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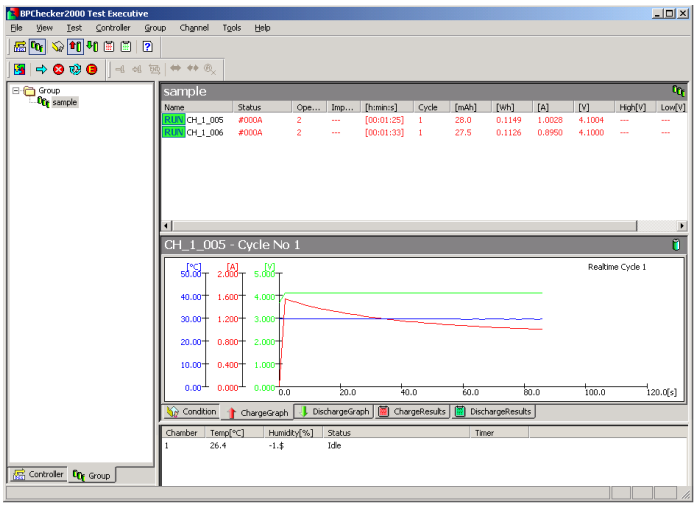
USER'S MANUAL

PFX2000 Series
Application Software(SD002)

BPChecker2000
Ver. 2.3



KIKUSUI

Use of Operation 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 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.

⚠ Safety Precautions

Before starting battery tests using this application software, please thoroughly read the *PFX2000 Series Charge/Discharge Battery Test System Operation Manual* that describes the system hardware. Use extreme caution to make correct connections and handle the components of the system properly. Improper connections or handling can lead to serious accidents such as damage to or explosion of the DUT (battery).

The system is equipped with many functions for protecting the DUT (battery) both by hardware and software. Some of the protection functions enable you to set appropriate values according to the test conditions. Unless there is a special reason not to do so, use these protection functions when performing tests.

Definition of Symbols

⚠CAUTION **Indicates a potentially hazardous situation which, if ignored, may result in damage to the product and other property.**

Arrangement of this manual

This Manual is made up of the following sections.

Preface

Provides a brief descriptions of the product and specifies its system requirements.

Chapter 1 Setup

This chapter covers the installation of the BPChecker2000 application and the USB driver.

Chapter 2 Before Using BPChecker2000

This chapter describes information you should know before using BPChecker2000.

Chapter 3 Configuring the Hardware

This chapter describes the Hardware Configuration Wizard that is used to configure the PFX2000 system hardware.

Chapter 4 Creating Groups

This chapter describes the Group Administrator that is used to create groups for performing tests.

Chapter 5 Creating Test Conditions

This chapter describes the Test Condition Editor and the procedure for creating test conditions.

Chapter 6 Preparations for Test Execution

This chapter describes items that you should check and items you need to configure before starting the actual test.

Chapter 7 Executing Tests

This chapter describes the procedures for starting the actual tests.

Chapter 8 Analyzing Test Results

This chapter describes the Graph Viewer, a tool for analyzing test results.

Appendix

The appendix provides explanation of recovery after power failures, alarms, operation when connections are improper, and folders and files that are created. It also provides a list of the menus and the range of test condition settings.

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Preface

Outline of This Manual

This user's manual describes BPChecker2000, an application software for the PFX2000 Series Charge/Discharge Battery Test System.

For information regarding the hardware of the PFX2000 Series, see the *PFX2000 Series Charge/Discharge Battery Test System Operation Manual*.

Product Version Covered

This user's manual covers BPChecker2000 version 2.3x.

Documents That Come with BPChecker2000

BPChecker2000 comes with the following documents.

User's Manual

This manual. Covers all aspects of BPChecker2000 including information on how to install the software and how to use the software.

Help Document

You can open the help document from the Help menu when BPChecker2000 is running. The help document includes all the information in this manual except the installation procedure. It also includes some contents that are not covered in this manual.

Start Guide

PDF documents in the tutor folder on the program CD-ROM. The guides are structured so that even first-time users can easily run the tests by using the sample test conditions file in the same folder.

There are two guides available, one for the PFX2011 Charge/Discharge Power Supply Units (PFX 2011 tutorial.pdf) and another for the PFX2021s (PFX2021 tutorial.pdf). Use the guide that corresponds to the charge/discharge power supply unit that you are using.

Graph Viewer Operating Procedure

A PDF document named Graph Viewer.pdf in the tutor folder on the program CD-ROM. This document explains the operating procedures of the Graph Viewer, a test result analysis program. The Graph Viewer is also described in this manual and the help document. However, this PDF document uses many screen images of the Graph Viewer so that even first-time users can easily understand the procedures.

NOTE

- Currently the tutorial documents are provided as in Japanese only.

Product Overview

BPChecker2000 is a dedicated application software for the PFX2000 Series Charge/Discharge Battery Test System. BPChecker2000 enables you to set the conditions of the battery charge/discharge characteristics tests, execute the tests, and analyze the test results on a personal computer (PC).

There are two editions of BPChecker2000: Full Edition and Basic Edition.

Full Edition

This edition provides you with all the functions of the BPChecker2000.

Full Edition enables you to control two systems of PFX2121 120-ch Control Units via the USB port. This means that up to 240 charge/discharge power supply channels can be controlled simultaneously.

The 120-ch Control Unit is equipped with two TP-BUS ports, each of which can control up to 60 charge/discharge power supply channels. For example, in the case of the PFX2332 5-Unit Frame with five PFX2011 2-ch Charge/Discharge Power Supply Units, up to six units can be connected to each TP-BUS port.

Furthermore, by adding a single PFX2211 Impedance Measurement Unit, impedance can be measured on up to 120 charge/discharge power supply channels that are connected to the control unit of the same system.

Moreover, if the PC is capable of GPIB or RS232C communications, temperature chambers (by Espec Corp.) can be controlled externally for synchronized testing.

Basic Edition

This edition provides you with limited functions of the BPChecker2000.

Basic Edition enables you to control one system of PFX2121 120-ch Control Unit via the USB port. However, the maximum number of charge/discharge power supply channels that can be controlled is limited to 2. You cannot add the impedance measurement unit, but synchronized temperature chamber control is equivalent to that of the Full Edition.

Basic Edition has limitations on the maximum number of channels that can be controlled and the impedance measurement function, but all other functions are equivalent to the Full Edition.

Comparison of Editions

	Full Edition	Basic Edition
Number of controllable channels*1	Up to 240 channels	Up to 2 channels
Ability to use the Impedance Measuring Unit	Possible	Not possible
Synchronized operation with temperature chambers	Possible	Possible

NOTE *1When using a PFX2021 Charge/Discharge Power Supply unit, the number of controllable channels is reduced to one-half.

Program Construction

BPChecker2000 consists of the following five programs.

Hardware Configuration Wizard

This program is used to detect the charge/discharge power supply units that are connected to the control unit and configure the connection environment with other hardware devices (impedance measurement unit, temperature chamber, etc.).

Group Administrator

This program is used to create or delete groups for performing tests.

Test Condition Editor

This program is used to create and edit all test conditions related to charge/discharge tests.

Test Executive

This program is used to execute charge/discharge tests according to the test conditions file that you created using the Test Condition Editor.

Graph Viewer

This program is used to display graphs of the test data created by the Test Executive on the screen and print the graphs.

System Requirements

The following are the minimum requirements for running BPChecker2000.

NOTE

- Turn OFF Advanced Power Management (APM) and Suspend functions on your PC, if they are available. If left ON, proper operation may be hindered by periodic interrupts called SMIs to the CPU.

Personal computer

CPU	Pentium III 450 MHz or faster
OS	Windows 2000 Professional (Intel) (SP2 or later) or Windows XP Professional (Intel)
Memory	128 MB or more
HDD	At least 20 MB of free space for installation. At least 10 GB of free space for storing data recommended
CD-ROM	Required for installing the application
Mouse	Required
Display	1024 × 768 or better
Printer	Printer supported by Windows 2000 or Windows XP

Communications requirements

■ Communications with the control unit

USB port	Free USB ports to connect at least the number of control units to be used

■ Communications with the temperature chamber

Communication environment with the temperature chamber is required only if you are controlling temperature chambers by Espec Corp. (up to 6 units). For the connection procedure, see the respective instruction manuals.

A VISA library must be installed in the controller (Windows) for performing communications with the temperature chambers.

Kikusui original VISA library (KI-VISA) is provided on the program CD-ROM. The latest version can also be downloaded from Kikusui website (http://www.kikusui.co.jp/en/download/).

VISA library	One of the VISA libraries below is required. • NI-VISA 2.6 or later by National Instruments • IO Libraries K01.00 or later by Agilent Technologies • KI-VISA Ver. 3.0.0 or later

Communicating using GPIB

You must install a GPIB driver.

GPIB board	GPIB board by National Instruments or Agilent Technologies. GPIB board by Contec or Interface can also be used when using KI-VISA.
GPIB driver	Appropriate driver for the board
Protocol converter	PMS-CA or PMS-CG by Espec Corp. (Control up to three temperature chambers when using RMS-CG)

Communicating using RS232C

Use a straight cable for the connection. Operation using USB-to-serial adapters is not warranted.

RS485-to-RS232C adapter	ERC-200C by Espec Corp.

RS485 protocol

Address	1 to 6
Transmission mode	NORMAL
Data rate	4800 bps
Stop bit	2 bits

Data bit	8 bits
Parity bit	NONE
Delimiter	CR + LF

Types of temperature chambers supported

Temperature chamber	Temperature chambers that can be controlled using the protocol converter or RS485-to-RS232C converter by Espec Corp. as indicated above.

Chapter 1 Setup

This chapter covers the installation of the BPChecker2000 application and the USB driver.

NOTE

- Installation of BPChecker2000 and USB driver requires an administrator privilege when you log on the windows. Once installed, the application can be executed using a user-level account.

