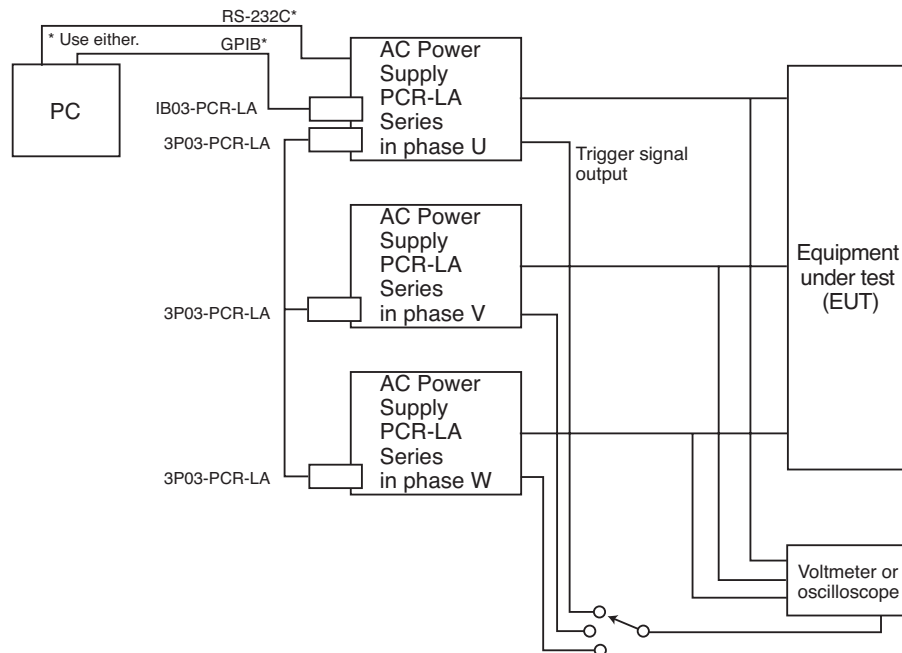
Fig. 2-3   Test Configuration for Three-phase Operations
(Example: Using AC Power Supply PCR-LAs)

NOTE	• The IT01-PCR-L immunity tester cannot be used in three-phase operations with Quick Immunity Sequencer.

2.3   Launching Quick Immunity Sequencer

To launch Quick Immunity Sequencer, double-click the Quick Immunity Sequencer shortcut on the desktop.

Shortcut

Kikusui Quick
Immunity Se...

Launching Quick Immunity Sequencer displays the window shown in Fig. 2-4 on page 2-10.

2.4   Setting up I/O Configuration

Set up the I/O configuration using I/O Configuration... from the Instrument Menu. For more information on this menu, please refer to 2.7.1, Menus.
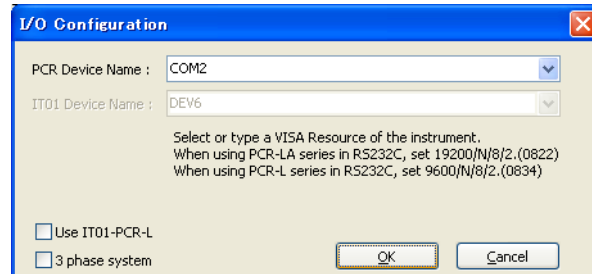
1. Select DEV1, COM1, COM2, etc., in the PCR Device Name: dropdown list box.

   "1" in DEV1 stands for a GPIB address. COM1 refers to COM communications port 1. Select COM1 or COM2 when using the RS-232C interface.

2. When using the RS-232C interface, the PCR-LA must be set as follows in advance:

Model	Baud rate	Parity	Data length	Stop bit	Panel display
PCR-LA	19200bps	None	8	2	0822
PCR-L	9600bps	None	8	2	0834

3. When using the IT01-PCR-L immunity tester, check the Use IT01-PCR-L checkbox.

   Select or enter "DEV×" into the IT01 Device Name: dropdown list box. The IT01-PCR-L immunity tester supports only the GPIB interface. If the IT01-PCR-L is also used, the AC Power Supply PCR-LA is controlled as well via the GPIB. The GPIB interface cannot be used with the RS-232C INTERFACE.

NOTE   ■ **Occurrence of a communication error**

- If the "As an interface error has occurred, Quick Immunity Sequencer is terminated. Turn off the power switch of the PCR-L(A)". message appears, the cable to the IT01-PCR-L may not be connected or the IT01-PCR-L's GPIB address (DEV×) may be incorrect. Make sure the GPIB cable is connected properly.

---

4. For three-phase operations, check the 3 phase system checkbox.

   If Use IT01-PCR-L checkbox is checked, uncheck it.

NOTE   • The IT01-PCR-L immunity tester cannot be used in three-phase operations with Quick Immunity Sequencer.

2.5 Troubleshooting at Startup

■ **It takes a long time to display the startup window.**

If the PCR-LA series device driver is used via the RS-232C interface, the timeout is set to 30 seconds. This is because it takes around 30 seconds to detect a communication error caused by an incorrect device name or communication cable connection, or other errors.

Note that the initial setting provided on installation of Quick Immunity Sequencer is the RS-232C interface.

If a communication error is detected when you launch Quick Immunity Sequencer, the I/O Configuration dialog box (please refer to 2.4, Setting up I/O Configuration) will appear. Check the driver settings.

■ **Error message: "This application cannot be launched because VISA32.DLL cannot be found. Reinstalling the application may solve this problem."**

This may indicate that no VISA driver is installed.

Install an appropriate VISA driver. For more information, please refer to 1.2, Installation.

This may indicate that use of KI-VISA as the VISA driver has not been set up.

To use the RS-232C interface, set the driver according to the procedure given in Measure 1 below. To use the GPIB interface, set according to the procedure given in Measure 2 below. For more information, please refer to 2.5.1, Setting up KI-VISA.

■ **Error message: "Runtime error XXX at XXXXXXXX"**

The PCR-LA series device driver may be installed incorrectly.

Re-install Quick Immunity Sequencer, or download and install the device driver for the PCR-LA series from the download page at http://www.kikusui.co.jp/.

■ **Error message: "Unable to open instrument in device DEV×"**

This may indicate that no GPIB driver has been installed, or that the GPIB driver has not been correctly set.

Check the GPIB driver setting.

■ **Error message: "Error write to instrument in device DEV×"**

The GPIB cable may be disconnected.

Check that the GPIB cable is properly connected.

The device name may be incorrect.

Check the device name on the dialog box shown in 2.4, Setting up I/O Configuration.

This may indicate that the IT01-PCR-L immunity tester has not been connected in a configuration in which the IT01-PCR-L is expected.

Uncheck the Use IT01-PCR-L checkbox in the dialog box shown in 2.4, Setting up I/O Configuration, or connect the IT01-PCR-L to the PCR-LA.

■ **Error message: "Different model access in device DEV×"**

The setting for single-phase or three-phase system for the connected PCR-LA may be incorrect.

Check the setting for the 3 phase system checkbox in the dialog box shown in 2.4, Setting up I/O Configuration.

■ **Error message: "As an interface error has occurred, Quick Immunity Sequencer is terminated. Turn off the power switch of the PCR-L(A)".**

This may indicate that the communication cable is disconnected.

Turn off the PCR-LA POWER switch.

Reconnect the communication cable, then re-start Quick Immunity Sequencer.

2.5.1　Setting up KI-VISA

■ **Measure 1: Using the RS-232C interface for KI-VISA**

1.　Click the Windows Start button, point to Program, Kikusui IO Software, and VISA, then click on IO Config.
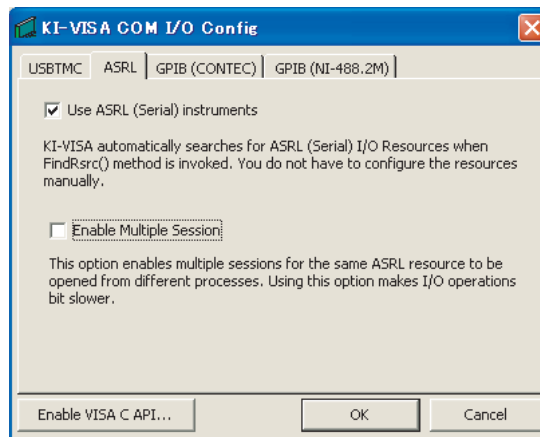
2.　Check the Use ASRL (Serial) instruments checkbox in the ASRL panel.

3.　Click the Enable VISA C API ... button.

4.　Follow the prompts displayed in the window.

The KI-VISA Setup window shown in step 2 is displayed once again.

5.　Click the OK button. This completes the setup process.

■ **Measure 2: Using the GPIB interface for KI-VISA**

When using National Instruments GPIB or Agilent GPIB, use the VISA driver from the respective manufacturers.

Users using the CONTEC or Interface GPIB should use the KI-VISA.

1. Click the Windows Start button, point to Program, Kikusui IO Software, and VISA, then click on IO Config.

■ **When using the CONTEC GPIB board**

2. Click on the GPIB (CONTEC) tab.
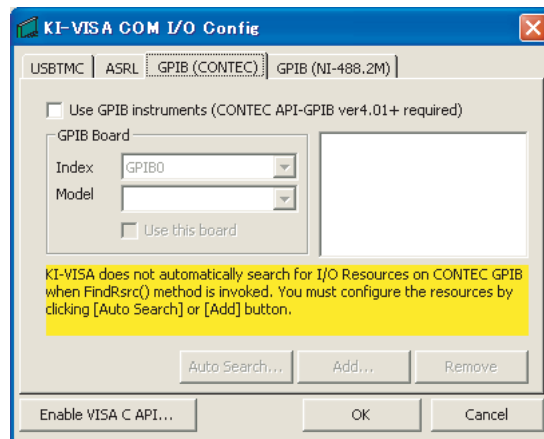
3. Check the Use GPIB instruments (CONTEC API-GPIB Ver. 4.01 + required) checkbox.

4. Enter (for example) "GPIB0" in the Index box and "GP-IB(PCI)F" in the Model box. Check the Use this board checkbox.

5. Ensure to click the Enable VISA C API ... button.

6. Follow the prompts displayed in the window.

The KI-VISA Setup window shown in step 2 is displayed once again.

7. Click the OK button. This completes the setup process.

■ When using the Interface GPIB board

2. Click on the GPIB (NI-488.2M) tab.
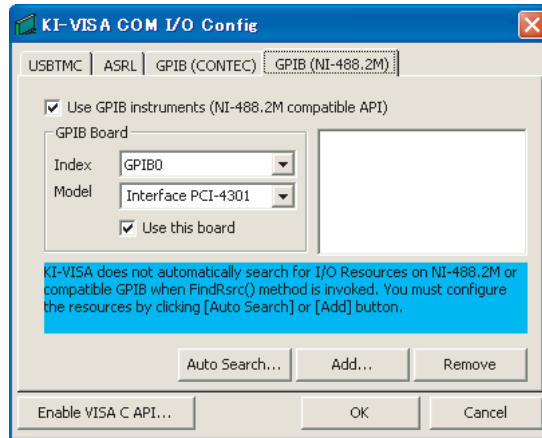
3. Check the Use GPIB instruments (NI-488.2M compatible API) checkbox.

4. Enter (for example) "GPIB0" in the Index box and "Interface PCI-4301" in the Model box. Check the Use this board checkbox.

5. Ensure to click the Enable VISA C API ... button.

6. Follow the prompts displayed in the window.

   The KI-VISA Setup window shown in step 2 is displayed once again.

7. Click the OK button. This completes the setup process.

2.6   Overall Picture of Test Sequences
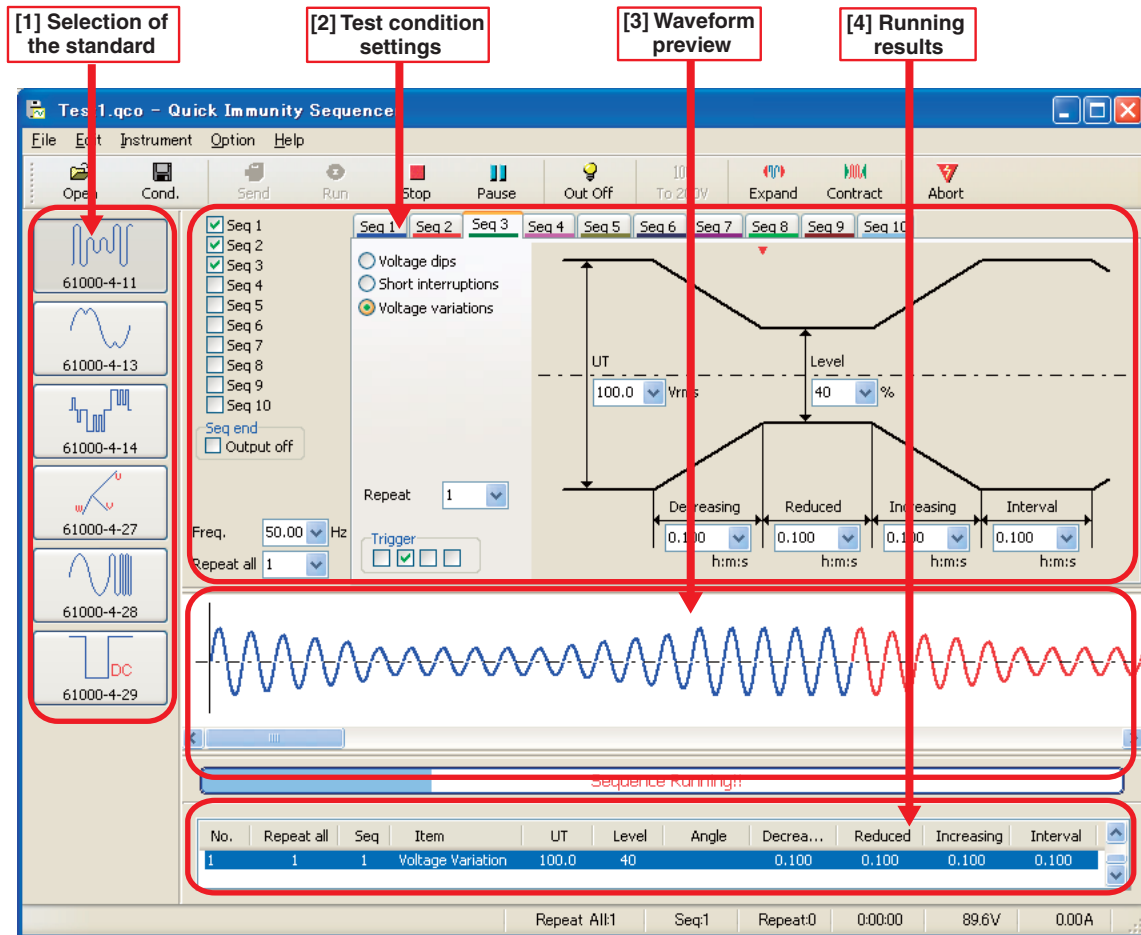
Fig. 2-4   Window Outline (Example of IEC 61000-4-11)

■ Window Outline

[1]   Selection of the standard

Select one of the following six standards:
- IEC61000-4-11: Voltage dips, Short interruptions, and Voltage variations
- IEC61000-4-13: Harmonics and Interharmonics
- IEC61000-4-14: Voltage fluctuation
- IEC61000-4-27: Unbalance
- IEC61000-4-28: Power frequency variations
- IEC61000-4-29: Voltage dips, Short interruptions, and Voltage variations for DC power inputs

[2]   Test condition settings

This part consists of the seq tabs (Seq 1 to Seq 10), checkboxes, and edit boxes.

Seq tabs (Seq 1 to Seq 10)

Each of the seq tabs (Seq 1 to Seq 10) allows you to set test conditions corresponding to the standards. The color of each tab corresponds to the color of the waveform displayed in the waveform preview. To change colors, use Color... in the Option Menu.

Edit boxes

The edit boxes used to enter a value are of the dropdown type. Click the down arrow head control of an edit box to select a typical value. To enter a value, type the desired value directly into the box (then accept the typed value by pressing the Enter key).

Edit boxes not in the panel area of a seq tab (Seq 1 to Seq 10) are common to all seq tabs. They are used to set voltage, frequency, or repetition count for all sequences. The voltage or frequency edit box is displayed depending on the specific standard in question.

Checkboxes (Seq 1 to Seq 10)

Check the corresponding checkboxes of the seq tabs whose test conditions are used to run a test sequence. Test sequences are run in turn starting at Seq 1. seq tabs whose corresponding checkboxes have not been checked are not used to run a test.

Checkboxes (Trigger)

For trigger output selection, the red symbol ▼ indicates at a location selected using a checkbox. Use these checkboxes when observing test signals on an oscilloscope. For more information on trigger signals, please refer to 2.9, Observing a Test Signal.

Checkbox (Seq end-Output off)

When this checkbox is checked, a test signal is turned off at the end of sequence running. (the AC Power Supply PCR-LA output is turned off.)

[3] Waveform preview

This part displays the waveform selected using seq tabs (Seq 1 to Seq 10). For voltage, this shows relative values, with the initial value set to "1." The Expand and Contract buttons on the toolbar allow the waveform to be horizontally expanded or contracted in ten steps. Note that there may be one period of a deviation from the actual output. The color of the waveform corresponds to the color of the seq tab set. Use Color... in the Option Menu to change colors for a seq tab.

[4] Running results

Progress bar

Displays the status of a test sequence run in bar graph form. To change colors, use Color... in the Option Menu.

List of the running results

Displays the set values for the seq tab whose sequence has been run. The specific items indicated depend on the standard in question. Please refer to the corresponding chapter.

2.7   Menus and Toolbar

2.7.1   Menus

File Menu

■ New

Sets the default values and creates a new test condition file under an untitled file name.

■ Open...

Opens the dialog box used to select a test condition file. This menu item has the same function as the Open button on the toolbar. The extension for a test condition filename is "qco."

■ Save (Test Conditions)

Saves the test condition settings under the same name as the currently open test condition file, replacing the earlier version. This menu item is used to save all the settings related to the standard.

■ Save As (Test Conditions)...

Lets you assign a desired name to a test condition file and save it in any folder. This menu item is used to save all the settings related to the standard.

■ Save As (Test Result)...

Allows you to assign a name to a running result file and save it to a selected folder.

■ Exit

Exits the Quick Immunity Sequencer.

Edit Menu

■ Seq tab Copy

Copies all the items of a selected seq tab into memory. This function is slightly similar to copying to the clipboard.

■ Seq tab Paste

Copies the contents of the memory copied using Seq tab Copy to a selected seq tab.

■ Copy to next Seq tab

This function is a combination of Seq tab Copy and Seq tab Paste. It copies all items of the selected seq tab to memory and pastes them to the next tab.

■ Default data for Class1,2,3,X

Each of classes 1 to 3 and X has submenus for test levels 1 to 6. Inapplicable classes and test levels are grayed out and cannot be selected. Clicking a test level makes it possible to detect the selected standard buttons and option buttons and to set default values conforming to these buttons.

Instrument Menu

■ Send

Sends the set test conditions to the PCR-LA. When transmission is completed, the Run button is enabled. This menu item has the same function as the Send button on the toolbar.

■ Run

Starts the test. This menu item has the same function as the Run button on the toolbar.

■ Stop

Stops the test. Note that output remains enabled. This menu item has the same function as the Stop button on the toolbar.

■ Pause

Entering step toward pause. A test is paused immediately before moving to the next seq tab. Until the sequence of the seq tab running at that time is complete, the menu indication changes to "Cancel." When the test is paused, output can be turned on/off, allowing the EUT to be checked or replaced. While the test is paused, the menu indication changes to "Continue." This menu item has the same function as the Pause button on the toolbar.

⚠ CAUTION   • Before connecting or disconnecting the EUT, always confirm that the AC Power Supply PCR-LA output is OFF.

■ Output On

Turns on the PCR-LA output. This allows you to start a test with the PCR-LA output set to ON. This menu item has the same function as the Out On button on the toolbar.

■ Output Off

Turns off the PCR-LA output. This menu item has the same function as the Out Off button on the toolbar.

■ Abort

This function is assigned to the F9 function key. It disables output change and turns output off. In the event of an emergency, you must also turn off the PCR-LA POWER switch. This menu item has the same function as the Abort button on the toolbar.

■ 100 V range

Sets the PCR-LA voltage range to 100 V. When the voltage range is set to 100 V, a check mark is displayed to the left of this item. This menu item has the same function as the To 100 V button on the toolbar.

■ 200 V range

Sets the PCR-LA voltage range to 200 V. When the voltage range is set to 200 V, a check mark is displayed to the left of this item. This menu item has the same function as the To 200 V button on the toolbar.

■ AC mode

Selects AC mode from AC/AC-S modes. This function is valid only in the PCR-LA series. In the PCR-L series, AC mode is the only valid mode.

■ AC-S mode

Selects AC-S mode from AC/AC-S modes. This function is valid only in the PCR-LA series. In the PCR-L series, AC mode is the only valid mode.

■ I/O Configuration...

Configures settings related to communications with the PCR-LA series and other devices.

When controlling the test system using the RS-232C interface, type "COM1" or "COM2" into the Edit box. To control the test system using the GPIB interface, type "DEV1," "DEV2," and so on into the Edit box. The number following DEV is a GPIB address.

This menu item also lets you select whether to use/not use the IT01-PCR-L immunity tester. If this is set for use, the AC Power Supply PCR-LA is also controlled via the GPIB interface only. In this case, type "DEV1," "DEV2," and so on in the same way into the IT01 Device Name dropdown list box.

NOTE
- If the Use IT01-PCR-L checkbox is checked, Voltage variation tests according to IEC 61000-4-11 are not possible. Only Voltage dips and Short interruptions may be selected.

For three-phase systems, check the 3 phase system checkbox. In this case, as IT01-PCR-L cannot be used, uncheck the Use IT01-PCR-L checkbox.

Option Menu

■ Default voltage and frequency...

Lets you select the voltage and frequency defaults for the set values entered when creating a new file. The settings configured for the Quick Immunity Sequencer on shipment from the factory are 100 V/50 Hz.

■ Color...

Lets you modify the color for background, progress bars, characters, and preview waveforms for each seq tab.

Help Menu

■ Quick Immunity Sequencer Help...

Opens the Help file.

■ About Quick Immunity Sequencer...

Displays the Quick Immunity Sequencer version information.

2.7.2   Toolbar
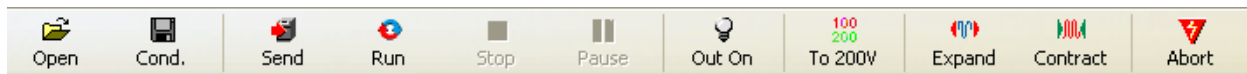
■ Open button

Opens the dialog box used to select a test condition file. This button has the same function as Open... on the File Menu.

■ Cond. button

Saves the test condition settings under the same name as the currently open test condition file, replacing the earlier version. This button has the same function as Save (Test Conditions) on the File Menu.

■ Send button

After setting the test conditions, click the Send button to send set data to the PCR-LA. When the data has been sent, the Run button is enabled and no longer grayed out.

For IEC 61000-4-13 (harmonics immunity test), the Send button is not available (unless output is turned off using the Out Off button) because the waveform banks have been overwritten.

■ Run button

Starts the test. This button is enabled if the set values are sent to the PCR-LA using the Send button.

You can also turn on output beforehand using the Out On button, then start a test using the Run button.

■ Stop button

Stops the test mid-course . Note that output remains enabled. If you also wish to switch off output, click the Abort button instead.

This button is enabled only while a test is running.

■ Pause button

This button pauses a test immediately before moving to the next tab after completing a sequence in a given seq tab. This function can be used, for example, to check or replace the EUT.

⚠ CAUTION
- Before connecting or disconnecting the EUT, always confirm that the AC Power Supply PCR-LA output is OFF.

If you click the Pause button while a test is running, the button indication changes to "Cancel" until the sequence of the seq tab running at that time is complete.

Checking the Cancel button cancels the pause-waiting status and returns the button displayed to the original Pause button.

When the sequence of the relevant seq tab is finished and the test is paused, the button indication changes to "Continue," enabling the Out On/Off button.

Click the Continue button to resume running the sequence.

■ Out On/Off button

When output is off, clicking the Out On button turns output on. When the output is on, the button indication changes to "Out Off."

The initial voltage of the valid seq tab is output, enabling a test based on the output ON state.

■ To 100 V/200 V button

This is a voltage range selector button. If the 100 V range is active, it displays "To 200 V." If the 200 V range is active, it displays "To 100 V."

In the 100 V range, output of up to 152.5 V is available; in the 200 V range, output of up to 305.0 V is available. Note that in the 200 V range, the maximum output current is half that of the 100 V range.

NOTE
- For IEC 61000-4-29 (Voltage dips, Short interruptions, and Voltage variations for DC power inputs), DC voltage applies. In the 100 V range, output of up to 215.5 V is available; in the 200 V range, output of up to 431.0 V is available.

■ Expand button

Horizontally expands the preview waveform in the middle of the window. This enlarges the beginning of the waveform for a valid seq tab.
- Quick Immunity Sequencer was designed so that the preview waveform and actual output will generally be in agreement. However, in certain rare cases, the preview waveform and the actual output will be off by a single period due to an error in zero-cross detection.

- The time-axis direction of the preview waveform area is finite and extends approx. 7 times the window size. In certain cases, depending on settings, the entire waveform cannot be displayed.

■ Contract button

Horizontally contracts the preview waveform in the middle of the window, allowing you to view the entire condition. However, in certain cases, if a long duration setting has been made, the entire waveform cannot be displayed.

■ Abort button

Disables output change and turns output off. In the event of an emergency, you must also turn off the AC Power Supply PCR-LA POWER switch.

2.8　Running a Test
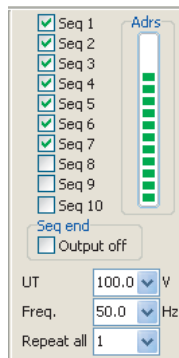
A test is conducted by running sequences of the seq tabs selected using the checkboxes in turn, starting with the smallest numbered seq tab. The test disregards seq tabs that have not been selected.

In an example of the figure shown on the left, Seq 1 to Seq 7 are run in turn.

Because the repetition count for all sequences (Repeal all) is "1," the test halts when the sequences are run up to Seq 7.

Since the Seq end-Output off checkbox has not been checked, output remains enabled at the end of the test.

NOTE
- A transition between the seq tabs takes approx. 1.3 seconds. Accordingly, the repetition interval at the end requiring a transition between the seq tabs is equal to the set value plus approx. 1.3 seconds.
- For testing according to the IEC 61000-4-27 standard, a transition between seq tabs will take several seconds. For more information, please refer to "Interval (repetition interval)" in 6.2, Preparing the Test Conditions.

2.8.1　Turning Power on/off in the Test Configuration

⚠ CAUTION
- Follow the procedure given below to turn power on/off. Departing from this procedure may generate an error or cause equipment/device failure.

■ Turning power on

1. Turn on the IT01-PCR-L immunity tester POWER switch.
2. Turn on the AC Power Supply PCR-LA POWER switch.
3. Launch Quick Immunity Sequencer.

■ **Turning power off**

1. Exit Quick Immunity Sequencer.

2. Turn off the AC Power Supply PCR-LA POWER switch.

3. Turn off the IT01-PCR-L immunity tester POWER switch.

2.8.2   Running Procedure

1. Select single phase or three phase.

   Click on I/O Configuration... from the Instrument Menu and check the 3 phase system checkbox in the dialog displayed.

2. Set the test conditions.

3. Send the set test conditions to the PCR-LA.

   Click the Send button on the toolbar.

   When transmission is completed, the Run button on the toolbar is enabled.

4. Run the sequences.

   Click the Run button on the toolbar.

   While the sequences are running, the "Sequence Running" indication appears in a progress bar that graphically represents the status of the sequence in question. When execution of the set test conditions has been completed, the test automatically stops.

5. Stop

   There are two ways to stop a test: the Stop button and the Pause button.

Stop button

   Stops the test mid-course. Note that output remains enabled. If you also wish to switch off output, click the Abort button instead.

Pause button

   This button pauses a test immediately before moving to the next tab after completing a sequence in a given seq tab. This function can be used, for example, to check or replace the EUT.

   If you click the Pause button while a test is running, the button indication changes to "Cancel" until the sequence of the seq tab running at that time is complete.

   Clicking the Cancel button cancels the pause-waiting status and returns the button displayed to the original Pause button.

   When the sequence of the relevant seq tab is finished and the test is paused, the button indication changes to "Continue."

   Click the Continue button to resume running the sequence.

2.8.3　Troubleshooting During Running

■ **The Run button remains disabled although the Send menu/button was clicked.**

With the IT01-PCR-L immunity tester, you must turn on the PCR-LA output before running a test. Click the Out On button to turn on the PCR-LA output.

■ **The Send button remains disabled although no test is being run.**

If IEC 61000-4-13 has been selected, you must turn off the PCR-LA output. This is because bank calculations were made while the test condition data was being sent.

2.8.4　Corrective Measures in the Event of Problems

If a problem occurs in the equipment under test (EUT), operate Quick Immunity Sequencer and the hardware to abort testing. For better protection of the EUT, we recommend aborting via hardware.

■ **Operating Quick Immunity Sequencer**

Click the F9 function key or the Abort button on the toolbar to abort testing. The AC Power Supply PCR-LA output is also turned off.

■ **Operating the hardware**

Turn off the AC Power Supply PCR-LA POWER switch.

2.9　Observing a Test Signal

When observing a test signal using an oscilloscope, use the trigger signal output described below. For trigger signal output from the AC Power Supply PCR-LA, a trigger signal selected under the test conditions for each standard is output. The IT01-PCR-L's trigger signal output is not related to a trigger signal selected in the test condition setting for each standard.

■ **Trigger signal output from the AC Power Supply PCR-LA**

A trigger signal is output from the SEQ TRIG OUT terminal (BNC connector) at the rear of the AC Power Supply PCR-LA. A low-level signal is output for several 10 μs at a location on the waveform where trigger signal output has been specified. The signal level in cases other than signal output is approx. +5 V. The low level is approx. 0 V.

The BNC connectors are isolated from the INPUT and OUTPUT terminal boards of the AC Power Supply PCR-LA. However, the line for each signal of the PEAK INIT IN, SEQ TRIG OUT, and SEQ STAT OUT terminals (BNC connectors) is shared in the AC Power Supply PCR-LA and is not isolated. The BNC connectors are also not isolated from the SLOTs' internal circuit. Note the slight time lag (approx. 100 μs) between the trigger signal output and actual output change.

Upper part of the rear of
the AC Power Supply PCR-LA

AC Power Supply
PCR-LA's internal circuit

SEQ TRIG OUT
5V ▲

SEQ STAT OUT
5V ▲

PEAK INIT IN
MAX 15V ▲

SEQ TRIG OUT
terminal

SLOT 4   SLOT 3   SLOT 2 (GPIB)   SLOT 1

(+5V)

1k
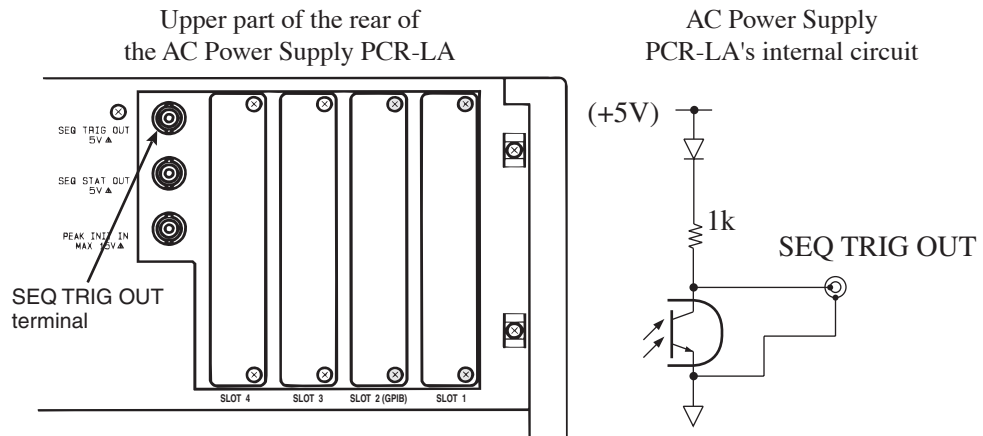
SEQ TRIG OUT

Fig. 2-5   SEQ TRIG OUT Terminal and Internal Circuit

■ **IT01-PCR-L trigger signal output**

With the IT01-PCR-L immunity tester, a trigger signal is output from the TRIG
OUT terminal (BNC connector) at the front of the IT01-PCR-L immunity tester. For
more information, please refer to the IT01-PCR-L Immunity Tester Operation
Manual.

3

Chapter 3　IEC 61000-4-11

Describes Voltage dip, Short interruption, and Voltage variation immunity tests according to the IEC 61000-4-11 standard.

3.1 Outline of the Test

The Voltage dip, Short interruption, and Voltage variation immunity tests determine the equipment's immunity against an abrupt drop or gentle decline in supply voltage.

■ Items not conforming to the standard's requirements

Certain Quick Immunity Sequencer items do not conform to the standard's requirements in the test configuration, including the hardware. The following table shows these items and the performance achieved in the test configuration.

Item	Standard's requirements	Performance achieved in the test configuration
Phase-basis setting for three-phase operations	A test is conducted with settings made for only one phase. Ideally, any of phases U, V, and W can be specified as a phase to be tested.	Only phase U can be specified.
Phase setting for three-phase operations[*1]	Within ±10°	±18° at 50 Hz or ±21.6° at 60 Hz with the exception of zero cross

*1. In single-phase operations, the standard's requirements are met if the IT01-PCR-L immunity tester is used.

NOTE
- We recommend using the IT01-PCR-L immunity tester for single-phase operations.
- The standard's performance specifications relating to voltage rise and fall time of a test voltage generator (1 μs to 5 μs) are met. The performance achieved without the IT01-PCR-L is approximately 30 μs.
- The standard's performance specifications relating to the starting phase angle of Voltage dips or Short interruptions (setting accuracy within (10°) are met. Without the IT01-PCR-L, the standard's performance specifications will be met at an angle of multiples of 18, such as 90°, 180°, etc., for 50 Hz. The setting accuracy at other phase angles is ±18° at 50 Hz or ±21.6° at 60 Hz.

■ Three-phase operations

The test conditions are all set in relation to phase U. Test signals change simultaneously in three phases on the basis of phase U.