1.1 Package Contents

The BPChecker2000 package contains the following items.

	Item	Quantity
	CD-ROM containing the program	1
	User's Manual (Z1-002-642)	1

1.2 Installing BPChecker2000

You must install the entire program to the hard disk to use BPChecker2000. Installation is performed using a setup program (SETUP.EXE) on the CD-ROM.

1. Insert the CD-ROM into the CD-ROM drive.
2. After a few moments, Internet Explorer starts.

   Select Quick Install to open the folder containing the setup program and double-click Setup.

NOTE

- If Internet Explorer does not start automatically, start Windows Explorer, click on the CD-ROM drive, and start Setup.

The following 2 setup options are available.

☐ Japanese Satellite

☐ WinXP Visual Style

Japanese Satellite

This option is valid on PCs running Japanese Windows. If the checkbox is selected, the Japanese version of BPChecker2000 is installed. (It is selected by default.) If the checkbox is cleared, the English version of BPChecker2000 is installed. (On PCs running English Windows, the English version of BPChecker2000 is installed regardless of whether the checkbox is selected or not.)

WinXP Visual Style

This option is valid on PCs running Windows XP. If the checkbox is selected, Windows XP style windows and dialog boxes are displayed by BPChecker2000.

NOTE

- Due to a problem of the SETUP program, the installation may fail if not selecting Japanese Satellite. Therefore it is highly recommended to select the Japanese Satellite option even if your PC is non-Japanese version.

  The Japanese GUI will appear only when running Japanese Windows, otherwise the English GUI will be enabled automatically.

1.3 Installing the USB Driver

If you are connecting the PFX2121 Control Unit to the PC for the first time, you must install the USB driver for the PFX2121. The USB driver file is included in the BPChecker2000 CD-ROM. The installation of the driver must be carried out separately from the installation of the application program.

Before connecting the control unit to the PC, check the rotary switch setting on the front panel. If you are using only a single control unit, be sure to set the rotary switch to 1. If you are using two control units simultaneously, set the rotary switches to 1 and 2. PC will only detect the control units if the control units are set as described above. BPChecker2000 will not operate properly if the two control units are set to the same rotary switch setting or if the rotary switch is set to 2 when only a single control unit is connected.

When connecting the control unit to the PC, you can connect the control unit directly to the USB port of the PC or to a self-powered USB hub. (The control unit cannot be connected to a bus-powered USB hub.) As the control unit is powered from the bus, a separate power line is not necessary.

■ Installing the driver

1. Connect the PFX2121 to the USB port on the PC using a USB cable.

   When the PC detects the control unit for the first time, the Plug&Play function opens the window shown in Fig. 1-1. The same window appears, if the PC is started with the control unit connected to the PC (assuming that the control unit is connected for the first time).

Fig.1-1 Detection of New Hardware

After a few moments, the Found New Hardware Wizard window shown in Fig. 1-2 appears.

Fig. 1-2 Found New Hardware Wizard

2. Click **Next** to move to the window shown in Fig. 1-3.

3. In Fig. 1-3, select **Search for a suitable driver for my device (recommended)** and click **Next**.

Fig. 1-3 Install Hardware Device Drivers

4. On the dialog box that appears as shown in Fig. 1-4, select **Specify a location** and click **Next**.

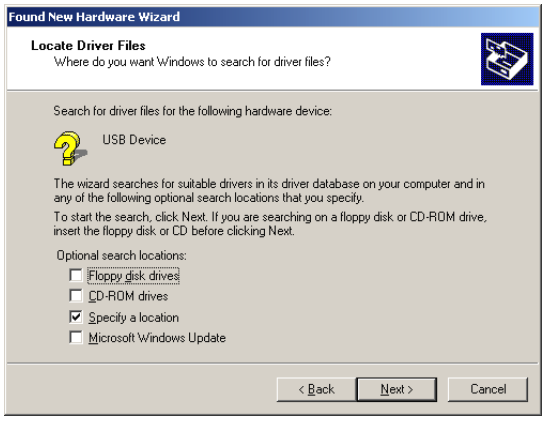


Fig. 1-4 Locate Driver Files

5. You will be asked to specify the location of the USB device driver file. Specify PFX2000K.INF in the usbdrv folder on the BPChecker2000 CD-ROM and click **OK**.

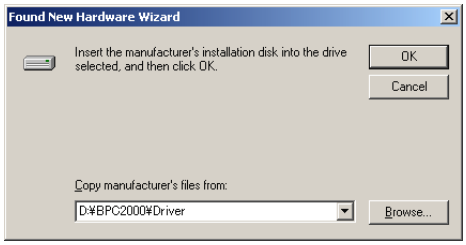


Fig. 1-5 Specify the Location of the Driver File

6. A message appears indicating that the wizard found the specified driver. Click **Next**.

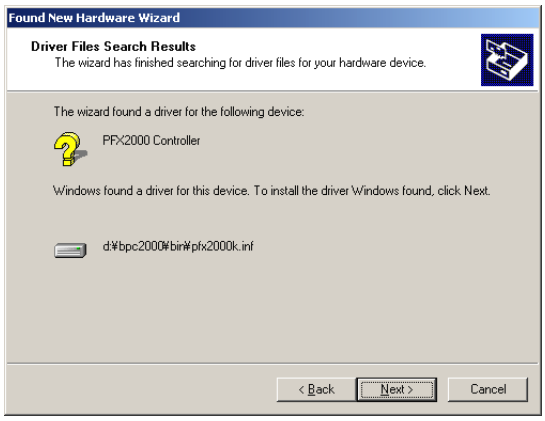


Fig. 1-6 Device Driver Detection

7. A screen appears indicating that Windows has finished installing the device driver. Click **Finish** to exit the wizard.

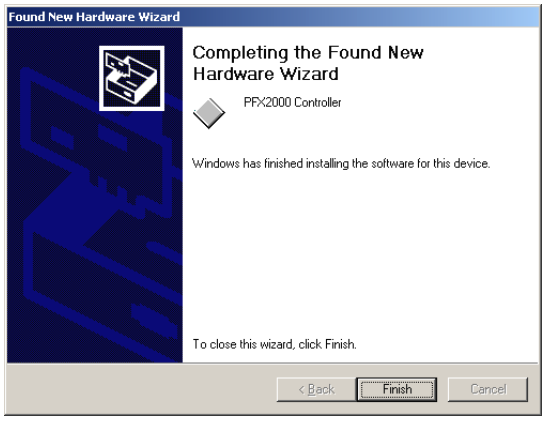


Fig. 1-7 Finish Wizard

■ Checking whether the driver has been installed properly

To check whether the driver has been installed properly, open Device Manager to check the status of the device.

1. Click the **Start** button, point to **Settings**, and then click **Control Panel**.
2. Double-click the **System** icon to open System Properties.
3. Click the **Hardware** tab and then click **Device Manager**.

   The Device Manager window appears as shown in Fig. 1-8.

   Find the Kikusui USB instruments category and check that KIKUSUI PFX2121 is shown under it.

   If two PFX2121 are connected, two KIKUSUI PFX2121 lines are shown.

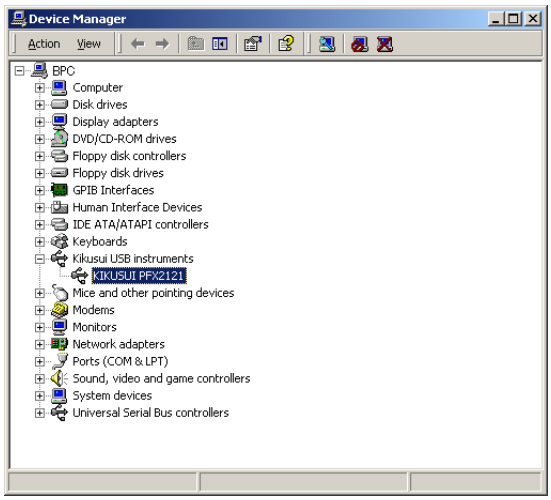


Fig. 1-8 Device Manager Display

4. Then, right-click KIKUSUI PFX2121 and choose **Properties** from the shortcut menu. KIKUSUI PFX2121 Properties appear.

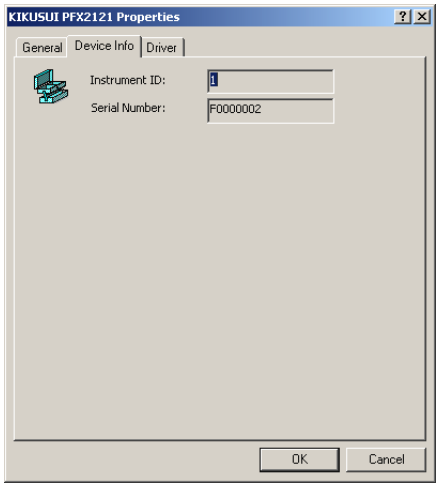


Fig. 1-9 PFX2121 Properties

5. Click the **Device Info** tab to display Instrument ID and Serial Number of the detected PFX2121.

   If you are using only a single PFX2121, confirm that Instrument ID is set to 1. If you are using two PFX2121s, check that one of them is set to 1 and the other is set to 2 (the order of 1 and 2 is irrelevant).

Chapter 2 Before Using BPChecker2000

This chapter describes information you should know before using BPChecker2000.

2.1 Hardware Configuration Concept on BPChecker2000

Concept of controllers

The concept of controllers as viewed from BPChecker2000 is the same as the actual hardware configuration. Instrument ID refers to the number that is set using the ID switch on the front panel of the PFX2121 120-ch Control Unit. The Instrument ID number is either 1 or 2.

Concept of channels

The concept of channels as viewed from BPChecker2000 is simplified greatly as compared with the actual hardware configuration. From BPChecker2000, all the channels that are connected to a single control unit (up to 120 channels) appear as they are connected directly. Therefore, hardware elements such as frames and units that are in between do not exist in BPChecker2000.