3.2 Preparing the Test Conditions

3.2.1 Voltage Dips and Short Interruptions
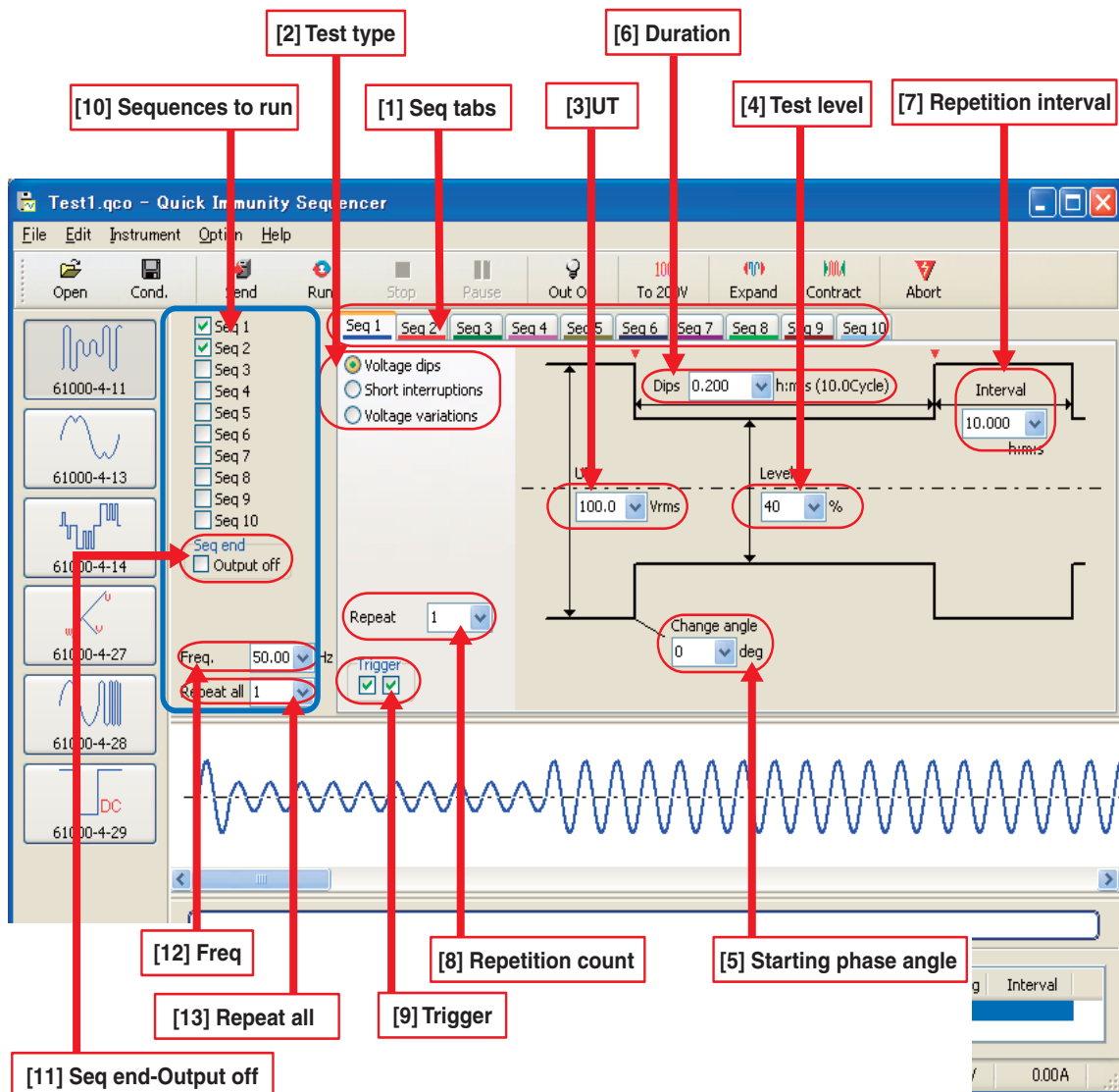
Fig. 3-1   Voltage Dips and Short Interruptions Setting Window

Set the following items. Select a value provided in the dropdown list or enter a value within the input range into the Edit box. After entering a value, press the Enter key to accept it.

[1]   Seq tabs

Allows you to set the test conditions in the panel of each seq tab (Seq 1 to Seq 10). These tabs show the heading numbers of the test conditions to be set in the following:

Test conditions can be copied or pasted between seq tabs. For more information, please refer to Edit Menu in 2.7.1, Menus.

[2] Test type

Select either Voltage dips, Short interruptions or Voltage variation. The diagram displayed on the right in the window changes depending on the test type button selected.

[3] UT

Enter the initial voltage (equal to voltage at return). For most cases, enter the rated voltage of the EUT.

Input range	Select one of 100 V, 110 V, 120 V, 200 V, 220 V, 230 V, and 240 V, or enter a value ranging from 0.0 V to 305.0 V.

NOTE • An appropriate voltage range must be selected. Use the toolbar or the Instrument Menu to set the voltage range. For more information, please refer to
■ To 100 V/200 V button in 2.7.2, Toolbar.

⚠ CAUTION • Check the set value of UT taken between the seq tabs used to run a test. If the UT set value differs between the seq tabs, unintended voltage change may occur, depending on selection of the seq tabs whose sequences are run.

[4] Level (test level)

For Voltage dips, enter a residual voltage in % with respect to UT. This level is set to 0 % (no input) in the case of Short interruptions.

Input range	Select either 40 % or 70 %, or enter a value ranging from 0 % to 200 %.
Input range (with IT01-PCR-L)	Select either 40 % or 70 %.

[5] Change angle (starting phase angle)

Enter the starting phase angle of Voltage dips or Short interruptions.

Input range	Select one of 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315°, or enter a value ranging from 0° to 359°.

[6] Dips/Short (duration)

Enter the duration of Voltage dips or Short interruptions. Enter the value in seconds or in hours: minutes: seconds format. The number of periods corresponding to time entered is then indicated.

Input range	Select one of 0.01 s, 0.02 s, 0.1 s, 0.2 s, 0.5 s, 0.6 s, and 1 s, or enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

Input range (with IT01-PCR-L)	The IT01-PCR-L allows the setting of a 0.5 period or value ranging from 1 to 3000 periods. Since this item is set as a time value, you must convert the number of periods into a time value to enter. 50 Hz: 0.010 s to 60.000 s 60 Hz: 0.008 s to 50.000 s

[7] Interval (repetition interval)

Enter the interval between the point at which the return voltage (UT) is reached and the next Voltage dip. At the end of repetition intervals, this is the time taken to move to the next seq tab. Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 10.000 s. Alternatively, enter a value ranging from 0.020 seconds to 999 hours 999 minutes 999.999 seconds.
Input range (with IT01-PCR-L)	Enter a value ranging from 10.000 s to 999.000 s (increment: 1 s).

[8] Repeat (repetition count)

Enter the number of repetitions for the test conditions in the seq tab in question.

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.
Input range (with IT01-PCR-L)	Select one of 3, 6, 9, and 12 times, or enter a multiple of 3 within the range of 3 to 9999.

[9] Trigger

Select trigger signal output. The red symbol ▼ indicates at a location selected using a checkbox.

[10] Sequences to run

Check the corresponding checkboxes of the seq tabs whose test conditions are used to run a test sequence. Test sequences are run in turn starting at Seq 1. Seq tabs whose corresponding checkboxes have not been checked are not used to run a test.

[11] Seq end-Output off

When this checkbox is checked, a test signal is turned off at the end of sequence running. (the AC Power Supply PCR-LA output is turned off.)

[12] Freq

Enter the rated frequency of the EUT.

Input range	Select either 50 Hz or 60 Hz, or enter a value ranging from 1 Hz to 999.90 Hz.
Input range (with IT01-PCR-L)	Select either 50 Hz or 60 Hz.

[13] Repeat all

Enter the repetition count of all the selected seq tabs (Seq 1 to Seq 10).

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.

3.2.2   Voltage Variations
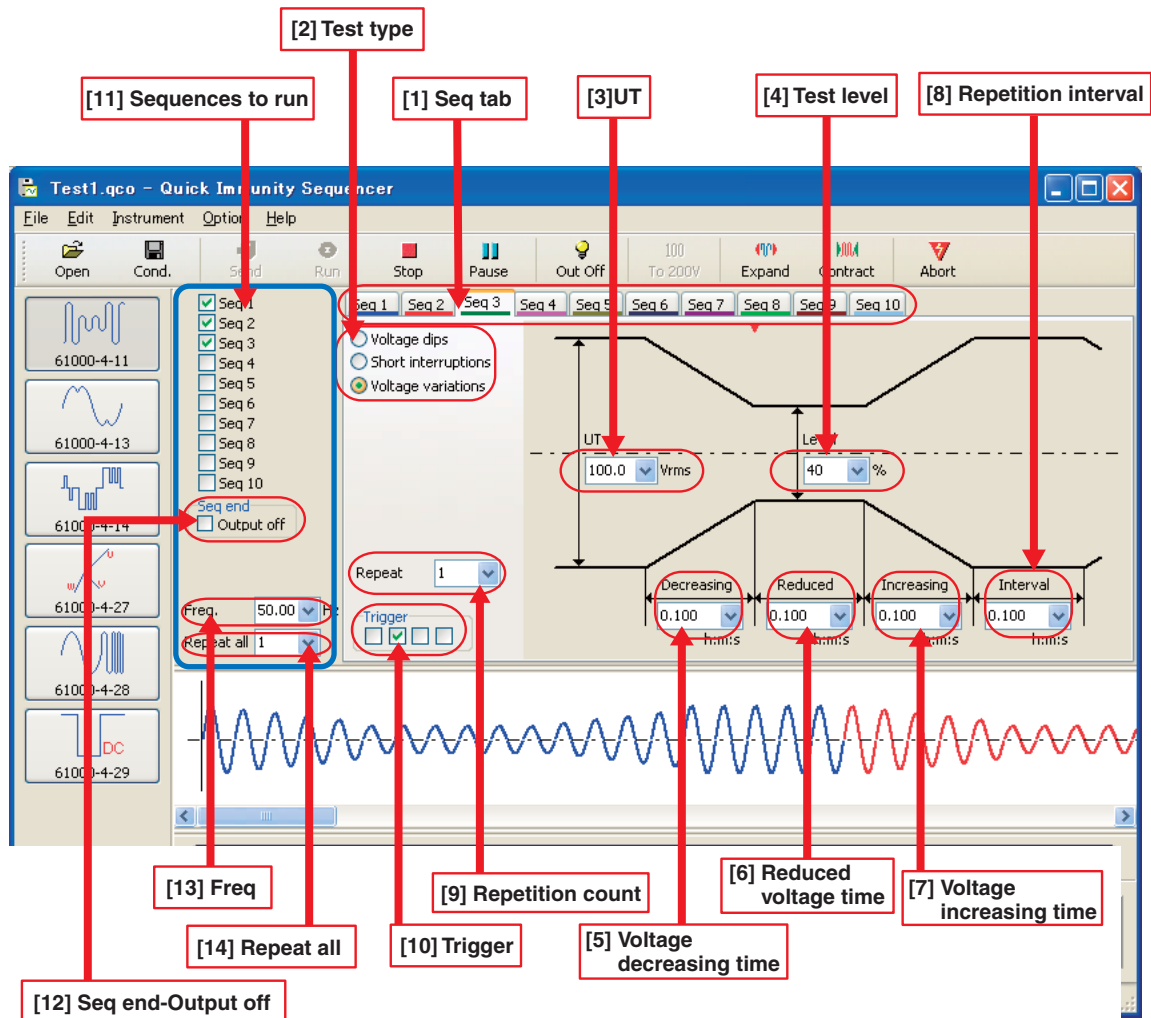
Fig. 3-2   Voltage Variations Setting Window

The following items other than 2, 5, 6, 7, and 11 are the same as for Voltage dips and Short interruptions. Please refer to 3.2.1, Voltage Dips and Short Interruptions.

[1]   Seq tabs

[2]   Test type

Select the Voltage variations.

NOTE   • If the Use IT01-PCR-L checkbox is checked in the dialog box displayed by clicking on I/O Configuration... from the Instrument Menu, Voltage variations are not possible.

---

[3]   UT

[4]   Level (test level)

[5]   Decreasing (voltage decreasing time)

Enter the time taken to reduce voltage from the initial voltage (UT) to the reduced voltage. Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 2.000 s. Alternatively, enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

[6]   Reduced (reduced voltage time)

Enter the reduced voltage duration. Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 2.000 s. Alternatively, enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

[7]   Increasing (voltage increasing time)

Enter the time taken to return from the reduced voltage to the initial voltage (UT). Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 10.000 s. Alternatively, enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

[8]   Interval (repetition interval)

[9]   Repeat (repetition count)

[10] Trigger

[11] Sequences to run

Check the corresponding checkboxes of the seq tabs whose test conditions are used to run a test sequence. Test sequences are run in turn starting at Seq 1. seq tabs whose corresponding checkboxes have not been checked are not used to run a test.

NOTE   • If the Use IT01-PCR-L checkbox is checked in the dialog box displayed by clicking on I/O Configuration... from the Instrument Menu, the seq tabs to which Voltage variation has been set are not used in the test.

---

[12] Seq end-Output off

[13] Freq

[14] Repeat all

3.3 Results of Sequence Running

The running results are indicated every time the sequence for one seq tab finishes. The starting date and time are shown in the row above the No. 1 row. Shown below is a typical test example. An indicated value becomes a blank or "0" if it is not related to the test.

Voltage dips, Short interruptions, and Voltage variations

Table 3-1   Example of Indication of Running Results

No.	Repeat all	Seq	Item	UT	Level	Angle	Decre-asing	Reduced	Incre-asing	Interval
1	1	1	Voltage variation	230.0	40	—	2.000	1.000	2.000	10.000
2	1	2	Voltage dips	230.0	70	0	0.0	0.200	0.0	10.000
3	1	3	Short interruption	230.0	0.0	0	0.0	0.100	0.0	10.000

■ Description of Table 3-1

[Number] in the following items corresponds to the numbered steps in Figs. 3-1 and 3-2.

No. 1: Voltage variations 40 %

- [1] Seq tab: The Seq 1 tab is used.
- [2] Test type: Voltage variations
- [3] UT: 230 V
- [4] Level (test level): 40 %
- [5] Decreasing time (voltage decreasing time): 2.000 seconds
- [6] Reduced (reduced voltage time): 1.000 second
- [7] Increasing time (voltage increasing time): 2.000 seconds
- [8] Interval (repetition interval): 10.000 seconds
- [9] Repeat (repetition count): The repetition count in the Seq 1 tab is not indicated.

No. 2: Voltage dips 70 %

- [1] Seq tab: The Seq 2 tab is used.
- [2] Test type: Voltage dips
- [3] UT: 230 V
- [4] Level (test level): 70 %
- [5] Change angle (starting phase angle): 0°
- [6] Dips/Short (duration): 0.200 seconds
- [7] Interval (repetition interval): 10.000 seconds
- [8] Repeat (repetition count): The repetition count in the Seq 2 tab is not indicated.

No. 3: Short interruptions

- [1] Seq tab: The Seq 3 tab is used.
- [2] Test type: Short interruptions
- [3] UT: 230 V

- [4] Level (test level): 0 %
- [5] Change angle (starting phase angle): 0°
- [6] Dips/Short (duration): 0.100 seconds
- [7] Interval (repetition interval): 10.000 seconds
- [8] Repeat (repetition count): The repetition count in the Seq 3 tab is not indicated.

Items common to No. 1, No. 2, and No. 3

- Trigger: Not indicated
- Sequences to run: Sequences are run in the order of Seq 1, Seq 2, and Seq 3.
- Seq end-Output off: Not indicated
- Freq: Not indicated
- Repeat all: The number of repetitions for the sequences to be run in the order of Seq 1, Seq 2, and Seq 3 is 1.

4

Chapter 4   IEC 61000-4-13

Describes Harmonics and interharmonics immunity tests according to the IEC 61000-4-13 standard.

4.1 Outline of the Test

The Harmonics and interharmonics immunity tests determine the equipment's immunity against distortions in supply voltage waveforms. Shown below are the specific tests that comprise these immunity tests:

- Flat curve
- Over swing
- Sweep in Frequency
- Odd harmonics, non-multiples of 3
- Odd harmonics, multiples of 3
- Even harmonics
- Interharmonics
- Meister curve

■ Test sequence

The tests that determine compliance with the standard provide the recommended test sequences in flowchart form for each test. To enable greater flexibility in preliminary tests and other tests, Quick Immunity Sequencer does not adopt these sequences. Instead, Quick Immunity Sequencer is designed to allow each test to be performed independently.

■ Electromagnetic environment classes

Quick Immunity Sequencer does not specify an electromagnetic environment class or assume it to be a setting condition. An electromagnetic environment class for test conditions should be set at the user's discretion.

■ Items not conforming to the standard's requirements

Certain Quick Immunity Sequencer items do not conform to the standard's requirements in the test configuration, including the hardware. The following table shows these items and the performance achieved in the test configuration.

Item	Standard's requirements	Performance achieved in the test configuration
Frequency sweep	The frequency step of a sweep is 0.1 x f1 minimum.	The frequency step of a sweep is 1 x f1 minimum (integral multiple).
Interharmonics	Required	Not provided
Meister curve		

■ Three-phase operations

The test conditions are all set in relation to phase U. Test signals change simultaneously in three phases on the basis of phase U.