Channels contain position information called node numbers. Node numbers are automatically determined from the combination of the frame address, which is assigned to each frame, and the node address, which is automatically determined by the position in which the corresponding unit is installed in the frame. The frame number is set using the FRAME switch on the rear panel of the frame. However, the user cannot arbitrary set the node address.

The physical installation position can be determined by combining the aforementioned Instrument ID and the node number. BPChecker2000 uses these two values to determine the channel name.

Concept of groups

Group is a concept that does not exist at the hardware level, but exists in BPChecker2000. Basically, group is a collection of channels that share a set of test conditions. Grouping multiple channels with the same test objective (same test conditions) offer many benefits such as the simplification of operations and hierarchical classification of test results on graphs. The assignment of temperature chamber is also done at the group level when performing tests in synchronization with the temperature chamber. (See “Concept of temperature chambers” below.)

You can create up to 64 groups. There is no limit on the number of channels that are bound to a single group. Channels present in another controller can also be mixed freely.

Groups are identified by their names. Unlike controllers and channels, there are no numbers for identifying groups.

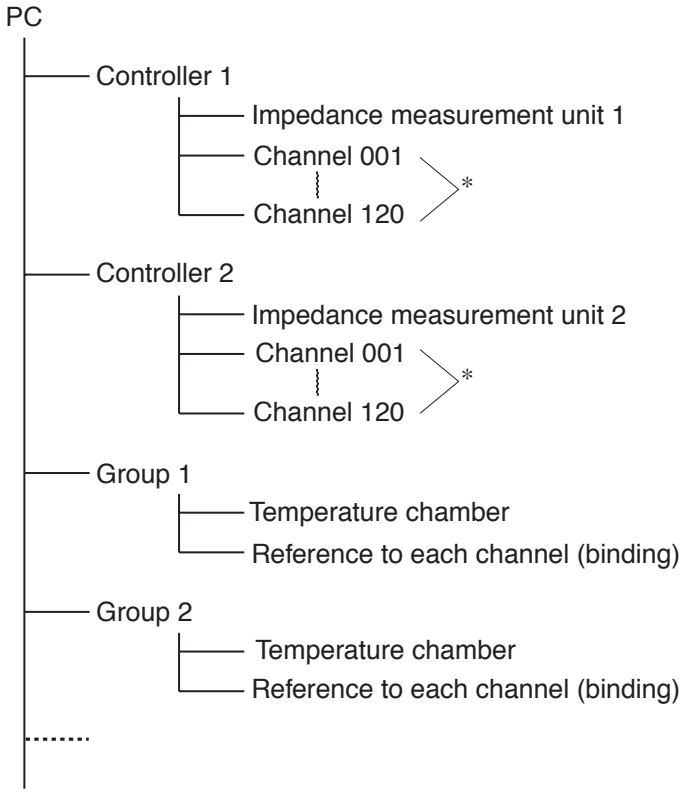
If a new group is created, the group does not contain any channels. Therefore, you must bind at least one channel to a group. You can also unbind channels that are already bound or delete groups that are no longer needed.

Concept of impedance measurement unit

There are no instances in which the optional PFX2211 Impedance Measurement Unit is implicitly handled on BPChecker2000. At the hardware level, one impedance measurement unit corresponds to one controller. Therefore, all the channels within the same controller system share a single impedance measurement unit. Consequently, the impedance measurement of each channel is performed in order according to a waiting list principle. BPChecker2000 automatically handles the waiting list process.

Concept of temperature chambers

The synchronization of temperature chambers is assigned at the group level. Since BPChecker2000 can create multiple groups, temperature chambers can be controlled independently per group. Note that the maximum number of temperature chambers that can be controlled is six. This means that temperature chambers cannot be assigned to all groups (the maximum number of groups is 64).



* When the PFX2021 Charge/Discharge Power Supply Unit is used, only odd-numbered channels are valid.

Fig.2-1 Hardware Configuration on BPChecker2000

2.2 Executable Charge/Discharge Tests

The following seven types of charge/discharge tests can be executed using BPChecker2000.

Charge

- Constant current/constant voltage charge (CC-CV)
- Constant current charge (CC)
- Pulse charge

Discharge

- Constant current discharge (CC)
- Constant power discharge (CP)
- Constant current/pulse discharge (CC-Pulse)
- Constant power/pulse discharge (CP-Pulse) (when using the PFX2021)

These tests can be arbitrary combined to create test conditions using the Test Condition Editor and executed using the Test Executive. For details on each test, see section 5.4, “Seq Sheets.”

2.3 Flow of Test Procedure

If you are using BPChecker2000 for the first time after installation, carry out the following procedure.

1. Configure the hardware (start the Hardware Configuration Wizard)

   Set the number of control units and the use of impedance measurement units and temperature chambers.

   Organize the channels (charge/discharge power supply unit) separately for each control unit system.

2. Create the group (start the Group Administrator)

   Create a special folder (group) that is recognized by the BPChecker2000 system, and specify the group folder name and path.

3. Create test conditions (start the Test Condition Editor)

   Create a test conditions file.

   Specify the group folder in which to save the test conditions.

4. Execute the test (start the Test Executive)

   Assign the channels that were organized using the Hardware Configuration Wizard to the groups created using the Group Administrator.

   Assign the test conditions you created using the Test Condition Editor to the channels and execute the test.

5. Analyze the test (start the Graph Viewer)

   Display the test result file created by the Test Executive on graphs.

3

Chapter 3 Configuring the Hardware

This chapter describes the Hardware Configuration Wizard that is used to configure the PFX2000 system hardware.

3.1 The Hardware Configuration Wizard

The Hardware Configuration Wizard is used to detect the charge/discharge power supply units (channel modules) that are connected to the control unit and configure the connection environment with other hardware devices (impedance measurement unit, temperature chamber, etc.). The screen takes on a Wizard format.

Starting the Hardware Configuration Wizard

The following two methods are available in starting the program.

- From the Windows desktop folder or program folder, double-click the shortcut icon of the Hardware Configuration Wizard program.
- Start the program from the Options menu of the Test Executive program.

The program that starts using either of the two methods is the same, but the operation of the program varies depending on the execution status of the Test Executive.

When the Test Executive is running

All the setup items on the Hardware Configuration Wizard are set to read-only, and settings cannot be changed.

When you exit the Test Executive, the settings can be changed.

When the Test Executive is not running

All the setup items on the Hardware Configuration Wizard can be changed.

However, do not start the Test Executive until you close the Hardware Configuration Wizard.

3.2 Configuring the Hardware

The Hardware Configuration Wizard consists of the following three steps (screens).

If you click the Cancel button in the middle of the operation, the settings on that page may be discarded.

Step 1 Controller configuration

Step 2 Channel configuration

Step 3 Temperature chamber configuration

1. Start the Hardware Configuration Wizard.

   The controller configuration screen appears.

   If the Test Executive is running, close it to allow changes in the Hardware Configuration Wizard settings.

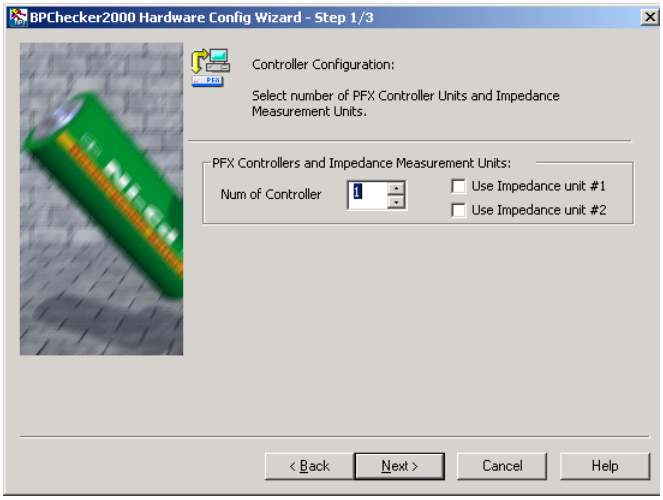


Fig.3-1 Step 1/3

On this screen, specify the number of controller units and impedance measurement units that is to be used.

- Num of Controller

  Select 1 or 2 depending on the number of control units to be used.

  On the Basic Edition, only 1 control unit can be used.

- Impedance unit #1 (#2)

  Specify whether to use the impedance measurement unit for each control unit.

  On the Basic Edition, the impedance measurement unit cannot be used.

2. When you are done with the settings, click **Next**.
The channel configuration screen appears.

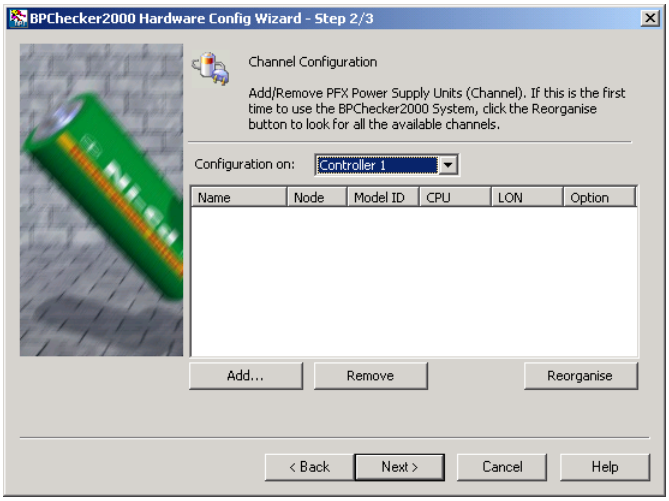


Fig. 3-2 Step 2/3 Channels Not Yet Configured

On this screen, set the number of channel modules (charge/discharge power supply units) to be used for each controller unit. The list shows all the channels that are currently detected.