4.2 Preparing the Test Conditions

4.2.1 Combined Harmonics (Flat Curve)
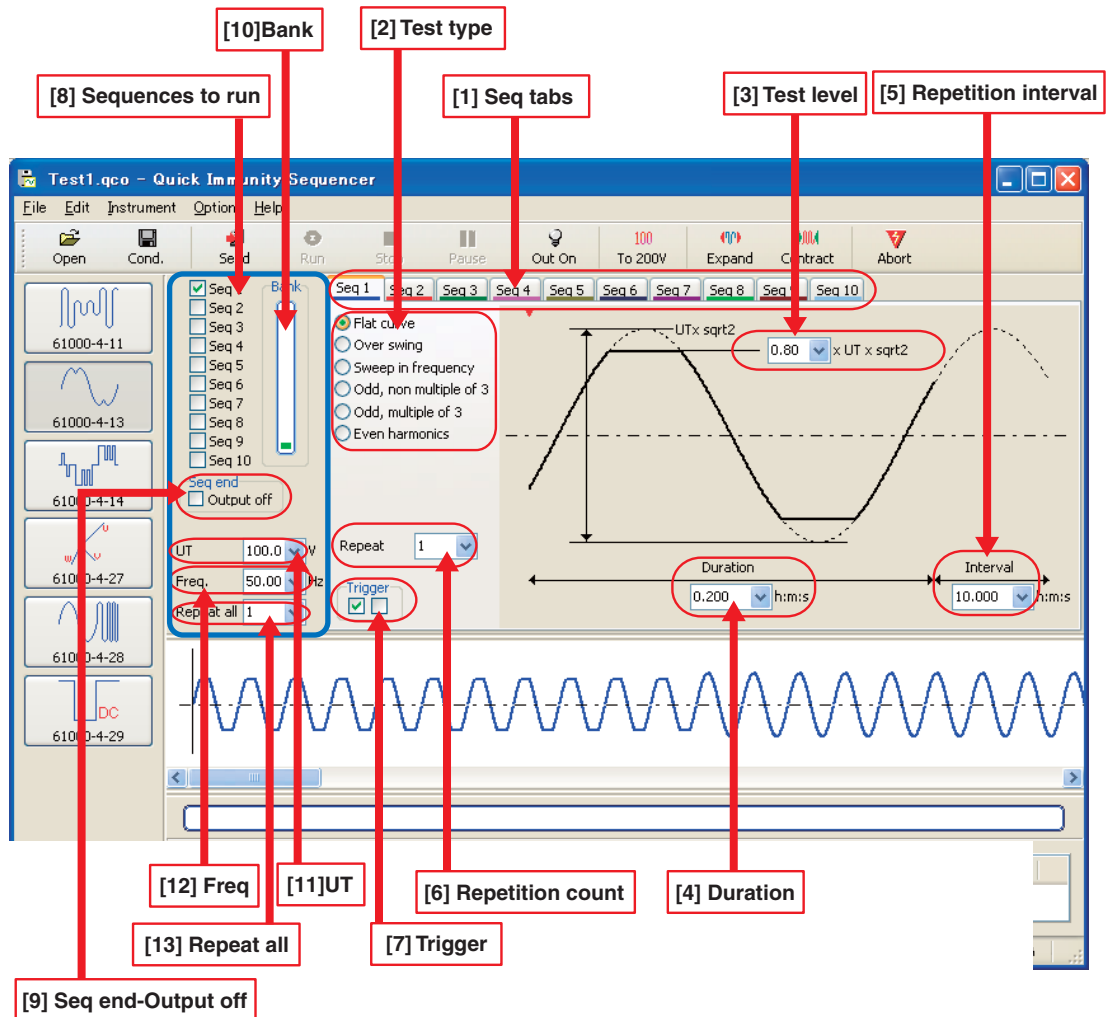
Fig. 4-1 Flat Curve Setting Window

Set the following items. Select a value provided in the dropdown list or enter a value within the input range into the Edit box. After entering a value, press the Enter key to accept it.

[1] Seq tabs

Allows you to set the test conditions in the panel of each seq tab (Seq 1 to Seq 10). These tabs show the heading numbers of the test conditions to be set in the following:

Test conditions can be copied or pasted between seq tabs. For more information, please refer toEdit Menu in 2.7.1, Menus.

[2] Test type

Select Flat curve from the following:
- Flat curve
- Over swing
- Sweep in frequency
- Odd, non-multiple of 3
- Odd, multiple of 3
- Even harmonics

[3] x UT x sqrt2 (test level)

Enter the ratio of the clipped section to the UT's peak value (UT x $\sqrt{2}$). If no clipping is made, the value should be "1."

Input range	Select one of 0.80, 0.90, and 0.95, or enter a value ranging from 0.78 to 0.99.
Input range (with IT01-PCR)	Select either 0.90 or 0.95, or enter a value ranging from 0.89 to 0.99.

Even when the test level is changed, the rms value remains at the UT value.

[4] Duration

Enter the duration of the flat curve waveform. Enter the value in seconds or in hours: minutes: seconds format.

Input range	Select 120 s, or enter a value ranging from 0.020 seconds to 999 hours 999 minutes 999.999 seconds.

NOTE
- How to enter in hours: minutes: seconds format: A time value of up to 999:999:999.999 may be set by delimiting each unit with a colon (:). If only one colon is used, the value is treated as if in minutes: seconds format. Without a colon, it is regarded as a second value. Second values can be entered up to the third decimal place.
- Waveform switching timing is at the 0°phase angle of the fundamental wave. That is, the current waveform is not switched at the end of the set time, but at the 0°phase angle of the next fundamental wave.

---

[5] Interval (repetition interval)

Enter the interval between the point at which the return voltage (UT) is reached and the next clipped voltage. At the end of repetition intervals, this is the time taken to move to the next seq tab. Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 10.000 s. Alternatively, enter a value ranging from 0.020 seconds to 999 hours 999 minutes 999.999 seconds.

- Waveform switching timing is at the 0° phase angle of the fundamental wave. That is, the current waveform is not switched at the end of the set time, but at the 0° phase angle of the next fundamental wave.

[6] Repeat (repetition count)

Enter the number of repetitions for the test conditions in the seq tab in question.

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.

[7] Trigger

Select trigger signal output. The red symbol ▼ indicates a location selected using the checkbox.

[8] Sequences to run

Check the corresponding checkboxes of the seq tabs whose test conditions are used to run a test sequence. Test sequences are run in turn starting at Seq 1. Seq tabs whose corresponding checkboxes have not been checked are not used to run a test.

[9] Seq end-Output off

When this checkbox is checked, a test signal is turned off at the end of sequence running. (the AC Power Supply PCR-LA output is turned off.)

[10] Bank

This test uses the AC Power Supply PCR-LA's waveform banks. The waveform banks are memory for storing special waveforms. Up to 15 types of waveforms can be stored. One of the stored waveforms (sine wave) is a reference waveform for the AC power supply and cannot be overwritten. Thus, the actual number of waveform types that can be stored is 14.

For the Bank indication, the fluctuating indicated bar is displayed in green. If this bar is displayed in red, the number of waveforms to be stored has exceeded 14 types. In this case, the Send button remains disabled to prevent further testing.

- Waveform bank data is stored temporarily, not backed up. Waveform bank data is lost when the AC Power Supply PCR-LA POWER switch is turned off.

[11] UT

Enter the initial voltage (equal to voltage at return). For most cases, enter the rated voltage of the EUT.

Input range	Select one of 100 V, 110 V, 120 V, 200 V, 220 V, 230 V, and 240 V, or enter a value ranging from 0.0 V to 305.0 V.

NOTE
- An appropriate voltage range must be selected. Use the toolbar or the Instrument Menu to set the voltage range. For more information, please refer to
  ■ To 100 V/200 V button in 2.7.2, Toolbar.

[12] Freq

Enter the rated frequency of the EUT.

Input range	Select either 50 Hz or 60 Hz, or enter a value ranging from 1 Hz to 999.90 Hz.

[13] Repeat all

Enter the repetition count of all the selected seq tabs (Seq 1 to Seq 10).

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.

4.2.2 Combined Harmonics (Over Swing)
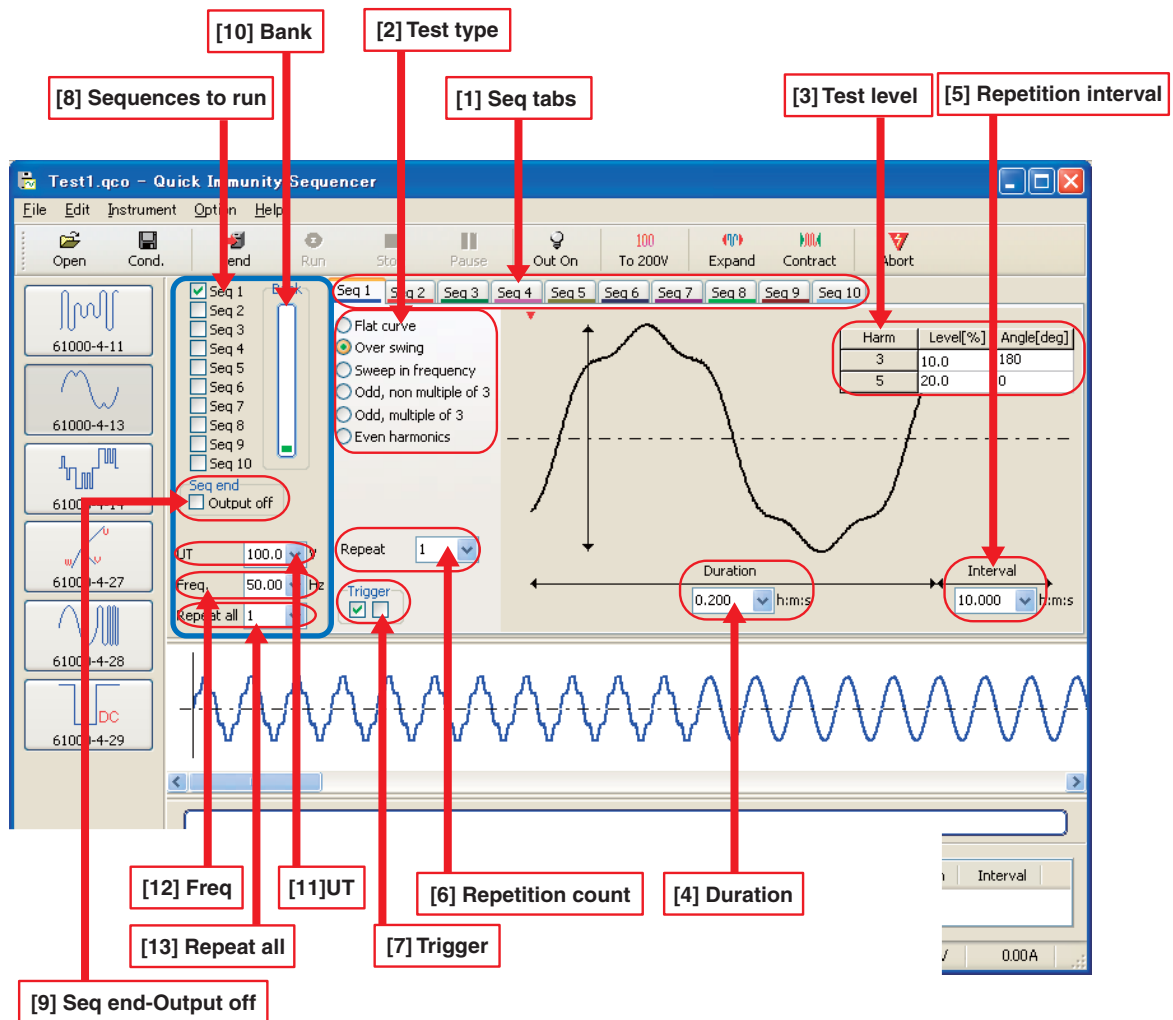
Fig. 4-2   Over Swing Setting Window

The following items other than 2 and 3 are the same as for the flat curve. Please refer to 4.2.1, Combined Harmonics (Flat Curve).

[1]   Seq tabs

[2]   Test type

Select Over swing from the following:
- Flat curve
- Over swing
- Sweep in frequency
- Odd, non-multiple of 3
- Odd, multiple of 3
- Even harmonics

[3] Harm.Level/Angle (test level)

Enter the ratio of the 3rd and 5th harmonics (to UT) superimposed on UT. Likewise, enter the phase angle.

Voltage ratio input range	Enter a value ranging from 0.0 % to 100.0 %.
Phase angle input range	Enter a value ranging from 0 deg. to 360 deg.

Even when the test level is changed, the rms value remains at the UT value.

[4] Duration

[5] Interval (repetition interval)

[6] Repeat (repetition count)

[7] Trigger

[8] Sequences to run

[9] Seq end-Output off

[10] Bank

[11] UT

[12] Freq

[13] Repeat all

4.2.3　Sweep in Frequency
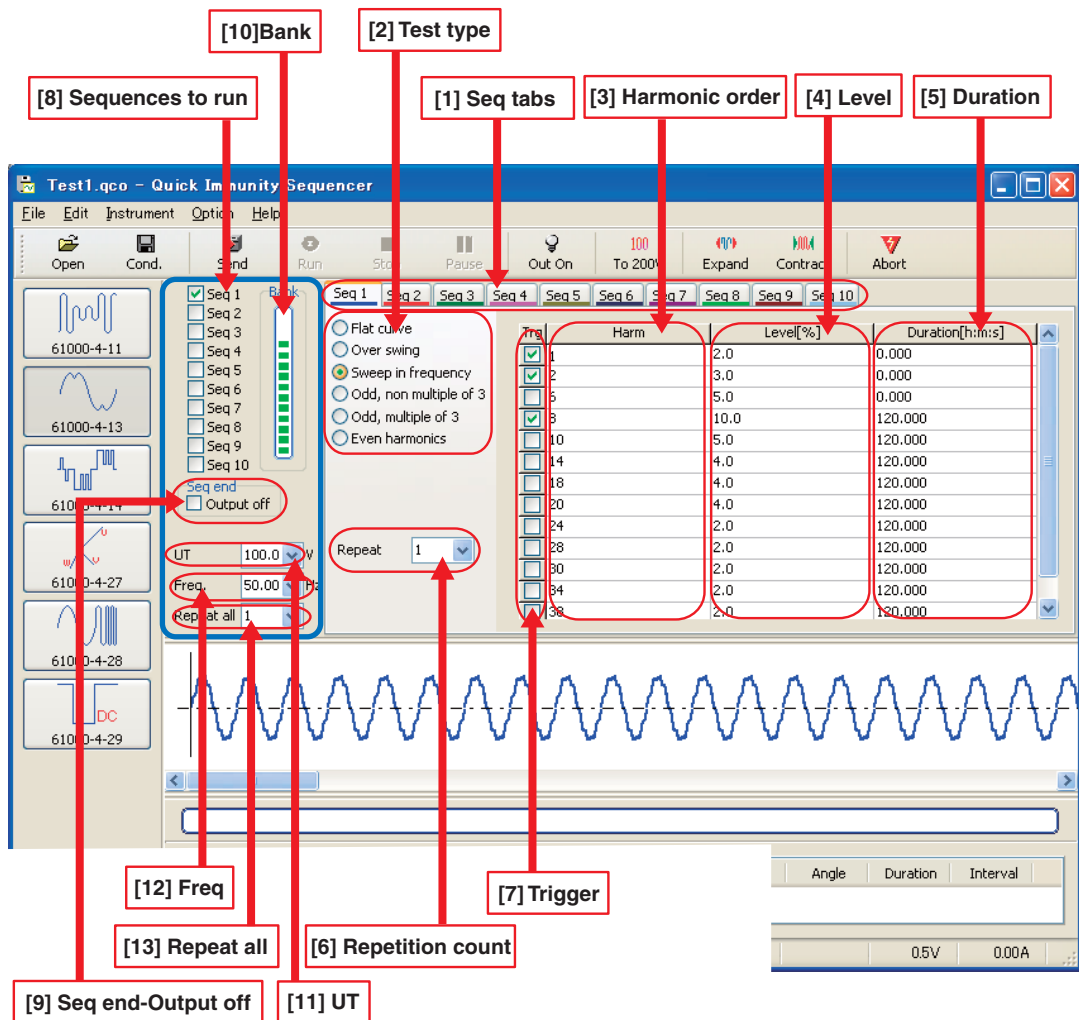
Fig. 4-3　Sweep in Frequency Setting Window

Frequency sweep method

This test uses the AC Power Supply PCR-LA's waveform banks. The waveform banks are memory for storing special waveforms. Up to 14 types of waveforms can be used. Quick Immunity Sequencer goes from frequency to frequency among the harmonic frequencies stored in the waveform banks to perform a stepwise sweep.

Determining sweep frequencies

Specify the sweep frequencies by harmonic orders, that is, integral multiples of the fundamental frequency. This means that the sweep frequency step must be an integral multiple of the fundamental frequency.

NOTE • As shown in Fig. 4-4, the sweep frequency step is an integral multiple of the fundamental frequency. Because the frequency changes significantly, compared with the standard's requirements, this feature can be used only in preliminary tests.
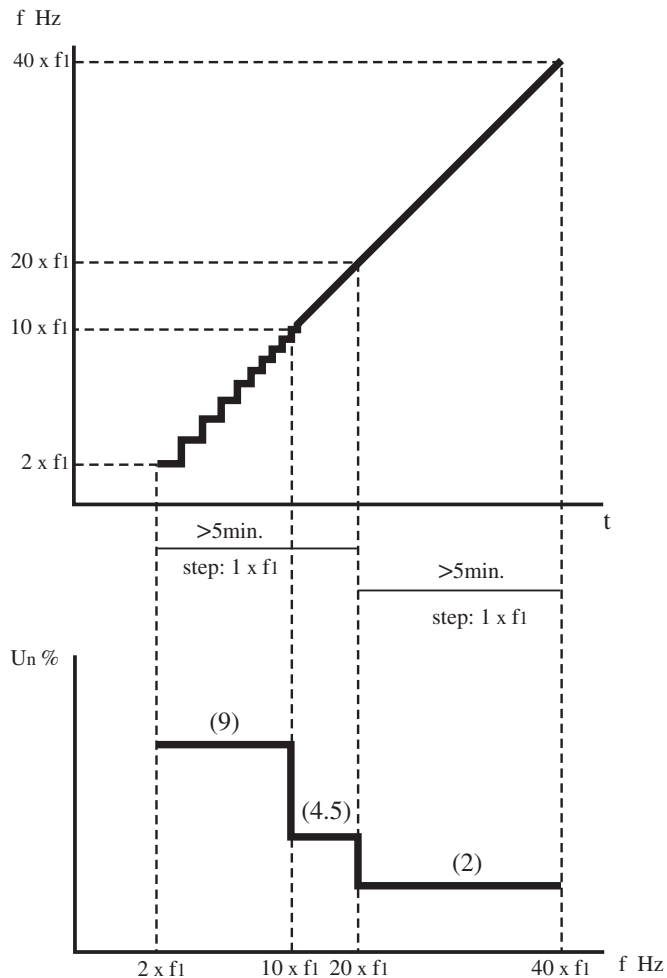
Fig. 4-4　　Example of Sweep in Frequency

A frequency sweep test switches the waveform banks (total: 14) to change the frequency stepwise. The contents of the waveform banks are harmonic orders, the ratio to the fundamental voltage, and durations. The following items other than 2, 3, 4, 5, and 7 are the same as for the combined harmonics (flat curve). Please refer to 4.2.1, Combined Harmonics (Flat Curve).

[1]　Seq tabs

[2]　Test type

Select Sweep in frequency from the following:
• Flat curve
• Over swing
• Sweep in frequency
• Odd, non-multiple of 3
• Odd, multiple of 3
• Even harmonics

[3] Harm (harmonic order)

Enter the order of the harmonics superimposed on the fundamental wave. A sweep step progresses downward from the highest row.

Input range	Enter a value ranging from 1 to 40.

[4] Level

Enter the ratio of the harmonic (to the fundamental voltage) superimposed on the fundamental wave.

Input range	Enter a value ranging from 0.0 % to 100.0 %.

[5] Duration

Enter the duration of the harmonic superimposed on the fundamental wave.

Input range	Enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

NOTE
- Waveform switching timing is at the 0° phase angle of the fundamental wave. That is, the current waveform is not switched at the end of the set time, but at the 0° phase angle of the next fundamental wave.

---

[6] Repeat (repetition count)

[7] Trigger

Select trigger signal output. A trigger signal is output at the start of the superimposed waveform output of harmonics selected using the checkboxes.

[8] Sequences to run

[9] Seq end-Output off

[10] Bank

For the Bank indication, the fluctuating indicated values are displayed in green. If this value is displayed in red, the number of waveforms to be stored has exceeded 14 types. In this case, the Send button remains disabled to prevent further testing.

Paring down the number of waveforms stored:
- Method 1: Reduce the number of checked checkboxes in the seq tabs .
- Method 2: Set the Duration setting to 0 (zero).

[11] UT

[12] Freq

[13] Repeat all

4.2.4　Individual Harmonics

Three harmonics are given below as individual harmonics. Each harmonic is set in the same way for all tests.

- Odd harmonics, non-multiples of 3
- Odd harmonics, multiples of 3
- Even harmonics
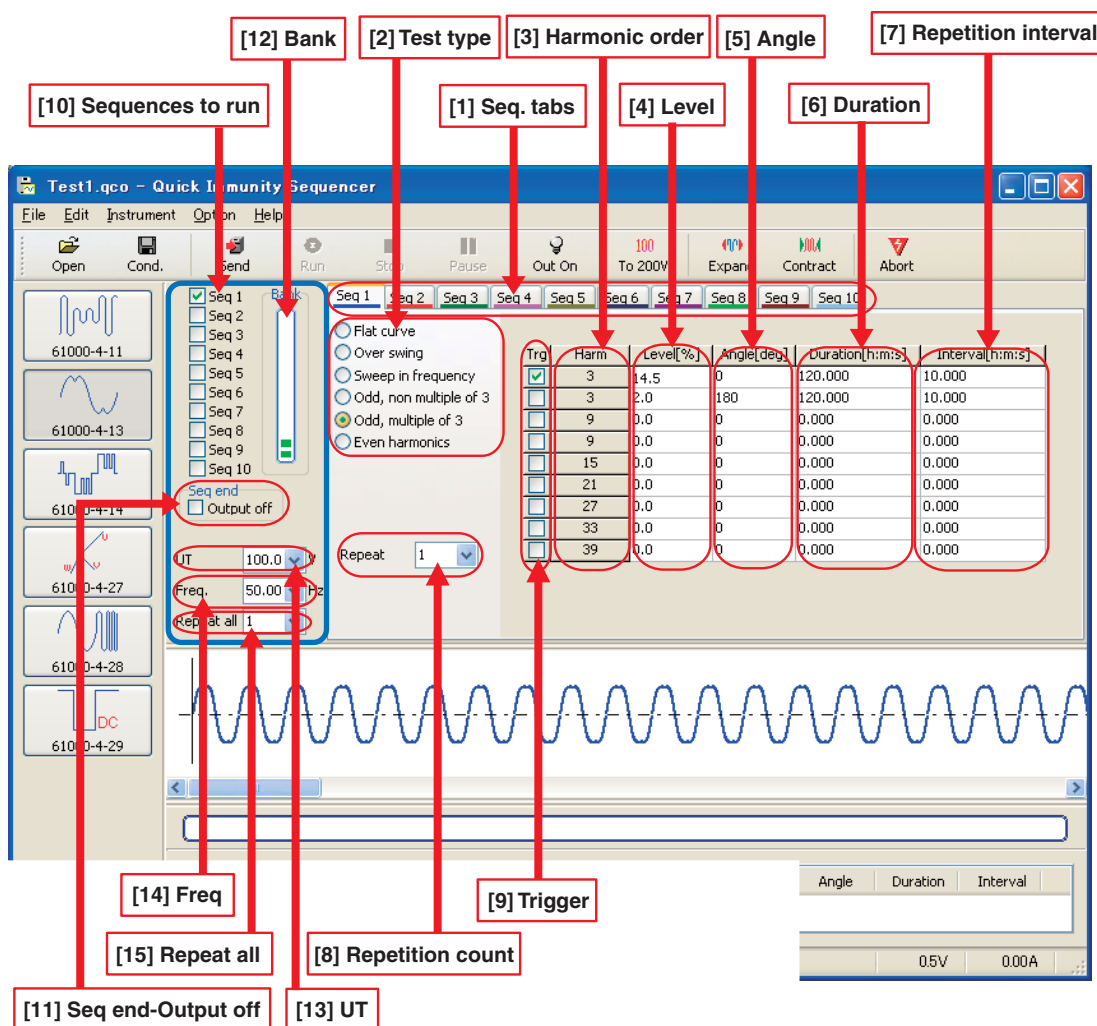
Fig. 4-5　Individual Harmonics Setting Window
(Odd Harmonics, Non-multiples of 3)

The individual harmonics test switches the waveform banks (total: 14) to change harmonics stepwise. The following items other than 2, 3, 4, 5, 6, 7, and 9 are the same as for the flat curve. Please refer to 4.2.1, Combined Harmonics (Flat Curve).

[1]　Seq tabs

[2]　Test type

Select Odd, non multiple of 3; Odd, multiple of 3, or Even harmonics from the following:

- Flat curve
- Over swing
- Sweep in frequency
- Odd, non multiple of 3
- Odd, multiple of 3
- Even harmonics

[3] Harm (harmonic order)

Enter the order of the harmonic superimposed on the fundamental wave. Changes in individual harmonics progress downward from the highest row.

Odd harmonics, non-multiples of 3	The values 5, 5, 7, 7, 11, 13, 17, 19, 23, 25, 29, 31, 35, and 37 are fixed and cannot be modified.
Odd harmonics, multiples of 3	The values 3, 3, 9, 9, 15, 21, 27, 33, and 39 are fixed and cannot be modified.
Even harmonics	Enter an even number ranging from 2 to 40.

[4] Level

Enter the ratio of the harmonic (to the fundamental voltage) superimposed on the fundamental wave.

Input range	Enter a value ranging from 0.0 % to 100.0 %.

[5] Angle (phase angle)

Enter the phase angle of the harmonic superimposed on the fundamental wave.

Input range	Enter a value ranging from 0° to 360°.

[6] Duration

Enter the duration of the harmonic superimposed on the fundamental wave.

Input range	Enter a value ranging from 0.000 seconds to 999 hours 999 minutes 999.999 seconds.

NOTE
- Waveform switching timing is at the 0° phase angle of the fundamental wave. That is, the current waveform is not switched at the end of the set time, but at the 0° phase angle of the next fundamental wave.

---

[7] Interval (repetition interval)

Enter the rest time until the next harmonic is superimposed. During this period, only the fundamental wave is present.

Input range	Enter a value ranging from 0.000 seconds to 999 hours 999 minutes 999.999 seconds.

• Waveform switching timing is at the 0° phase angle of the fundamental wave. That is, the current waveform is not switched at the end of the set time, but at the 0° phase angle of the next fundamental wave.

[8] Repeat (repetition count)

[9] Trigger

Select trigger signal output. A trigger signal is output at the start of the superimposed waveform output of harmonics selected using the checkboxes.

[10] Sequences to run

[11] Seq end-Output off

[12] Bank

For the Bank indication, the fluctuating indicated values are displayed in green. If this value is displayed in red, the number of waveforms to be stored has exceeded 14 types. In this case, the Send button remains disabled to prevent further testing.

Paring down the number of waveforms stored:
• Method 1: Reduce the number of checked checkboxes in the seq tabs .
• Method 2: Set the settings for Duration and Interval (repetition interval) to
        0 (zero).

[13] UT

[14] Freq

[15] Repeat all

4.3 Results of Sequence Running

The running results are indicated every time the sequence for one seq tab finishes. The starting date and time are shown in the row above the No.1 row. Shown below are some typical test examples. An indicated value becomes a blank or "0" if it is not related to the test.

Combined Harmonics

Table 4-1   Example of Indication of Running Results
(Flat Curve and Over Swing)

No.	Repeat all	Seq	Item	UT	Flatt	Harm.	Level	Angle	Dura-tion	Interval
1	1	1	Flat curve	230.0	0.95	—	—	—	120.000	10.000
2	1	2	Over swing	230.0	—	3,5	1.0,1.0	0,0	1.000	10.000

■ Description of Table 4-1

[Number] in the following items corresponds to the numbered steps in Figs. 4-1 and 4-2.

No. 1: Flat curve

- [1] Seq tab: The Seq 1 tab is used.
- [2] Test type: Flat curve
- [3] Flat (x UT x sqrt2, test level): 0.95
- [4] Duration: 120.000 seconds
- [5] Interval (repetition interval): 10.000 seconds

No. 2: Over swing

- [1] Seq tab: The Seq 2 tab is used.
- [2] Test type: Over swing
- [3] Harm. (test level): 3rd and 5th orders
- [3] Level (test level): 3rd: 1.0 %, 5th: 1.0 %
- [3] Angle (test level): 3rd: 0°, 5th: 0°
- [4] Duration: 1.000 second
- [5] Interval (repetition interval): 10.000 seconds

Items common to No. 1 and No. 2

- Repeat (repetition count): The repetition count in a seq tab is not indicated.
- Trigger: Not indicated
- Sequences to run: Sequences are run in the order of Seq 1 and Seq 2.
- Seq end-Output off: Not indicated
- Bank: Not indicated
- UT: 230 V
- Freq: Not indicated
- Repeat all: The number of repetitions for the sequences run in the order of Seq 1 and Seq 2 is 1.

Frequency Sweep

Table 4-2   Example of Indication of Running Results
(Frequency Sweep)

No.	Repeat all	Seq	Item	UT	Flatt	Harm.	Level	Angle	Dura-tion	Interval
1	1	3	Sweep frequency	230.0	—	2	1.0	—	1.000	—
1	1	3	Sweep frequency	230.0	—	6	1.0	—	1.000	—
1	1	3	Sweep frequency	230.0	—	8	1.0	—	1.000	—

■ Description of Table 4-2

[Number] in the following items corresponds to the numbered steps in Fig. 4-3.

No. 1 (1st row): Frequency sweep

- [1] Seq tab: The Seq 3 tab is used.
- [2] Test type: Sweep in frequency
- [3] Harm. (harmonic order): 2nd
- [4] Level: 1.0 %
- [5] Duration: 1.000 second

No. 1 (2nd row): Frequency sweep

- [1] Seq tab: The Seq 3 tab is used.
- [2] Test type: Sweep in frequency
- [3] Harm. (harmonic order): 6th
- [4] Level: 1.0 %
- [5] Duration: 1.000 second

No. 1 (3rd row): Frequency sweep

- [1] Seq tab: The Seq 3 tab is used.
- [2] Test type: Sweep in frequency
- [3] Harm. (harmonic order): 8th
- [4] Level: 1.0 %
- [5] Duration: 1.000 second

Items common to No. 1 (1st to 3rd rows)

- Repeat (repetition count): The repetition count in a seq tab is not indicated.
- Trigger: Not indicated
- Sequences to run: Sequences are run in the Seq 3 tab.
- Seq end-Output off: Not indicated
- Bank: Not indicated
- UT: 230 V
- Freq: Not indicated
- Repeat all: The number of repetitions for the sequences to be run in Seq 3 is 1.

Individual Harmonics

Table 4-3　Example of Indication of Running Results
(Odd Harmonics, Multiples of 3)

No.	Repeat all	Seq	Item	UT	Flatt	Harm.	Level	Angle	Dura-tion	Interval
1	1	4	Odd harmonics multiple of 3	230.0	—	3	1.0	0	5.000	1.000
1	1	4	Odd harmonics multiple of 3	230.0	—	9	1.0	0	5.000	1.000
1	1	4	Odd harmonics multiple of 3	230.0	—	15	1.0	0	5.000	1.000

■ Description of Table 4-3

[Number] in the following items corresponds to the numbered steps in Fig. 4-5.

No. 1 (1st row): Odd harmonics, multiples of 3

- [1] Seq tab: The Seq 4 tab is used.
- [2] Test type: Odd, multiple of 3
- [3] Harm. (harmonic order): 3rd
- [4] Level: 1.0 %
- [5] Angle: 0°
- [6] Duration: 5.000 seconds
- [7] Interval: 1.000 second

No. 1 (2nd row): Odd harmonics, multiples of 3

- [1] Seq tab: The Seq 4 tab is used.
- [2] Test type: Odd, multiple of 3
- [3] Harm. (harmonic order): 9th
- [4] Level: 1.0 %
- [5] Angle: 0°
- [6] Duration: 5.000 seconds
- [7] Interval: 1.000 second

No. 1 (3rd row): Odd harmonics, multiples of 3

- [1] Seq tab: The Seq 4 tab is used.
- [2] Test type: Odd, multiple of 3
- [3] Harm. (harmonic order): 15th
- [4] Level: 1.0 %
- [5] Angle: 0°
- [6] Duration: 5.000 seconds
- [7] Interval: 1.000 second

Items common to No. 1 (1st to 3rd rows)

- Repeat (repetition count): The repetition count in a seq tab is not indicated.
- Trigger: Not indicated
- Sequences to run: Sequences are run in the Seq 4 tab.
- Seq end-Output off: Not indicated
- Bank: Not indicated
- UT: 230 V
- Freq: Not indicated
- Repeat all: The number of repetitions for the sequences to be run in Seq 4 is 1.

Chapter 5   IEC 61000-4-14

Describes the Voltage fluctuation immunity test according to the IEC 61000-4-14 standard.

5.1 Outline of the Test

The Voltage fluctuation immunity test determines the equipment's immunity against Voltage fluctuation in the supply voltage.

■ Electromagnetic environment classes

Quick Immunity Sequencer does not specify an electromagnetic environment class or assume it to be a setting condition. An electromagnetic environment class for test conditions should be set at the user's discretion.

■ Items not conforming to the standard's requirements

Certain Quick Immunity Sequencer items do not conform to the standard's requirements in the test configuration, including the hardware. The following table shows these items and the performance achieved in the test configuration.

Item	Standard's requirements	Performance achieved in the test configuration
tf/tr of Voltage fluctuation	The timing for five periodic transitions must be specified.	The timing for five periodic transitions is not specified.
Start phase of three-phase operations	270° for each phase	270° only at the first period in phase U

■ Three-phase operations

The test conditions are all set in relation to phase U. Test signals change simultaneously in three phases on the basis of phase U.