The maximum number of channels that can be used on the Basic Edition is 2.

When configuring new channels

When configuring a new channel such as when you are using the BPC2000 system for the first time, select the controller system from **Configuration** on and click **Reorganise**.

Channels that are connected to the selected controller are displayed. When using 2 controller systems, configure the channels for each.

⚠CAUTION

- When reorganize is carried out, all the data including the current channel configuration, group and channel assignments, and the progress status of the test are lost. Use extra caution when performing this procedure.
  To simply add or delete channels, use the **Add** or **Delete** buttons. In this case, the existing configuration information is retained.

When adding or deleting channels from an existing channel configuration

To add a channel to the existing channel configuration, click **Add**. The Add Channel dialog box appears. Enter the node number of the channel module to be added and click **Add**.

Fig. 3-3 Addition of Channels

To delete channels from the existing channel configuration, select the channels you wish to delete, and click **Delete**.

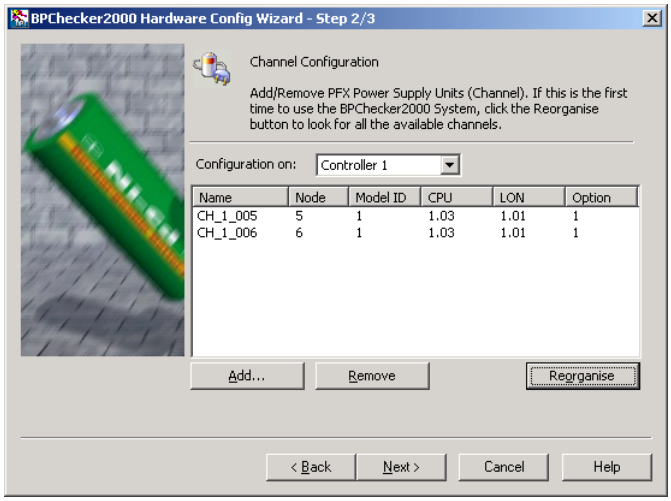
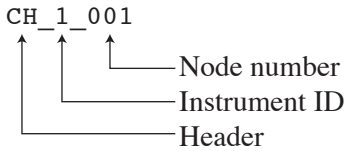


Fig. 3-4 Step 2/3 Channels Configured

The channel names that appear on the list take the following form.



3. When you are done with the settings, click **Next**.

The temperature chamber configuration screen appears. For details on synchronized operation of temperature chambers, see section 7.10, “Temperature Chamber Synchronization.”

If you are not using the temperature chamber, select 0 and proceed to step 4.

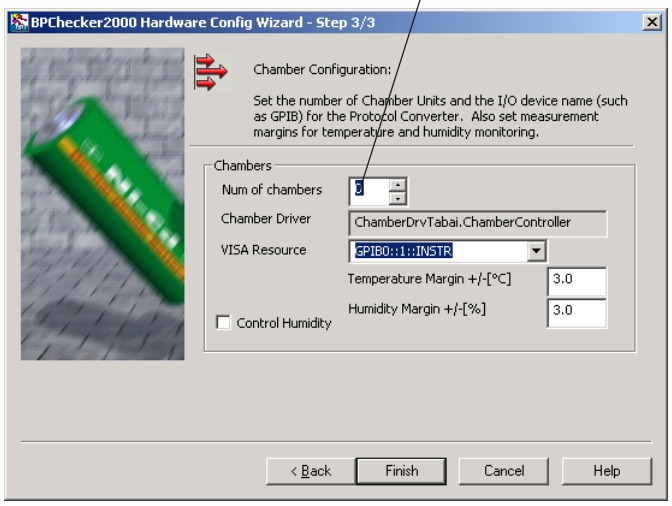


Fig. 3-5 Step 3/3

On this screen, enter settings for using the temperature chamber.

- Num of Chambers

  Set the number of temperature chambers. You can specify up to 6 chambers. A value of 0 means that the temperature chamber is not used. VISA library software is required to use the temperature chambers. For details on the VISA library, see “Communications with the temperature chamber” on page P-4 .
- Chamber Driver

  Select the driver software for the temperature chamber. Currently, only Tabai is supported.
- VISA Resource

  To use GPIB, specify the GPIB board number and GPIB address name.

  Example) If the GPIB board number is 0 and the GPIB address is 1

  Select GPIB0::1::INSTR.

  To use RS232C, specify the COM number of the serial port.

  Example) For serial port COM1

  Select ASRL1::INSTR.
- Control Humidity

  If this checkbox is selected, humidity control is performed. If it is not, only temperature control is performed.
- Temperature Margin and Humidity Margin

  Set the margins for the temperature and humidity settings.

4. Click **Finish** to exit the Hardware Configuration Wizard.

Chapter 4 Creating Groups

This chapter describes the Group Administrator that is used to create groups for performing tests.

4.1 The Group Administrator

The Group Administrator is used to create groups for performing tests.

Groups are used to handle multiple test execution channels collectively. All files including test conditions and test results are created within a specific group folder. Channels existing in the same group can share the test conditions created within the group. In addition, when performing tests in synchronization with the temperature chambers, they are done at the group level.

Starting the Group Administrator

To start the Group Administrator, double-click the shortcut icon of the Group Administrator program from the Windows desktop folder or program folder.

You can also start the program from the Group menu of the Test Executive program.

4.2 Adding and Deleting Groups

When the Group Administrator is stared, a list of all current registered groups is shown on the screen.

To create a group, you must decide on the group name and folder name for saving the data files (test conditions, measurement data, etc.) in advance. (It is recommended that the same name be used for the group name and folder name.)

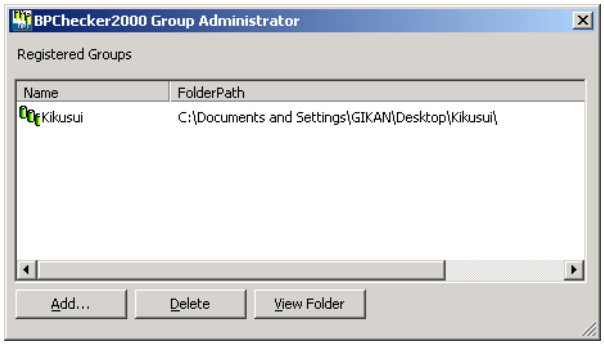


Fig.4-1 Registered Group

■ Adding a group

1. Click **Add**.

   Add Group dialog box appears.

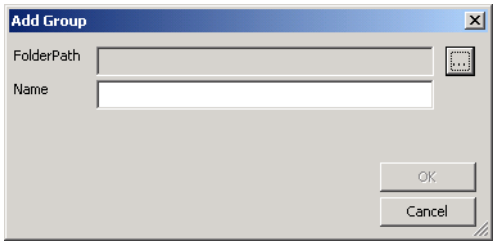


Fig. 4-2

2. Click the [...] button to the right of the folder path box.

   The Browse For Folder dialog box appears.

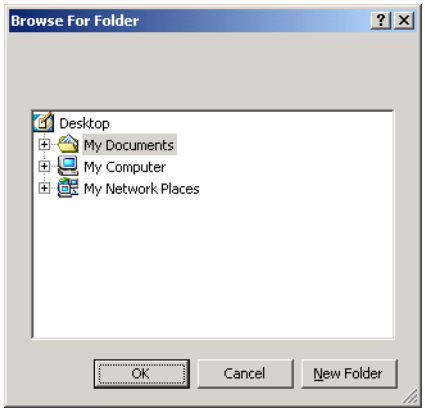


Fig. 4-3

3. Specify the data folder that the group is to use.

   For the data folder, you can use an existing folder or create a new folder in the Browse For Folder dialog box.

   If the group name or the folder is already in use by an existing group, the new group cannot be created.

   When you specify the data folder and return to the Add Group dialog box, the folder path is displayed. By default, the folder name is entered in the Name box.

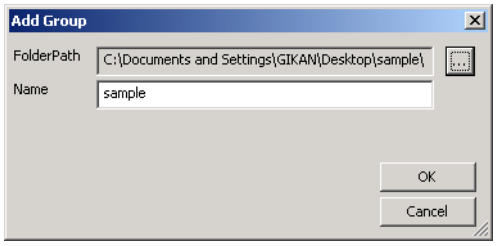


Fig. 4-4

4. If you do not need to change the group name, click **OK** to close the dialog box.

   If you wish to use a different group name, enter the group name in the Name box, and then click **OK** to close the dialog box.

When group creation is complete, the group is registered and managed as a BPChecker2000 system group. From this point, it is identified by the Test Executive program.

In addition, the folder is given a special icon. The icon is used also when the folder is displayed on Windows Explorer. (A Desktop.INI file is created in the group folder to display the special icon. Do not delete this file.)

If an existing folder is specified as the folder for the group, the existing folders and files inside the specified folder are not deleted or changed (however, Desktop.INI is created).

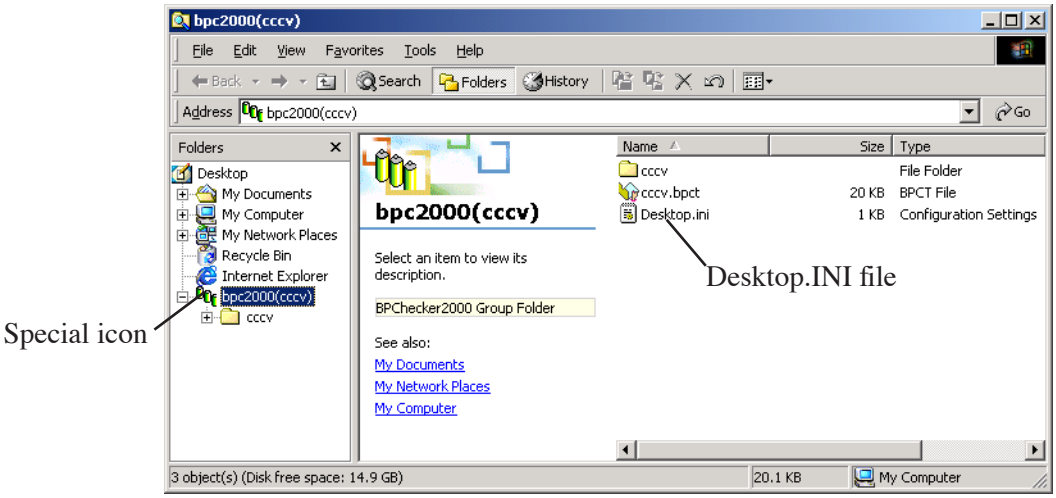


Fig. 4-5

■ Deleting a group

If you wish to delete an existing group, select the group and click **Delete**.

However, groups that have one or more channels bounded to them cannot be deleted.

When group deletion is complete, the registration of the group is removed from the group management of the BPChecker2000 system, and the special icon is no longer displayed. The folder and existing folders and files inside the folder are not deleted or changed (however, Desktop.INI is deleted).

5

Chapter 5 Creating Test Conditions

This chapter describes the Test Condition Editor and the procedure for creating test conditions.

5.1 Test Condition Editor

The Test Condition Editor is a program used to create and edit all test conditions related to charge/discharge tests.

The contents that are edited using the Test Condition Editor include several items other than those that actually concern the test conditions. The editable contents are grouped into the following categories.

1. Module
2. Comment
3. Battery information
4. Protections
5. Recording Method
6. Impedance Measurement
7. Life Judgement
8. Sequence
9. Sequence sheets

You can assign an arbitrary name to the test conditions file and place the file in an arbitrary folder.

Starting the Test Condition Editor

To start the Test Condition Editor, double-click the shortcut icon of the Test Condition Editor program from the Windows desktop folder or program folder.

You can also start the program from the Group menu of the Test Executive program.

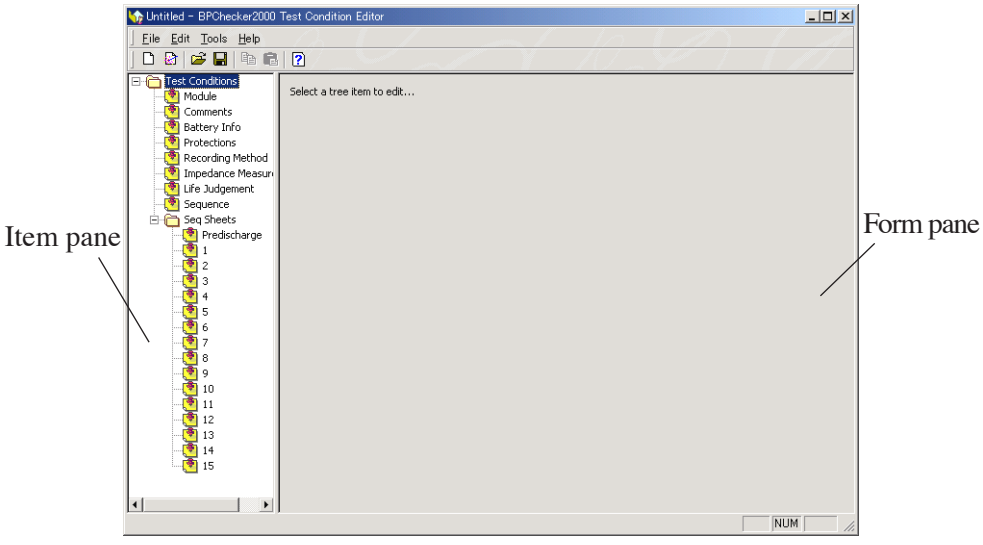


Fig.5-1 Test Conditions > Initial Screen

The left and right sides of the screen are called Item Pane and Form Pane, respectively.

5.2 Creating and Saving Test Conditions Files

■ Creating a test conditions file

Creating a new file

To create a new test conditions file, choose **New** from the **File** menu. The condition of the program when it is started is the same as when the Test Condition Editor is first started from the shortcut icon. The test conditions file name is shown as Untitled.

Changing an existing file

To change an existing test conditions file, choose **Open** from the **File** menu.

If you save the modified file to a separate file by selecting **Save As** from the **File** menu, a new file diverted from the existing file can be created.

■ Saving the test conditions file

To save the opened test conditions file, choose **Save** from the **File** menu.

To save to a separate name, choose **Save As** from the **File** menu, and specify the destination file name in the file dialog box. When saving the file by assigning a name, the Test Condition Editor sometimes displays a message concerning group management.

Message that appears when saving a file

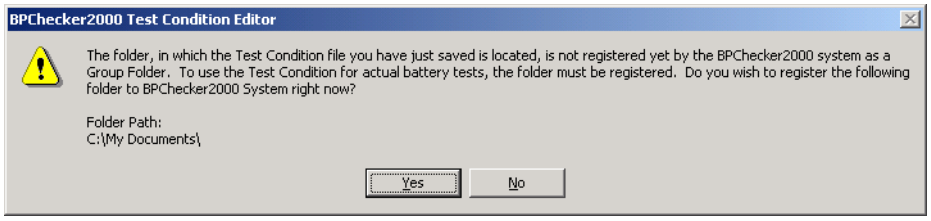


Fig. 5-2 Message That Appears When Saving a File

When the Test Executive program uses a test conditions file to execute the test, the test conditions file must reside immediately under the folder of a group that the BPChecker2000 system identifies.

For example, if a test conditions file named C:\MyFolder\MyTestCond.BPCT is created and the file is to be used in an actual test, the folder named C:\MyFolder must be a group folder that the BPChecker2000 system identifies. If the folder is not yet identified, the test conditions file can be saved, but the Test Executive cannot use it.

When a test conditions file is saved, the Test Condition Editor always checks whether the folder that will contain the test conditions file belongs to a group that the BPChecker2000 system identifies. If it is not, the Test Condition Editor will ask whether the folder is to be registered and identified as a group. If you decide to register, the Add Group dialog box appears.

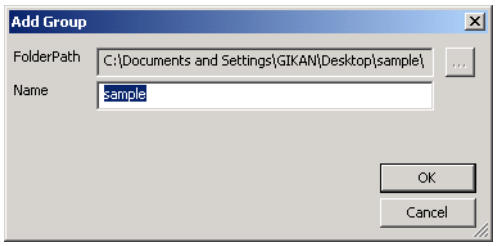


Fig. 5-3 Add Group Dialog Box

This dialog box is basically the same as the dialog box that the Group Administrator displays, except the folder path name is already determined and cannot be changed.

In addition, the group name that is indicated is a recommended name that has already been confirmed as a new assignable group name. Unless there is a special reason not to do so, create the group using this name.

If the folder is identified as a group here, the Test Executive will interpret the file as a test conditions file that can be used for executing the test.

5.3 Test Condition Items

The Test Condition Editor takes on a window layout similar to Windows Explorer. Selecting an item on the left side of the screen (Item Pane) switches the right side of the screen (Form Pane). The contents of the Form Pane vary depending on the selected item.

The succeeding sections will describe the contents of each item in order.

NOTE

- **Showing the input range**

  For items that require a value to be entered in a text box such as the nominal voltage of Fig. 5-4, the input range appears when you move the mouse pointer over the text box.

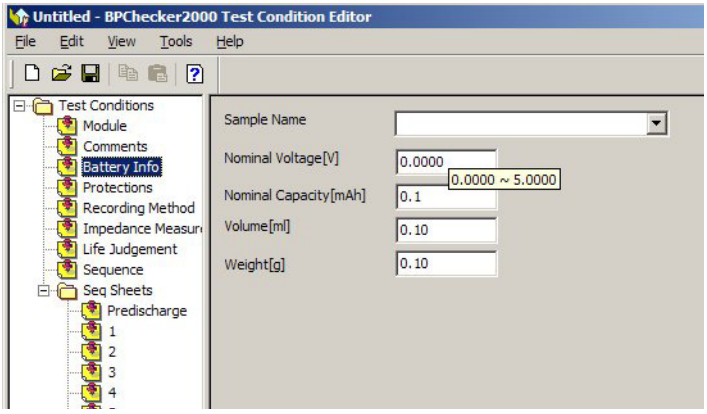


Fig. 5-4 Showing the input range

The example of Fig. 5-4 indicates that the nominal voltage can be entered in the range of 0.0000 V to 5.0000 V.

You can enter a value outside the indicated range, but when you select an item from a different item pane (move to different screen), a message illustrated in Fig. 5-5 will appear.

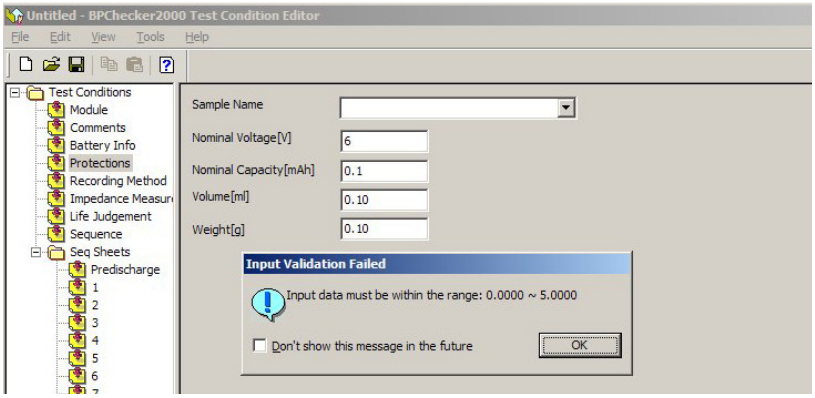


Fig. 5-5 Message Indicating That the Value Is Outside the Range

- The input ranges are listed in appendix section A.5, “Range of Test Condition Settings.”