5.2   Preparing the Test Conditions

The test conditions are prepared using two separate windows: the Voltage fluctuation and interval setting windows.
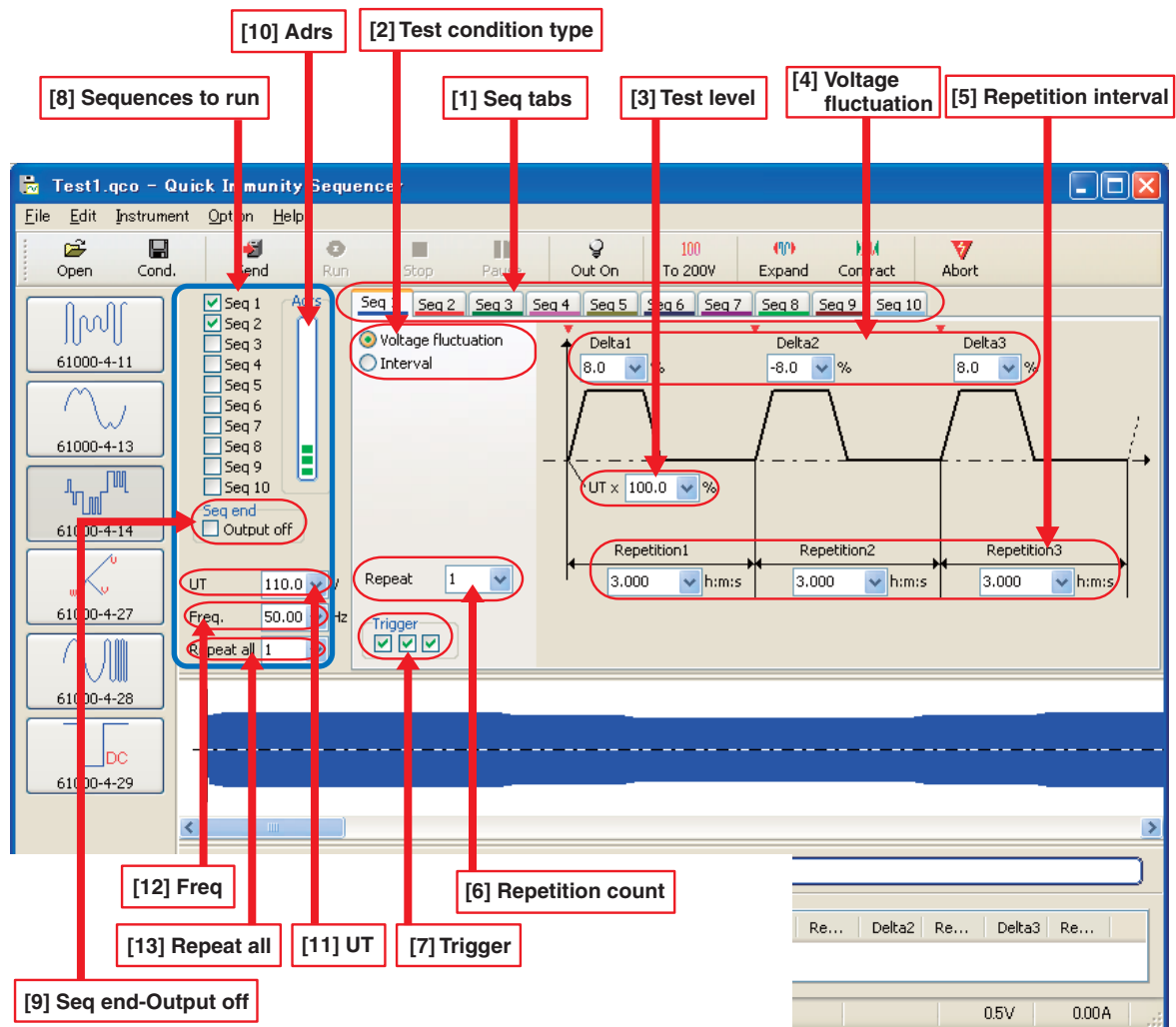
5.2.1   Voltage Fluctuation

Fig. 5-1   Voltage Fluctuation Setting Window

Set the following items. Select a value provided in the dropdown list or enter a value within the input range into the Edit box. After entering a value, press the Enter key to accept it.

[1]   Seq tabs

Allows you to set the test conditions in the panel of each seq tab (Seq 1 to Seq 10). These tabs show the heading numbers of the test conditions to be set in the following:

Test conditions can be copied or pasted between seq tabs. For more information, please refer to Edit Menu in 2.7.1, Menus.

[2] Test condition type

Select Voltage fluctuation from the following:
- Voltage fluctuation
- Interval

[3] UT% (test level)

Enter the center value of Voltage fluctuation. This should be a ratio to the rated voltage of the EUT.

Input range	Select one of 90 %, 100 %, and 110 %, or enter a value ranging from 1.0 % to 150.0 %.

⚠ **CAUTION** • Check the set value of UT taken between the seq tabs used to run a test. If the UT set value differs between the seq tabs, unintended voltage change may occur, depending on selection of seq tabs whose sequences are run.

---

[4] Delta1/2/3 (Voltage fluctuation)

Enter the Voltage fluctuation range. This should be a ratio to the rated voltage of the EUT.

Input range	Select one of -12 %, -8 %, 8 %, and 12 %, or enter a value ranging from -50 % to 50 %.

The duration of Voltage fluctuation is 2 seconds (fixed).

[5] Repetition1/2/3 (repetition interval)

Enter the repetition interval of Voltage fluctuation. Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 5 s. Alternatively, enter a value ranging from 3 seconds to 999 hours 999 minutes 999.999 seconds.

- -

NOTE • How to enter in hours: minutes: seconds format: A time value of up to 999:999:999.999 may be set by delimiting each unit with a colon (:). If only one colon is used, the value is treated as if in minutes: seconds format. Without a colon, it is regarded as a second value. Second values can be entered up to the third decimal place.

• A transition between the seq tabs takes approx. 1.3 seconds. Accordingly, Repetition 3 (repetition interval) at the end requiring a transition between the seq tabs is equal to the set value plus approx. 1.3 seconds.

- -

[6] Repeat (repetition count)

Enter the number of repetitions for the test conditions in the seq tab in question.

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.

[7] Trigger

Select trigger signal output. The red symbol ▼ indicates a location selected using the checkbox.

[8] Sequences to run

Check the corresponding checkboxes of the seq tabs whose test conditions are used to run a test sequence. Test sequences are run in turn starting at Seq 1. Seq tabs whose corresponding checkboxes have not been checked are not used to run a test.

[9] Seq end-Output off

When this checkbox is checked, a test signal is turned off at the end of sequence running. (the AC Power Supply PCR-LA output is turned off.)

[10] Adrs

To implement the Voltage fluctuation immunity test, Quick Immunity Sequencer uses the AC Power Supply PCR-LA sequence function. This sequence function can accommodate up to 100 addresses (adrs).

For Voltage fluctuation, 18 sequence addresses are used for one seq tab, while two sequence addresses are used for one seq tab for Interval. If six or more of the seq tabs for which Voltage fluctuation is specified are selected in the running sequence, the number of sequence addresses will exceed 100.

If this Adrs indicator bar is displayed in red, the number of the sequence addresses has exceeded 100, disabling transmission of the test condition data.

In this case, reduce the number of the seq tabs selected for sequences to run until the indicator bar changes to green, so that the number of sequence addresses becomes 100 or less.

[11] UT

Enter the rated voltage of the EUT.

Input range	Select one of 100 V, 110 V, 120 V, 200 V, 220 V, 230 V, and 240 V, or enter a value ranging from 0.0 V to 305.0 V.

NOTE
- An appropriate voltage range must be selected. Use the toolbar or the Instrument Menu to set the voltage range. For more information, please refer to
  ■ To 100 V/200 V button in 2.7.2, Toolbar.

---

[12] Freq

Enter the rated frequency of the EUT.

Input range	Select either 50 Hz or 60 Hz, or enter a value ranging from 1 Hz to 999.90 Hz.

[13] Repeat all

Enter the repetition count of all the selected seq tabs (Seq 1 to Seq 10).

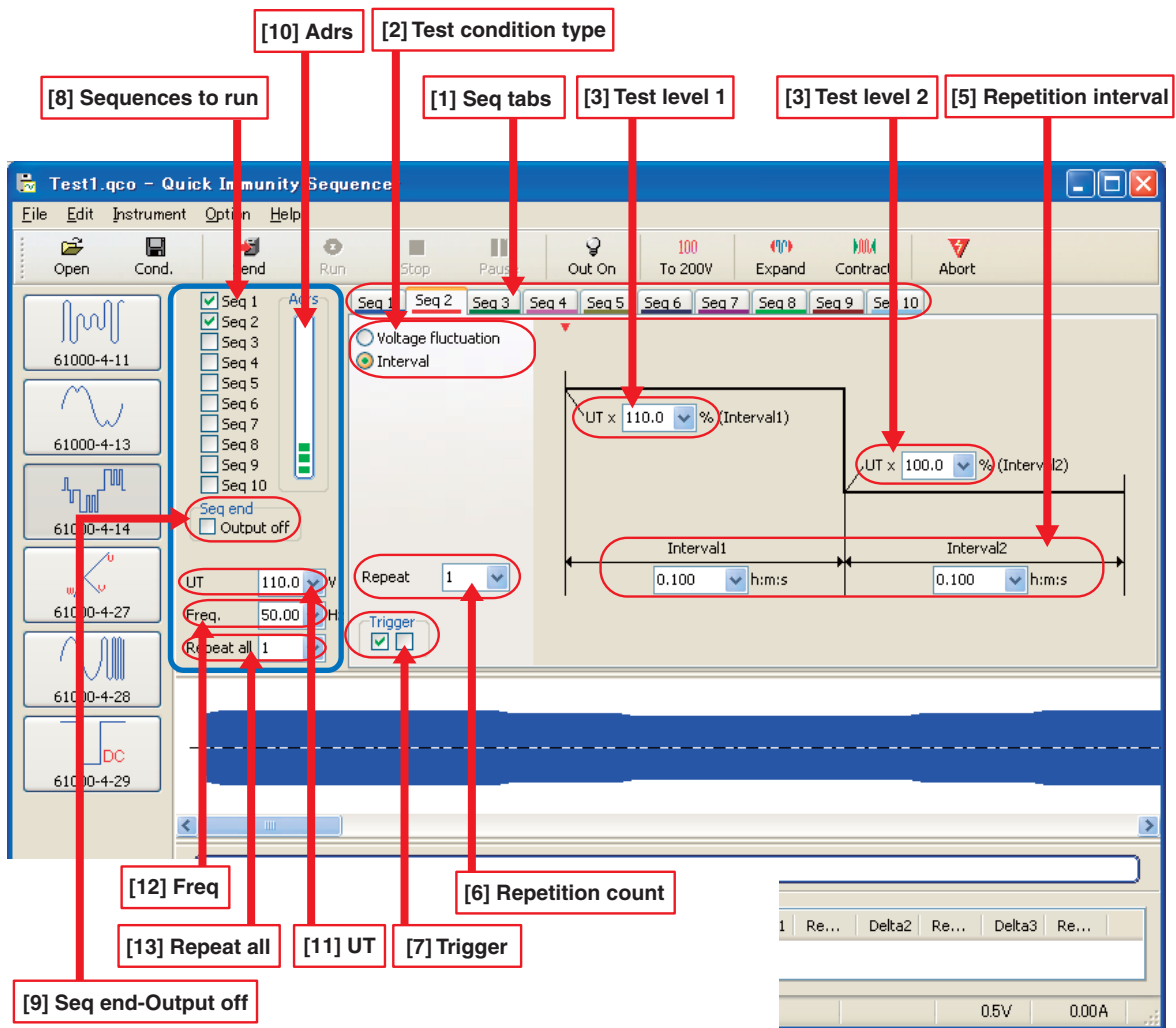| Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9 999.

5.2.2 Interval

Fig. 5-2   Interval Setting Window

Set the following items. Select a value provided in the dropdown list or enter a value within the input range into the Edit box. After entering a value, press the Enter key to accept it. The following items other than 2, 3, 4, and 5 are the same as for Voltage fluctuation. Please refer to 5.2.1, Voltage Fluctuation.

[1] Seq tabs

[2] Test condition type

Select Interval from the following:
- Voltage fluctuation
- Interval

[3] UT% (Interval1) (test level 1)

Enter the center value of Voltage fluctuation. This should be a ratio to the rated voltage of the EUT. For most cases, set it to the value of the UT% of the previous seq tab in running sequences.

Input range	Select one of 90 %, 100 %, and 110 %, or enter a value ranging from 1.0 % to 150.0 %.

⚠ CAUTION
- Check the set value of UT taken between the seq tabs used to run a test. If the UT set value differs between the seq tabs, unintended voltage change may occur, depending on selection of seq tabs whose sequences are run.

[4] UT% (Interval2) (test level 2)

Enter the center value of Voltage fluctuation. This should be a ratio to the rated voltage of the EUT. For most cases, set it to the value of the UT% of the next seq tab in running sequences.

Input range	Select one of 90 %, 100 %, and 110 %, or enter a value ranging from 1.0 % to 150.0 %.

[5] Interval1/2 (repetition interval)

Enter the repetition interval of Voltage fluctuation. Enter the value in seconds or in hours: minutes: seconds format.

Input range	Select either 60 s or 120 s, or enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

NOTE
- A transition between the seq tabs takes approx. 1.3 seconds. Accordingly, Interval2 (repetition interval) at the end requiring a transition between the seq tabs is equal to the set value plus approx. 1.3 seconds.

[6] Repeat (repetition count)

[7] Trigger

[8] Sequences to run

[9] Seq end-Output off

[10] Adrs

[11] UT

[12] Freq

[13] Repeat all

5.3   Results of Sequence Running

The running results are indicated every time the sequence for one seq tab finishes. The starting date and time are shown in the row above the No.1 row. Shown below is a typical test example. An indicated value becomes a blank or "0" if it is not related to the test. The Repeat set value in the panel for each seq tab is not indicated.

Table 5-1   Example of Indication of Running Results

No.	Repeat all	Seq	Item	UT	UT%	UT% Inter- val2	Delta1	Repet- ition1	Delta2	Repet- ition2	Delta3	Repet- ition3
1	1	5	Voltage fluctuation	230.0	100.0	—	8.0	5.000	8.0	5.000	8.0	5.000
2	1	6	Interval	230.0	100.0	90.0	—	60.000	—	60.000	—	—

■ **Description of Table 5-1**

[Number] in the following items corresponds to the numbered steps in Figs. 5-1 and 5-2.

No. 1: Voltage fluctuation

- • [1] Seq tab: The Seq 5 tab is used.
- • [2] Test condition type: Voltage fluctuation
- • [3] UT% (test level): 100.0 %
- • [4] Delta1 (Voltage fluctuation): 8.0 %
- • [5] Repetion1 (repetition interval): 5.000 seconds
- • [4] Delta2 (Voltage fluctuation): 8.0 %
- • [5] Repetion2 (repetition interval): 5.000 seconds
- • [4] Delta3 (Voltage fluctuation): 8.0 %
- • [5] Repetion3 (repetition interval): 5.000 seconds

No. 2: Interval

- • [1] Seq tab: The Seq 6 tab is used.
- • [2] Test condition type: Interval
- • [3] UT% (test level 1): 100.0 %
- • [4] UT% Interval2 (test level 2): 90.0 %
- • [5] Interval (repetition interval): 60.000 seconds

Items common to No. 1 and No. 2

- Repeat (repetition count): The repetition count in a seq tab is not indicated.
- Trigger: Not indicated
- Sequences to run: Sequences are run in the order of Seq 5 and Seq 6.
- Seq end-Output off: Not indicated
- Adrs: Not indicated
- UT: 230 V
- Freq: Not indicated
- Repeat all: The number of repetitions for sequences to be run in the order of Seq 5 and Seq 6 is 1.

Chapter 6   IEC 61000-4-27

Describes the Unbalance immunity test according to the IEC 61000-4-27 standard.

6.1　Outline of the Test

The Unbalance immunity test determines the equipment's immunity against unbalance in three phases.

■ Electromagnetic environment classes

Quick Immunity Sequencer does not specify an electromagnetic environment class or assume it to be a setting condition. An electromagnetic environment class for test conditions should be set at the user's discretion.

■ Items not conforming to the standard's requirements

Certain Quick Immunity Sequencer items do not conform to the standard's requirements in the test configuration, including the hardware. The following table shows these items and the performance achieved in the test configuration.