5.3.1 Module

This screen displays information about the charge/discharge power supply unit to be used. The screen is used to enter basic settings.

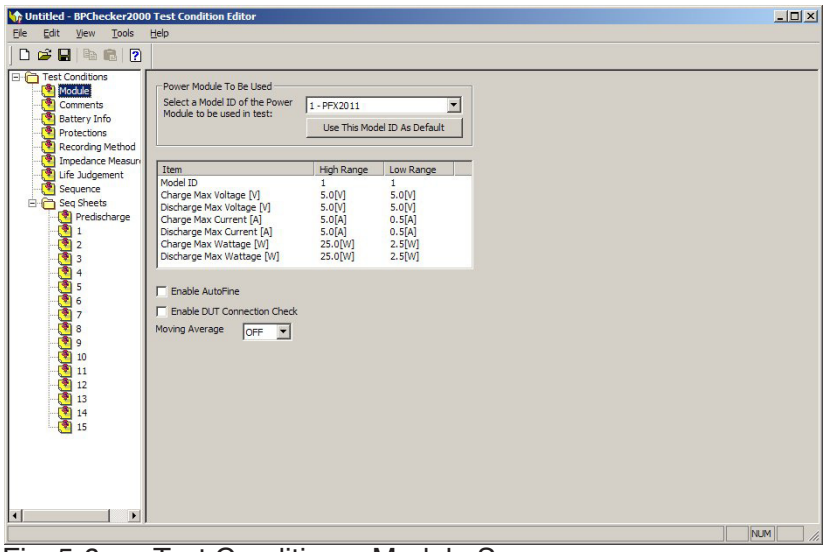


Fig. 5-6 Test Condition > Module Screen

Expected Model

Set the model (Model ID) of the power supply module you plan to use. This allows appropriate input ranges of parameters such as voltage and current to be speculated. The appropriate input ranges that are determined by the model selection are also used to check the range of values entered for other items that specify the actual charge/discharge conditions.

Normally, the selectable models are as follows:

Model ID	Model
1	PFX2011
21	PFX2021

The list shown below the drop-down list contains an outline of the electrical specifications of the selected charge/discharge power supply unit.

If you select PFX2011, the values for high and low current ranges are displayed. You can select different ranges for the high and low ranges for each cycle or for charge and discharge even within the same cycle.

If you select PFX2021, values are shown only in the high range column, because there is only one current range.

Use This Model ID As Default

Press this button to make the model selected for Expected Model the default model. The condition of this default model is applied to the new test conditions that are created.

NOTE

- On some special-order specifications of the BPChecker2000 systems, you may be able to select Model IDs that are not usually selectable.
  When assigning test conditions to actually execute the test, the Model ID selected here and the actual model ID of the module (power supply module that is actually used in the charge/discharge test) must match, or the test cannot be executed.
  When multiple Model IDs are supported, select the Model ID here carefully.

Enable AutoFine

The auto fine (auto correction) function is enabled if the checkbox is selected.

The auto fine function brings the current value set by the constant current operation and the current that actually flows closer together through automatic adjustment. You can eliminate the error caused by the accuracy of the constant current setting by enabling this function. This function is effective when you need higher accuracy of constant current performance or when you wish to suppress the current error between channels.

Enable DUT Connection Check

The connection check function of the DUT (device under test) is enabled if the checkbox is selected.

The DUT connection check function generates a warning when you attempt to execute the test when the DUT is not connected.

Moving Average

Select the moving average value.

You can decrease the fluctuation of the measured value even further by performing moving average. You can select the average count from n = 0 (OFF), 2, 4, and 8.

5.3.2 Comments

This screen is used to enter the date, the name of the operator, and notes.

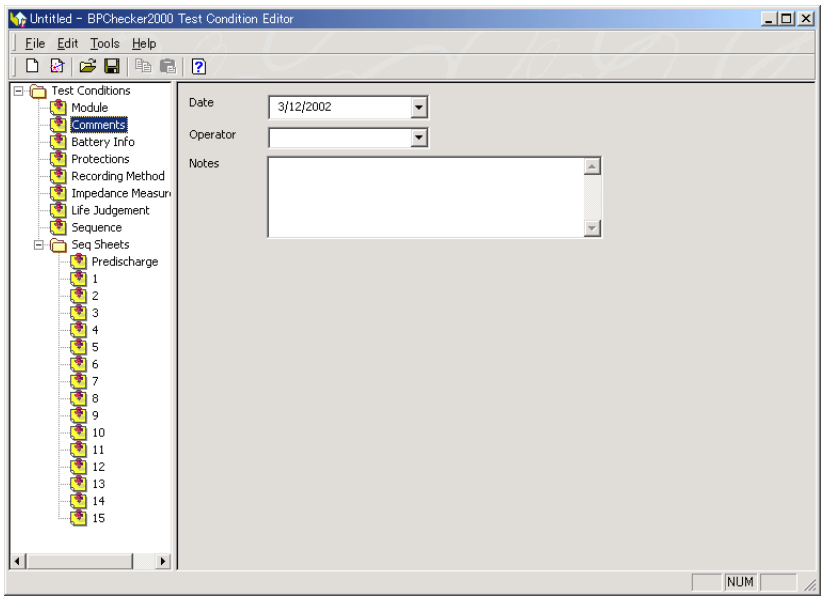


Fig. 5-7 Test Condition > Comments Screen

Date

Enter the date directly or click the arrow on the right and use the date picker (calendar screen used to enter the date) that appears.

Input format	dd/mm/yyyy or some similar format (The actual input format of the date depends on the Windows region setting.)

Operator

Enter the name of the operator. You can enter up to 63 characters.

Notes

Enter an arbitrary note or comment. You can enter up to 255 characters.

5.3.3 Battery Info

This screen is used to enter information concerning the battery.

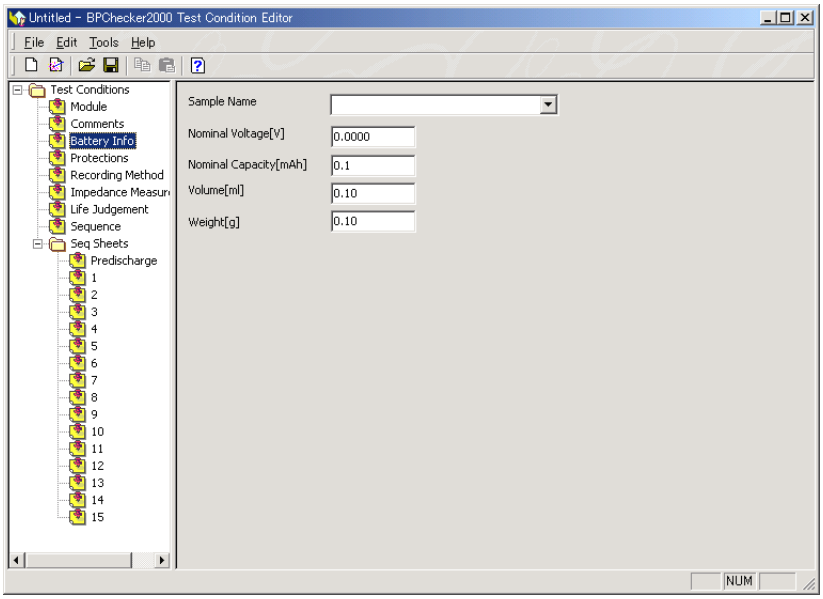


Fig. 5-8 Test Condition > Battery Info

Sample Name

Enter the name of the DUT (battery).

Nominal Voltage

Enter the nominal voltage of the DUT.

Nominal Capacity

Enter the nominal capacity of the DUT. The nominal capacity is used as a reference when setting OAH (overcharge capacity protection). Enter an appropriate value.

Volume

Enter the volume of the DUT.

Weight

Enter the weight of the DUT.

5.3.4 Protections

⚠ CAUTION

- This function is used to prevent serious accidents such as damages to or explosion of the DUT (battery). Unless there is a special reason not to do so, use this protection function when performing tests.

NOTE

- You must set software protection to protect the DUT (battery). However, if you do not set appropriate values, alarms and warnings will occur frequently, and you will not be able to execute the tests.

  For a detailed explanation of alarms and warnings, see the appendix.

This screen is used to set the software protection. For a description of how to set the hardware protection, see “Protections page” in section 7.12.4, “Properties Display.”

Each item is enabled only when the checkbox is selected. Items that have their checkboxes cleared do not function.

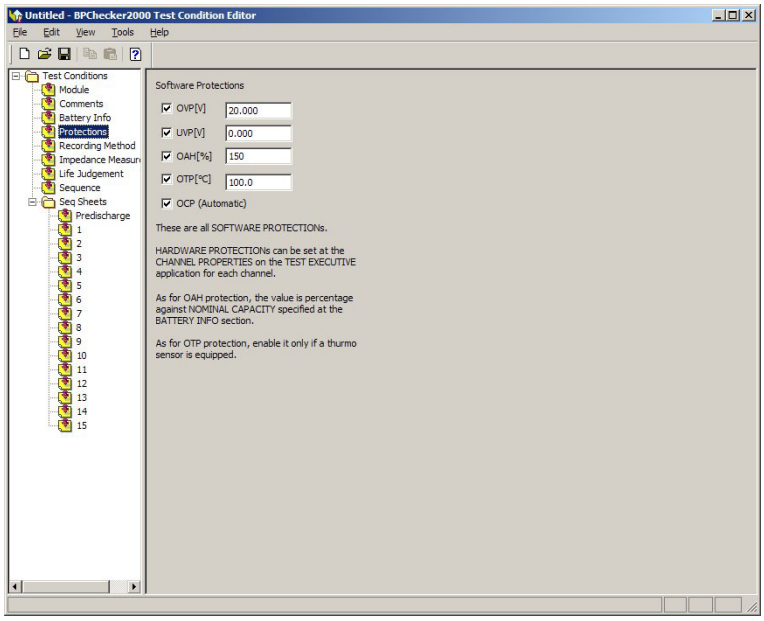


Fig. 5-9 Test Condition > Protections

OVP

Enter the software OVP (overvoltage protection) value. If battery voltage exceeds the OVP value during testing, an alarm occurs and the test is aborted.

UVP

Enter the software UVP (undervoltage protection) value. If battery voltage falls below the UVP value during testing, an alarm occurs and the test is aborted.
In normal cases, set a voltage relatively close to the cutoff voltage for discharging.

OAH

Enter the software OAH (overcharge capacity protection) value. If battery capacity exceeds the OAH value during charge testing, an alarm occurs and the test is aborted. The value is a percentage with respect to the nominal capacity [mAh] that was entered in section 5.3.3, “Battery Info.”
Set an appropriate value when performing overcharge or overdischarge tests.

OTP

Enter the software OTP (overtemperature protection) value. If battery temperature exceeds the OTP value during testing, an alarm occurs and the test is aborted.
Specify an appropriate value by taking the temperature measurement error and ambient temperature fluctuation into consideration.

OCP (Automatic)

The software OCP (overcurrent protection) value is equal to the specified current + 100 mA (10 mA when set to low range). If charge current exceeds the OCP value during testing, an alarm occurs and the test is aborted.

5.3.5 Recording Method

This screen is used to set the recording method of the charge/discharge data file that the Test Executive creates. You can select one or more items.

Each item is enabled only when the checkbox is selected. Items that have their checkboxes cleared do not function.

NOTE

- Note that charge/discharge data will not be recorded, if all items are not selected.

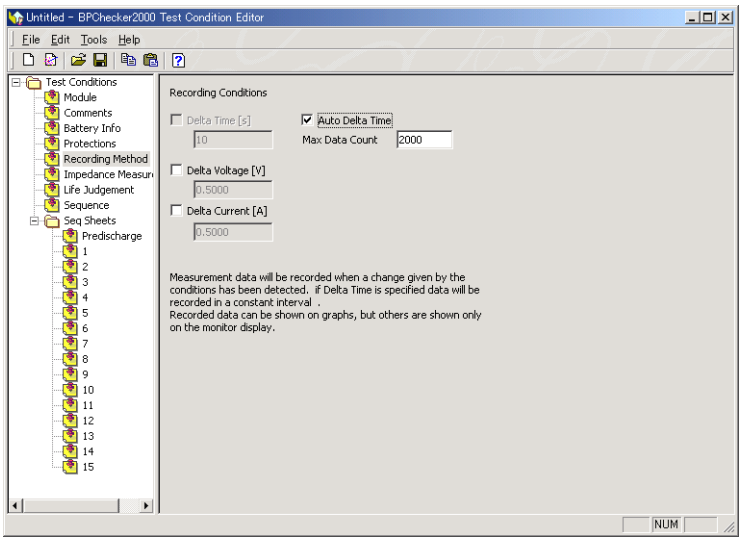


Fig. 5-10 Test Condition > Recording Method

Delta Time [s]

Data is recorded at the specified time interval. If a short time is specified, the amount of data that is recorded increases. Note that if the test period is long (several hours or more), the number of data points becomes greater than 1 000 points. Therefore, use caution when setting the time.

When the test period is long, consider using “AutoDelta Time” that puts a limitation based on the total amount of data. If AutoDelta Time is selected, this item cannot be selected.

Auto Delta Time

Calculates a different delta time for each test phase and uses the calculated time interval to record the data. The delta time is calculated by dividing the maximum test period of each phase (the time when the test is performed as scheduled without early termination including the pause section) by the “maximum number of data points.” Specify the maximum number of data points here.

If Delta Time is selected, this item cannot be selected.

Delta Voltage [V]

Data is recorded when the voltage changes by an amount greater than the specified value.

Delta Current [A]

Data is recorded when the current changes by an amount greater than the specified value.

5.3.6 Impedance Measurement

This screen is used to set the impedance measurement.

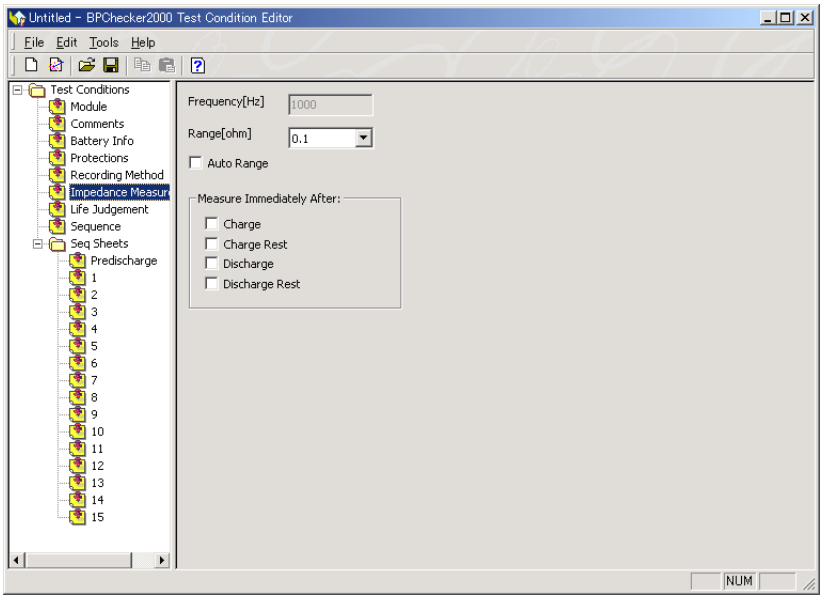


Fig. 5-11 Test Condition > Impedance Measurement

Frequency [Hz]

Set the measurement frequency. The frequency is fixed to 1000 Hz in the current version of the software.

Range [Ω]

Select the measurement range.

Auto Range

The auto range function is enabled if the checkbox is selected. Using the selected measurement range as the starting point, this function automatically switches the range as necessary.

Measure Immediately After

Specify the point in the test execution cycle when impedance measurement is to be carried out. You can turn ON/OFF the selection independently. Measurement is performed only at the point corresponding to the selected checkboxes.

Charge	Measures immediately after charge is complete.
Charge Rest	Measures immediately after charge rest is complete.
Discharge	Measures immediately after discharge is complete.
Discharge Rest	Measures immediately after discharge rest is complete.

5.3.7 Life Judgement

This screen is used to set the life judgement items. Battery capacity generally degrades or its impedance increases as batteries are repeatedly charged and discharged. The life judgement function determines the performance degradation of the battery by comparing the actual capacity against the nominal capacity and measuring the impedance value. This function terminates the test in the same manner as when the test is normally completed if it determines that the battery has reached the end of its life. For details on the termination of the test, see section 7.4, “Terminating Tests."

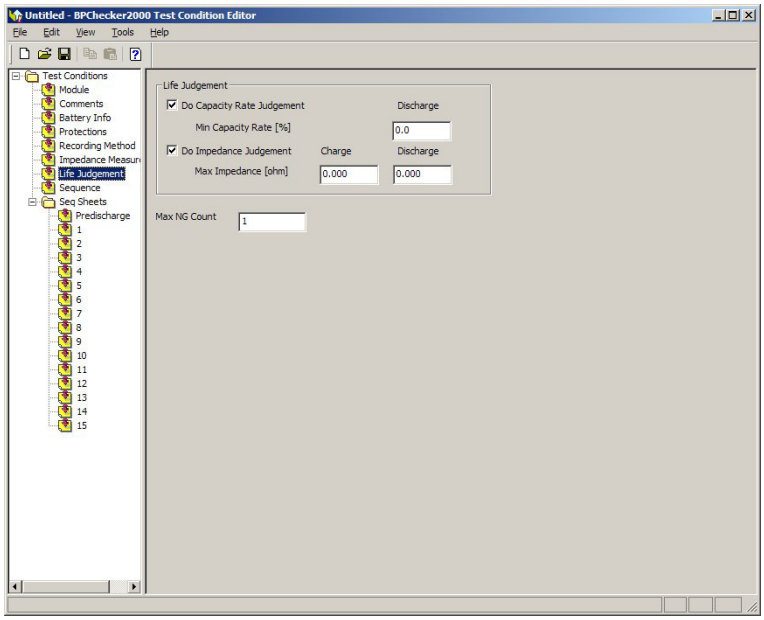


Fig. 5-12 Test Condition > Life Judgement

Do Capacity Rate Judgement

If this checkbox is selected, the function determines that the battery has reached the end of its life when the measured capacity falls below the specified percentage (minimum capacity rate value) of the nominal capacity.

- **Min Capacity Rate [%]**

  The minimum capacity rate can only be specified for discharge. The reference capacity value is the nominal capacity [mAh] that was entered in section 5.3.3, “Battery Info,” which is taken to be 100%.

Do Impedance Judgement

If this checkbox is selected, the function determines that the battery has reached the end of its life when the measured impedance exceeds the specified impedance.

- **Max Impedance [mohm]**

  The maximum impedance can be specified independently for charge and discharge. The maximum impedance is evaluated on all measurements that were specified in section 5.3.6, “Impedance Measurement.”

Max NG Count

Specify the number of failures for terminating the test. For example, if you specify a value of 9, the test is terminated when the function determines that the battery has reached the end of its life nine times.

5.3.8 Sequence

This screen is used to set the sequence. Sequence defines how to execute the charge/discharge contents that are specified in sequence sheets #1 to #15 (described in section 5.4, “Seq Sheets”). The Test Executive performs the charge/discharge test according to the sequence information specified here.

Repeat specifies the number of times a sequence sheet is repeated; Loop specifies the number of times the set of sequence sheets (all 15 types) are repeated. The test is performed in order from sequence sheet #1.