Item	Standard's requirements	Performance achieved in the test configuration
Voltage and phase changes in three-phase operations	Concurrent changes between phases	Presence of a lag of several seconds between phases
Minimum duration of unbalance	0.1 seconds	1 to several seconds
Responsiveness to voltage changes	1 µs to 5 µs	Approx. 30 µs

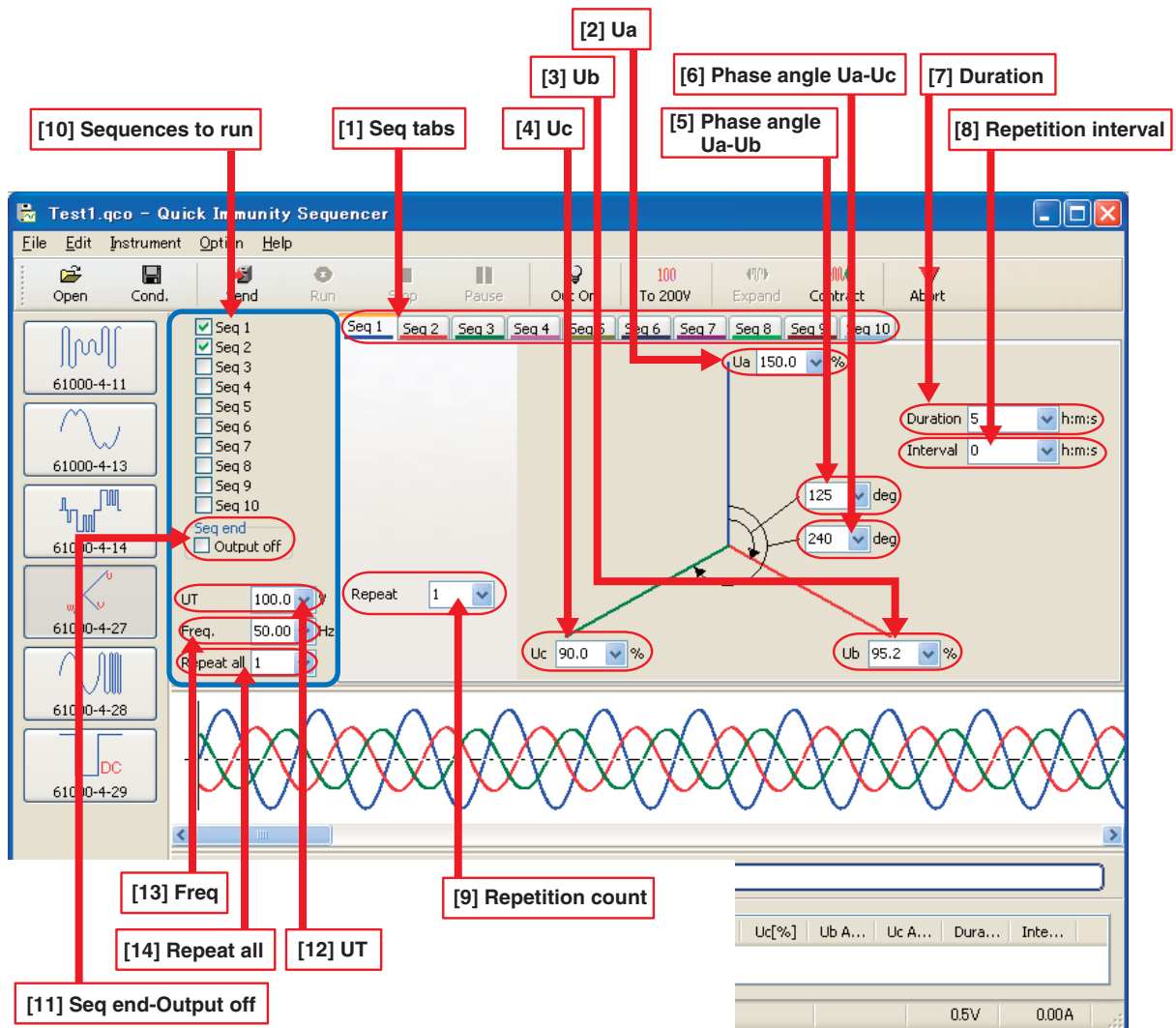# 6.2 Preparing the Test Conditions

Fig. 6-1   Unbalance Setting Window

Set the following items. Select a value provided in the dropdown list or enter a value within the input range into the Edit box. After entering a value, press the Enter key to accept it.

[1] Seq tabs

Allows you to set the test conditions in the panel of each seq tab (Seq 1 to Seq 10). These tabs show the heading numbers of the test conditions to be set in the following:

Test conditions can be copied or pasted between seq tabs. For more information, please refer to Edit Menu in 2.7.1, Menus.

[2] Ua

Enter a ratio of a quantity to the rated voltage of the EUT.

Input range	Select either 100 % or 110 %, or enter a value ranging from 0.0 % to 150.0 %.

[3] Ub

Enter a ratio of a quantity to the rated voltage of the EUT.

Input range	Select one of 66 %, 87 %, 90 %, 93.5 %, and 95.2 %, or enter a value ranging from 0.0 % to 150.0 %.

[4] Uc

Enter a ratio of a quantity to the rated voltage of the EUT.

Input range	Select one of 71 %, 74 %, 80 %, 87 %, and 90 %, or enter a value ranging from 0.0 % to 150.0 %.

[5] Phase angle Ua-Ub

Enter the Ua-Ub phase angle.

Input range	Select one of 125°, 127°, 131°, 134°, and 139°, or enter a value ranging from 1° to 360°.

[6] Phase angle Ua-Uc

Enter the Ua-Uc phase angle.

Input range	Select one of 235°, 238°, 239°, and 240°, or enter a value ranging from 1° to 360°.

[7] Duration

Enter the duration of unbalance. Enter the value in seconds or in hours: minutes: seconds format.

Input range	Select one of 2 s, 15 s, 30 s, and 60 s, or enter a value ranging from 1.000 second to 999 hours 999 minutes 1000 seconds.

[8] Interval (repetition interval)

Enter the repetition interval of unbalance. In this period, each phase voltage is set to 100 %, the Ua-Ub phase angle is set to 120°, and the Ua-Uc phase angle is set to 240°. The increment is 1 second. Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 180 s. Alternatively, enter a value ranging from 0 seconds to 999 hours 999 minutes 1000 seconds.

- How to enter in hours: minutes: seconds format: A time value of up to 999:999:1000 may be set by delimiting each unit with a colon (:). If only one colon is used, the value is treated as if in minutes: seconds format. Without a colon, it is regarded as a second value. Second values after decimal places cannot be entered.

- A transition between the seq tabs takes several seconds. Accordingly, Interval time (repetition time) at the end requiring a transition between the seq tabs is equal to the set value plus several seconds.

[9] Repeat (repetition count)

Enter the number of repetitions for the test conditions in the seq tab in question.

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.

[10] Sequences to run

Check the corresponding checkboxes of the seq tabs whose test conditions are used to run a test sequence. Test sequences are run in turn starting at Seq 1. Seq tabs whose corresponding checkboxes have not been checked are not used to run a test.

[11] Seq end-Output off

When this checkbox is checked, a test signal is turned off at the end of sequence running. (the AC Power Supply PCR-LA output is turned off.)

[12] UT

Enter the rated voltage of the EUT.

Input range	Select one of 100 V, 110 V, 120 V, 200 V, 220 V, 230 V, and 240 V, or enter a value ranging from 0.0 V to 305.0 V.

- An appropriate voltage range must be selected. Use the toolbar or the Instrument Menu to set the voltage range. For more information, please refer to
  ■ To 100 V/200 V button in 2.7.2, Toolbar.

[13] Freq

Enter the rated frequency of the EUT.

Input range	Select either 50 Hz or 60 Hz, or enter a value ranging from 1 Hz to 999.90 Hz.

[14] Repeat all

Enter the repetition count of all the selected seq tabs (Seq 1 to Seq 10).

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.

6.3　Results of Sequence Running

The running results are indicated every time the sequence for one seq tab finishes. The starting date and time are shown in the row above the No.1 row. Shown below is a typical test example. An indicated value becomes a blank or "0" if it is not related to the test. The Repeat set value in the panel for each seq tab is not indicated.

Table 6-1　Example of Indication of Running Results

No.	Repeat all	Seq	Item	UT	Freq	Ua (%)	Ub (%)	Uc (%)	Ub Angle	Uc Angle	Dura- tion	Inter- val
1	1	1	Unbalance	230.0	50.0	100.0	95.2	90.0	125	240	30	60
2	1	2	Unbalance	230.0	50.0	100.0	90.0	80.0	131	239	15	60
3	1	3	Unbalance	230.0	50.0	110.0	66.0	71.0	139	235	1	60

■ Description of Table 6-1

[Number] in the following items corresponds to the numbered steps in Fig. 6-1.

No. 1 (1st row): Unbalance

- [1] Seq tab: The Seq 1 tab is used.
- [2]Ua: 100.0 %
- [3]Ub: 95.2 %
- [4]Uc: 90.0 %
- [5]Ub Angle: 125°
- [6]Uc Angle: 240°
- [7] Duration: 30.000 seconds
- [8] Interval (repetition interval): 60.000 seconds

No. 2 (2nd row): Unbalance

- [1] Seq tab: The Seq 2 tab is used.
- [2]Ua: 100.0 %
- [3]Ub: 90.0 %
- [4]Uc: 80.0 %
- [5]Ub Angle: 131°
- [6]Uc Angle: 239°
- [7] Duration: 15.000 seconds
- [8] Interval (repetition interval): 60.000 seconds

No. 3 (3rd row): Unbalance

- [1] Seq tab: The Seq 3 tab is used.
- [2]Ua: 110.0 %
- [3]Ub: 66.0 %
- [4]Uc: 71.0 %
- [5]Ub Angle: 139°
- [6]Uc Angle: 235°
- [7] Duration: 1.000 second
- [8] Interval (repetition interval): 60.000 seconds

Items common to No. 1, No. 2, and No. 3

- Repeat (repetition count): The repetition count in a seq tab is not indicated.
- Sequences to run: Sequences are run in the order of Seq 1, Seq 2, and Seq 3.
- Seq end-Output off: Not indicated
- UT: 230 V
- Freq: 50.0 Hz
- Repeat all: The number of repetitions for the sequences to be run in the order of Seq 1, Seq 2, and Seq 3 is 1.

Chapter 7   IEC 61000-4-28

Describes the Power frequency variation immunity test according to the IEC 61000-4-28 standard.

7.1 Outline of the Test

The Power frequency variation immunity test determines the equipment's immunity against Power frequency variations.

■ Electromagnetic environment classes

Quick Immunity Sequencer does not specify an electromagnetic environment class or assume it to be a setting condition. An electromagnetic environment class for test conditions should be set at the user's discretion.

■ Three-phase operations

The test conditions are all set in relation to phase U. Test signals change simultaneously in three phases on the basis of phase U.

7.2 Preparing the Test Conditions
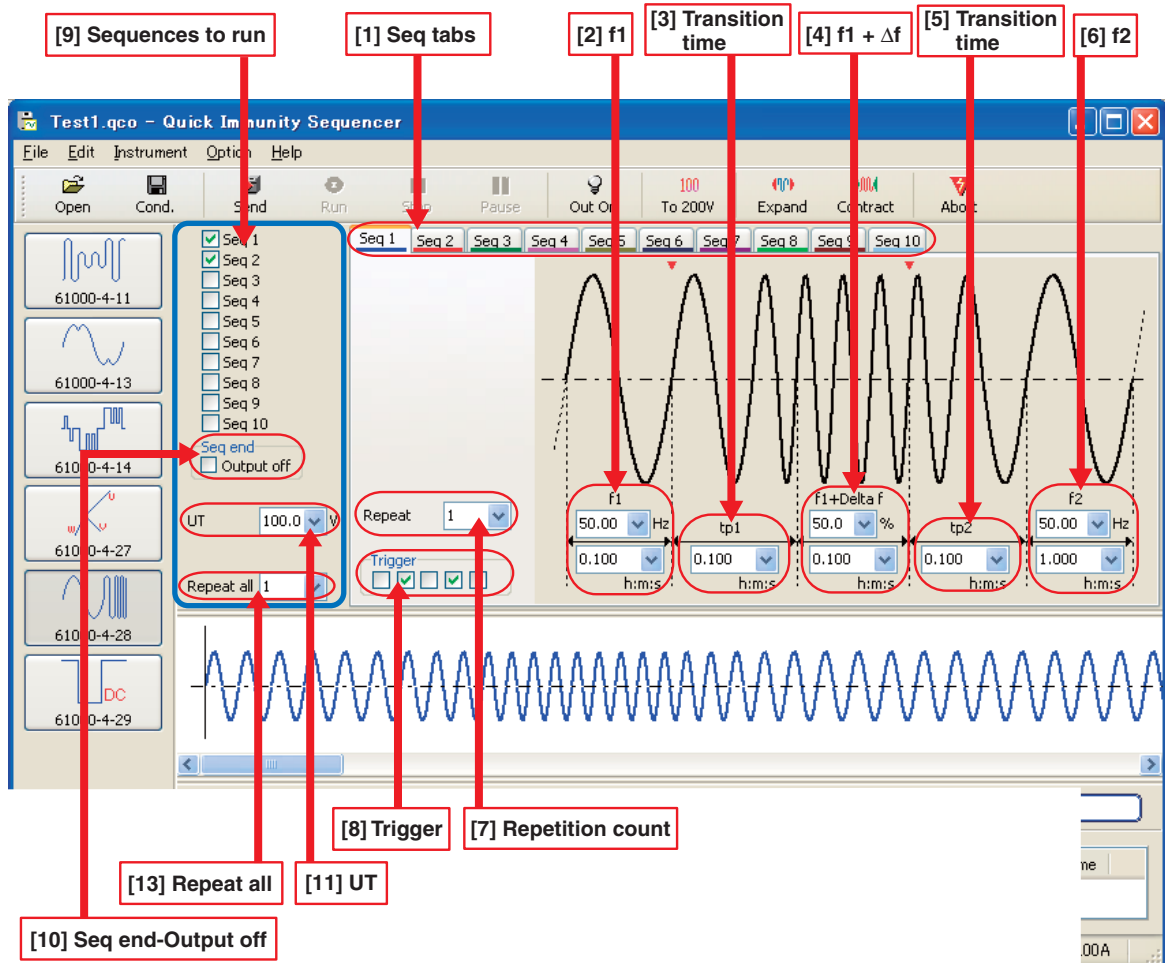
Fig. 7-1   Power Frequency Variation Setting Window

Set the following items. Select a value provided in the dropdown list or enter a value within the input range into the Edit box. After entering a value, press the Enter key to accept it.

[1]   Seq tabs

Allows you to set the test conditions in the panel of each seq tab (Seq 1 to Seq 10). These tabs show the heading numbers of the test conditions to be set in the following:

Test conditions can be copied or pasted between seq tabs. For more information, please refer to Edit Menu in 2.7.1, Menus.

[2] f1 (1st frequency and duration)

Enter the power frequency of the EUT.

Input range	Select either 50 Hz or 60 Hz, or enter a value ranging from 1 Hz to 999.90 Hz.

Enter the duration of f1. Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 60 s. Alternatively, enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

NOTE
• How to enter in hours: minutes: seconds format: A time value of up to 999:999:999.999 may be set by delimiting each unit with a colon (:). If only one colon is used, the value is treated as if in minutes: seconds format. Without a colon, it is regarded as a second value. Second values can be entered up to the third decimal place.

----

[3] tp1 (transition time)

Enter the transition time. Enter the value in seconds or in hours: minutes: seconds format.

Input range	Select either 1 s or 10 s, or enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

[4] f1 + Δf (variation ratio and duration)

Enter a variation ratio.

Input range	Select one of -15 %, -6 %, -3 %, 3 %, 4 %, and 15 %, or enter a value ranging from -50.0 to 50.0

Enter the duration of f1 + Δf. Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 120 s. Alternatively, enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

[5] tp2 (transition time)

Enter the return time. Enter the value in seconds or in hours: minutes: seconds format.

Input range	Select either 1 s or 10 s, or enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

[6] f2 (2nd frequency and duration)

Enter the power frequency of the EUT.

Input range	Select either 50 Hz or 60 Hz, or enter a value ranging from 1 Hz to 999.90 Hz

Enter the duration of f2. Enter the value in seconds or in hours: minutes: seconds format. When the test sequence moves to the next tab, it takes approx. 1.3 seconds for its preparation.

Input range	For most cases, select 60 s. Alternatively, enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

[7]   Repeat (repetition count)

Enter the number of repetitions for the test conditions in the seq tab in question.

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.

[8]   Trigger

Select trigger signal output. The red symbol ▼ indicates a location selected using the checkbox.

[9]   Sequences to run

Check the corresponding checkboxes of the seq tabs whose test conditions are used to run a test sequence. Test sequences are run in turn starting at Seq 1. Seq tabs whose corresponding checkboxes have not been checked are not used to run a test.

[10] Seq end-Output off

When this checkbox is checked, a test signal is turned off at the end of sequence running. (the AC Power Supply PCR-LA output is turned off.)

[11] UT

Enter the rated voltage of the EUT.

Input range	Select one of 100 V, 110 V, 120 V, 200 V, 220 V, 230 V, and 240 V, or enter a value ranging from 0.0 V to 305.0 V.

NOTE • An appropriate voltage range must be selected. Use the toolbar or the Instrument Menu to set the voltage range. For more information, please refer to
■ To 100 V/200 V button in 2.7.2, Toolbar.

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[12] Repeat all

Enter the repetition count of all the selected seq tabs (Seq 1 to Seq 10).

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.

7.3 Results of Sequence Running

The running results are indicated every time the sequence for one seq tab finishes. The starting date and time are shown in the row above the No.1 row. Shown below is a typical test example. An indicated value becomes a blank or "0" if it is not related to the test. The Repeat set value in the panel for each seq tab is not indicated.

Table 7-1   Example of Indication of Running Results

No.	Repeat all	Seq	Item	UT	f1	f1+Del taf	f1 time	tp1 time	Dura-tion	f2	tp2 time	f2 time
1	1	1	Variation of frequency	230.0	50.00	3.0	60.000	10.000	120.000	50.00	10.000	60.000
2	1	2	Variation of frequency	230.0	50.00	-3.0	60.000	10.000	120.000	50.00	10.000	60.000

■ **Description of Table 7-1**

[Number] in the following items corresponds to the numbered steps in Fig. 7-1.

No. 1 (1st row): Power frequency variations

- [1] Seq tab: The Seq 1 tab is used.
- [2] f1: 50.00 Hz
- [2] f1 time: 60.000 seconds
- [3] tp1 time: 10.000 seconds
- [4] tp1 + Deltaf: 3.0 %
- [4] Duration: 120.000 seconds
- [5] tp2 time: 10.000 seconds
- [6] f2: 50.00 Hz
- [6] f2 time: 60.000 seconds

No. 2 (2nd row): Power frequency variations

- [1] Seq tab: The Seq 2 tab is used.
- [2] f1: 50.00 Hz
- [2] f1 time: 60.000 seconds
- [3] tp1 time: 10.000 seconds
- [4] tp1 + Deltaf: -3.0 %
- [4] Duration: 120.000 seconds
- [5] tp2 time: 10.000 seconds
- [6] f2: 50.00 Hz
- [6] f2 time: 60.000 seconds

Items common to No. 1 and No. 2

- Repeat (repetition count): The repetition count in a seq tab is not indicated.
- Trigger: Not indicated
- Sequences to run: Sequences are run in the order of Seq 1 and Seq 2.
- Seq end-Output off: Not indicated
- UT: 230 V
- Repeat all: The number of repetitions for the sequences to be run in the order of Seq 1 and Seq 2 is 1.

8

Chapter 8   IEC 61000-4-29

Describes Voltage dip, Short interruption, and Voltage variation immunity tests for DC power inputs according to the IEC 61000-4-29 standard.

8.1 Outline of the Test

The Voltage dip, Short interruption, and Voltage variation immunity tests for DC power inputs determine the equipment's immunity against an abrupt drop or gradual decline in the supply voltage.

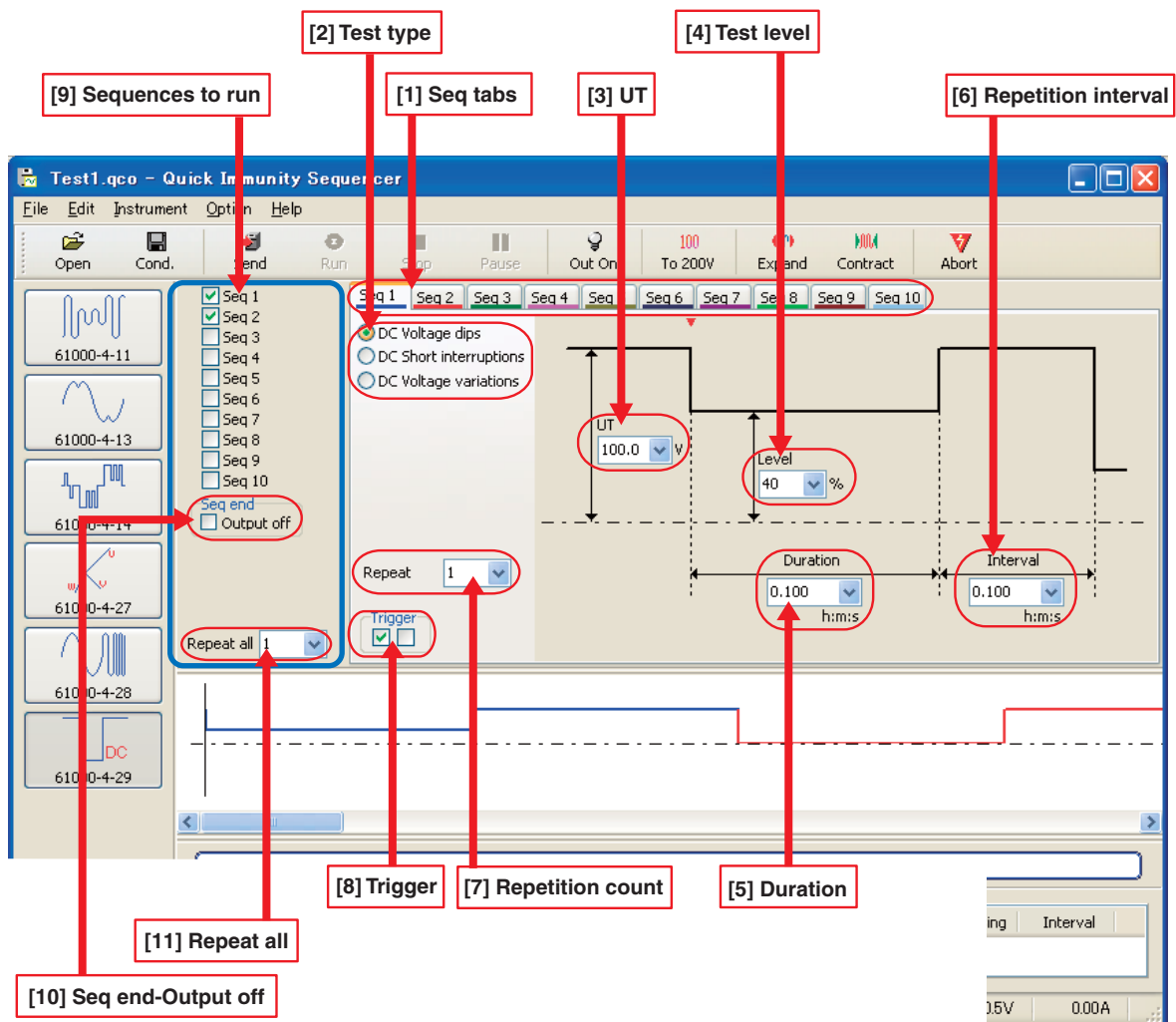## 8.2 Preparing the Test Conditions

8.2.1 DC Voltage Dips and Short Interruptions

Fig. 8-1   DC Voltage Dips and Short Interruptions Setting Window

Set the following items. Select a value provided in the dropdown list or enter a value within the input range into the Edit box. After entering a value, press the Enter key to accept it.

[1]　Seq tabs

Allows you to set the test conditions in the panel of each seq tab (Seq 1 to Seq 10). These tabs show the heading numbers of the test conditions to be set in the following:

Test conditions can be copied or pasted between seq tabs. For more information, please refer to Edit Menu in 2.7.1, Menus.

[2]　Test type

Select either DC Voltage dips, DC Short interruptions or DC Voltage variations as an immunity test. The diagram displayed on the right in the window changes depending on the test type button selected.

[3]　UT

Enter the initial voltage (equal to voltage at return).

Input range	Select one of 100 V, 110 V, 120 V, 200 V, 220 V, 230 V, and 240 V, or enter a value ranging from 0.0 V to 431.0 V.

NOTE • An appropriate voltage range must be selected. Use the toolbar or the Instrument Menu to set the voltage range. For more information, please refer to
■ To 100 V/200 V button in 2.7.2, Toolbar.

⚠ CAUTION • Check the set value of UT taken between the seq tabs used to run a test. If the UT set value differs between the seq tabs, unintended voltage change may occur, depending on selection of seq tabs whose sequences are run.

[4]　Level (test level)

For DC Voltage dips, enter a residual voltage in % with respect to UT. This level is set to 0 % (no input) in the case of DC Short interruptions.

Input range	Select either 40 % or 70 %, or enter a value ranging from 0 % to 200 %.

For DC Short interruptions, enter the impedance condition.

Input range	Select either High-impedance or Low-impedance.

When High-impedance is selected, an inverse current from the EUT is blocked. When Low-impedance is selected, an inrush current from the EUT is absorbed.

[5] Duration

Enter the duration of the DC Voltage dip or DC Short interruption. Enter the value in seconds or in hours: minutes: seconds format.

Input range	Select one of 0.01 s, 0.03 s, 0.1 s, 0.3 s, and 1 s, or enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

NOTE

- How to enter in hours: minutes: seconds format: A time value of up to 999:999:999.999 may be set by delimiting each unit with a colon (:). If only one colon is used, the value is treated as if in minutes: seconds format. Without a colon, it is regarded as a second value. Second values can be entered up to the third decimal place.

[6] Interval (repetition interval)

Enter the interval between the point at which the return voltage (UT) is reached and the next voltage drop. At the end of repetition intervals, this is the time taken to move to the next seq tab. Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 10.000 s. Alternatively, enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

[7] Repeat (repetition count)

Enter the number of repetitions for the test conditions in the seq tab in question.

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.

[8] Trigger

Select trigger signal output. The red symbol ▼ indicates a location selected using the checkbox.

[9] Sequences to run

Check the corresponding checkboxes of the seq tabs whose test conditions are used to run a test sequence. Test sequences are run in turn starting at Seq 1. Seq tabs whose corresponding checkboxes have not been checked are not used to run a test.

[10] Seq end-Output off

When this checkbox is checked, a test signal is turned off at the end of sequence running. (the AC Power Supply PCR-LA output is turned off.)

[11] Repeat all

Enter the repetition count of all the selected seq tabs (Seq 1 to Seq 10).

Input range	Select one of 1, 3, 5, and 10 times, or enter a value ranging from 1 to 9999.

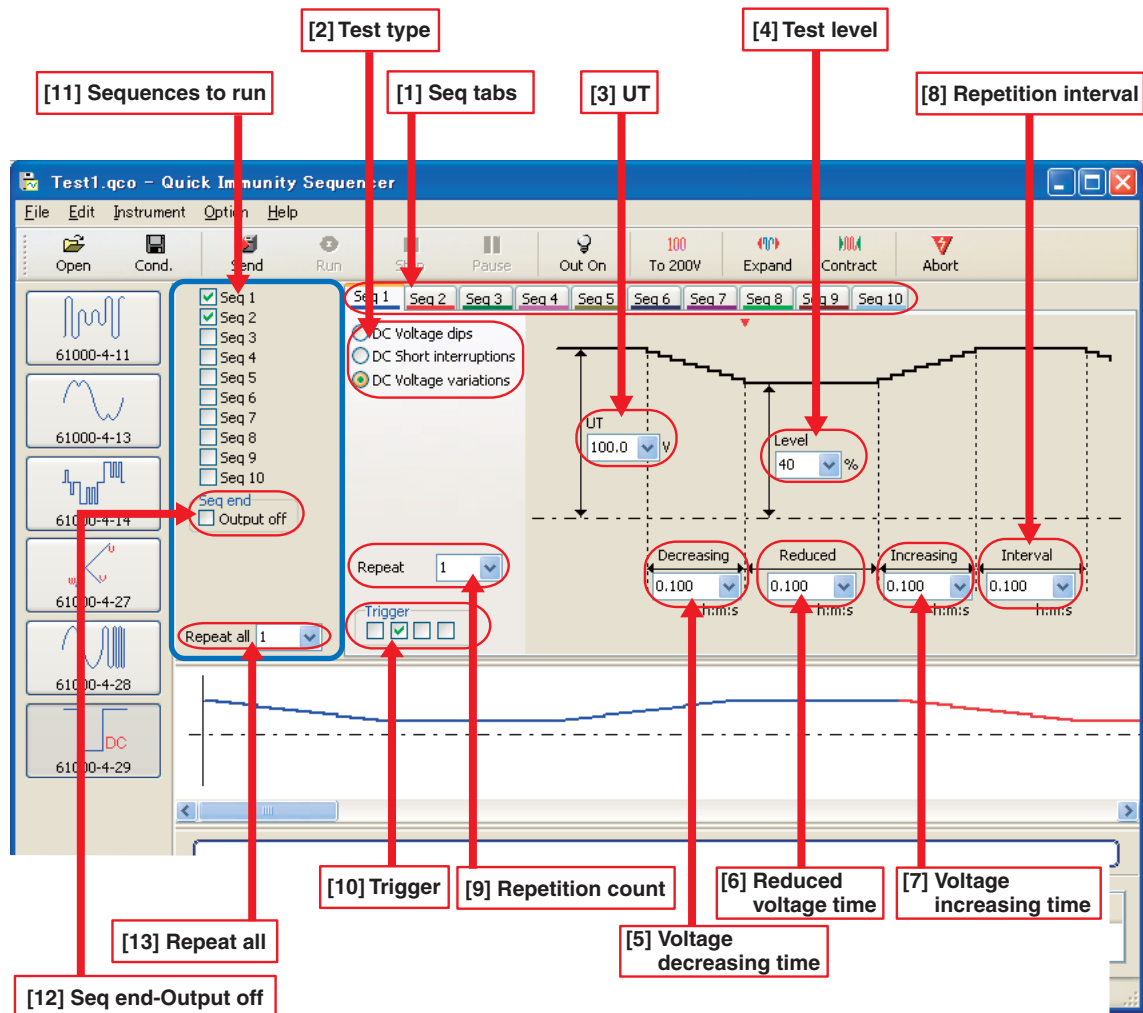## 8.2.2 DC Voltage Variations

Fig. 8-2   DC Voltage Variations Setting Window

The following items other than 2, 4, 5, 6, and 7 are the same as for DC Voltage dips and DC Short interruptions. Please refer to 8.2.1, DC Voltage Dips and Short Interruptions.

[1] Seq tabs

[2] Test type

Select DC Voltage variations.

[3] UT

[4] Level (test level)

For DC Voltage variations, enter the rate of change of DC voltage with respect to UT.

Input range	Enter one of 80 %, 85 %, and 120 %, or enter a value ranging from 0 % to 200 %.

[5] Decreasing (voltage decreasing time)

Enter the time taken to reduce voltage from the initial voltage (UT) to the reduced voltage. Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 2.000 s. Alternatively, enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

NOTE • Voltage rise and drop are approximated stepwise via the PCR-LA sequence function. The sequence function allows up to 100 steps to be set. For example, if there is only one valid seq tab and DC voltage variations have been set to it, both voltage rise and drop are approximated in 48 steps. If all seq tabs are selected (made valid) and configured for DC voltage variations, both voltage rise and drop are approximated in three steps.

[6] Reduced (reduced voltage time)

Enter the reduced voltage duration. Enter the value in seconds or in hours: minutes: seconds format.

Input range	Select one of 0.01 s, 0.03 s, 0.1 s, 0.3 s, and 1 s, or enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

[7] Increasing (voltage increasing time)

Enter the time taken to return from the reduced voltage to the initial voltage (UT). Enter the value in seconds or in hours: minutes: seconds format.

Input range	For most cases, select 10.000 s. Alternatively, enter a value ranging from 0.001 seconds to 999 hours 999 minutes 999.999 seconds.

[8] Interval (repetition interval)

[9] Repeat (repetition count)

[10] Trigger

[11] Sequences to run

[12] Seq end-Output off

[13] Repeat all

8.3 Results of Sequence Running

The running results are indicated every time the sequence for one seq tab finishes. The starting date and time are shown in the row above the No.1 row. Shown below is a typical test example. An indicated value becomes a blank or "0" if it is not related to the test. The Repeat set value in the panel for each seq tab is not indicated.

Table 8-1　Example of Indication of Running Results

No.	Repeat all	Seq	Item	UT	Level	Decre-asing	Duration	Incre-asing	Interval
1	1	1	DC Voltage variation	230.0	85	2.000	1.000	2.000	10.000
2	1	2	DC Voltage dips	230.0	70	—	0.100	—	10.000
3	1	3	DC Short interruption	230.0	70	—	0.100	—	10.000

■ Description of Table 8-1

[Number] in the following items corresponds to the numbered steps in Figs. 8-1 and 8-2.

No. 1: DC Voltage variations 40 %

- [1] Seq tab: The Seq 1 tab is used.
- [2] Test type: DC Voltage variations
- [3] UT: 230 V
- [4] Level (test level): 85 %
- [5] Decreasing time (voltage decreasing time): 2.000 seconds
- [6] Reduced (reduced voltage time): 1.000 second
- [7] Increasing time (voltage increasing time): 2.000 seconds
- [8] Interval (repetition interval): 10.000 seconds
- [9] Repeat (repetition count): The repetition count in the Seq 1 tab is not indicated.

No. 2: DC Voltage dips 70 %

- [1] Seq tab: The Seq 2 tab is used.
- [2] Test type: DC Voltage dips
- [3] UT: 230 V
- [4] Level (test level): 70 %
- [5] Duration: 0.100 seconds
- [7] Interval (repetition interval): 10.000 seconds
- [8] Repeat (repetition count): The repetition count in the Seq 2 tab is not indicated.

No. 3: DC Vhort interruptions

- [1] Seq tab: The Seq 3 tab is used.
- [2] Test type: DC Short interruptions
- [3]UT: 230 V
- [4] Level (impedance): Not indicated
- [5] Duration: 0.100 seconds

- [7] Interval (repetition interval): 10.000 seconds
- [8] Repeat (repetition count): The repetition count in the Seq 3 tab is not indicated.

Items common to No. 1, No. 2, and No. 3

- Trigger: Not indicated
- Sequences to run: Sequences are run in the order of Seq 1, Seq 2, and Seq 3.
- Seq end-Output off: Not indicated
- Repeat all: The number of repetitions for the sequences to be run in the order of Seq 1, Seq 2, and Seq 3 is 1.

Appendix

Guides users to the appropriate standard depending on the nature of the testing desired.

A.1 Test Standard Selection Guide

Items you wish to test	Generic term	Single- or three-phase or DC	Standard	Refer to:
Abrupt voltage changes	Voltage change	Single- or three-phase	IEC61000-4-11	3.2.1, Voltage Dips and Short Interruptions
Abrupt voltage changes and short interruptions falling to 0V				
Abrupt voltage changes, and specifying the phase angle at the start of change				
Slow voltage changes				3.2.2, Voltage Variations
Peak of waveform clipped	Voltage distortion		IEC61000-4-13	4.2.1, Combined Harmonics (Flat Curve)
Waveform with sharp peaks				4.2.2, Combined Harmonics (Over Swing)
Superimposing noise on power supply				4.2.3, Sweep in Frequency 4.2.4, Individual Harmonics
Fluctuating voltage in relatively low amplitude	Voltage change		IEC61000-4-14	5.2.1, Voltage Fluctuation, 5.2.2, Interval
Unbalance in three phases	Voltage unbalance or phase angle change	Three-phase	IEC61000-4-27	6.2, Preparing the Test Conditions
Changes in power frequency	Power frequency	Single- or three-phase	IEC61000-4-28	7.2, Preparing the Test Conditions
Abrupt DC voltage changes	Voltage change	DC	IEC61000-4-29	8.2.1, DC Voltage Dips and Short Interruptions
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