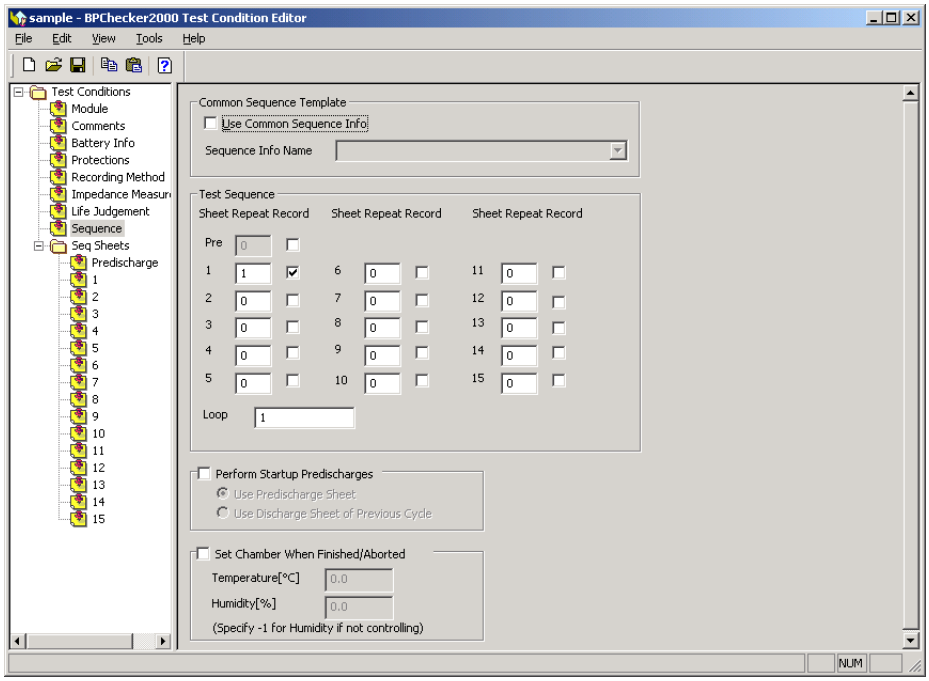


Fig. 5-13 Test Condition > Sequence

Common Sequence Template

The “Common Sequence Template” is a function that is necessary only when controlling temperature chambers.

BPChecker2000 is designed to accommodate the case in which the temperature chamber synchronization is used.

For details, see section 7.10.3, “Common Sequence Templete."

If the Common Sequence Template function is on

Set the name of the "common sequence template" that is shared among multiple test conditions files.

If the Common Sequence Template function is off

A separate .si file is not generated. All of the information are saved to the .bpct file.

Test sequence

The test is executed according to the sequence specified here. 15 types (#1 to #15) of test sheets of charge and discharge can be specified. You can repeat any of these sheets the necessary number of times and loop the entire sequence the necessary number of times. In addition, by using the sheet dedicated to predischarge (also referred to as sheet #0), you can perform predischarge.

Repeat

Set the number of times to execute the corresponding sequence sheet. If you specify 0, the sequence sheet is skipped.

Record

Specify whether to record the C/D data (charge/discharge data) at the test cycle when the corresponding sequence sheet is enabled. Record (data file) remains only if the checkbox is selected. However, since the last cycle when the entire test is finished or aborted must be saved, C/D data file is created once even if Record is disabled. The file is automatically deleted when the relevant cycle is no longer the last cycle (when the data for the next cycle is created).

Loop

Set the number of times to repeat the test consisting of sequence sheets #1 to #15.

Perform Startup Discharges

Select whether to execute startup predischarge. Startup predischarge refers to discharge that is carried out before the execution of the first cycle when a new test is started or when the test is aborted and restarted.

If enabled, you must specify the details of the startup predischarge that is to be executed.

If you select the **Use Predischarge Sheet** checkbox, a special predischarge sequence sheet (sequence sheet #0) is used, not the discharge sheet of sequence sheets #1 to #15.

If you select the **Use Discharge Sheet of Previous Cycle**, the discharge sheet of the sequence sheet that corresponds to the cycle previous to the restart cycle is used.

However, if the **Do Predischarge when the sheet is first used** setting that is present in each charge sheet of sequence sheets #1 to #15 and the execution condition of predischarge conflict with each other, the setting of each sheet is prioritized. If predischarge is executed according to the setting of each sheet, sequence sheet #0 is used.

Relationship between the predischarge settings and discharge sheets that are executed

The relationship of these settings is explained using Table 5-1 shows how predischarge is executed depending on the predischarge settings when a simple sequence is created using only sequence sheets #1 and #2. There are twelve patterns in the predischarge setup pattern that you can set by using two sequence sheets (the top block in Table 5-1.)

Table5-1 Examples of Predischarge Settings and Discharge Sheets That Are Executed

1	2	3	4	5	6	7	8	9	10	11	12	Predischarge setup pattern
Execute startup discharges												
				✓	✓	✓	✓					Use Predischarge Sheet
								✓	✓	✓	✓	Use Discharge Sheet of Previous Cycle
Do Predischarge when the sheet is first used												
	✓		✓		✓		✓		✓		✓	Sequence sheet #1
		✓	✓			✓	✓			✓	✓	Sequence sheet #2

Test start	**Case 1**												
Predischarge	-	#0	-	#0	#0	#0	#0	#0	#0	#0	#0	#0	Sequence setting Sheet #1 Repeat: 2 Sheet #2 Repeat: 1 Sheets #3 to #15 Repeat: 0 Loop: 2 The value #0 in the predischarge row indicates that the predischarge sheet is used.
Cycle 1	Sequence sheet #1												
Cycle 2	Sequence sheet #1												
Predischarge	-	-	#0	#0	-	-	#0	#0	-	-	#0	#0	
Cycle 3	Sequence sheet #2												
Cycle 4	Sequence sheet #1												
Cycle 5	Sequence sheet #1												
Cycle 6	Sequence sheet #2												

Test start	**Case 2**												
Predischarge	-	#0	-	#0	#0	#0	#0	#0	#0	#0	#0	#0	Sequence setting Sheet #1 Repeat: 2 Sheet #2 Repeat: 1 Sheets #3 to #15 Repeat: 0 Loop: 2 Abort the test at cycle 3 and restart. The values #0, #1, and #2 in the predischarge row indicate that the predischarge sheet, the discharge sheet of sheet #1, and the discharge sheet of sheet #2 are used, respectively.
Cycle 1	Sequence sheet #1												
Cycle 2	Sequence sheet #1												
Predischarge	-	-	#0	#0	-	-	#0	#0	-	-	#0	#0	
Cycle 3	Sequence sheet #2Abort												
Test restart													
Predischarge	-	-	#0	#0	#0	#0	#0	#0	#1	#1	#0	#0	
Cycle 3	Sequence sheet #2												
Cycle 4	Sequence sheet #1												
Cycle 5	Sequence sheet #1												
Cycle 6	Sequence sheet #2												

- **Case 1**

Case 1 (the middle block in Table 5-1) is the case when the specified sequence finished normally.

The predischarge setup patterns 1 to 5 and 7 are executed simply as they are specified.

For patterns 6 and 8, there is a conflict in the predischarge settings immediately after the test is started between the sequence sheet setting and the sheet #1 setting. In this case, the setting of each sheet has priority, and predischarge is never executed twice.

For patterns 9 to 12, **Use Discharge Sheet of Previous Cycle** is selected. Since startup predischarge is executed only immediately after the test is started (there is no previous cycle) in Case 1, the result is the same as when **Use Predischarge Sheet** is selected.

- **Case 2**

Case 2 (the bottom block in Table 5-1) is the case when the test is aborted at cycle 3 of the specified sequence and then restarted. Since a test is restarted from the aborted cycle, the test in Case 2 is restarted from cycle 3.

The sequence sheet that is used first when the test is restarted is the sheet that was being used when the test was aborted. However, the trace that the sheet was used is lost when the test is aborted.

In Case 2, sequence sheet #2 is used when the test is restarted, but in this case, sequence sheet #2 is considered to be used for the first time. In other words, if the **Do Predischarge when the sheet is first used** checkbox of sequence sheet #2 is selected, the predischarge sheet is reused as shown in predischarge setup patterns 3, 4, 7, 8, 11, and 12.

Use Predischarge Sheet is selected in patterns 5 and 6. Thus, predischarge is executed when the test is restarted.

Use Discharge Sheet of Previous Cycle is selected in patterns 9 and 10. Thus, predischarge is executed using sequence sheet #1 when the test is restarted.

Set Chamber When Finished/Aborted

This setting is enabled when the test is executed using the temperature chamber synchronization.

If the checkbox is selected, the temperature and humidity of the temperature chamber specified on the sequence sheet can be reset to the values specified here when the test is finished or aborted.

When setting the humidity, check the control range of the temperature and humidity of the temperature chamber being used. Depending on the performance of the temperature chamber, some humidity ranges may not be possible against the specified temperature. In such case, specify -1 and the humidity control will be disabled.

For details on synchronized operation of temperature chambers, see section 7.10, “Temperature Chamber Synchronization."

5.4 Seq Sheets

Sequence sheets include the predischarge sheet and sheets #1 to #15. Since each sheet from #1 to #15 consists of a charge condition sheet and a discharge condition sheet, the total number of sheets is 31.

This section describes the sequence sheets in the following order.

1. Items common to charge condition sheets
2. Items of CC-CV charge mode
3. Items of CC charge mode
4. Items of Pulse charge mode
5. Items common to the predischarge sheet and discharge condition sheets
6. Items of CC discharge mode
7. Items of CP discharge mode
8. Items of CC-Pulse discharge mode
9. Items of CP-Pulse discharge mode

5.4.1 Charge Conditions (Sequence Sheets #1 to #15)

Here, the type of charge test to be executed is specifically defined. Since the items that need to be specified vary greatly depending on the operation mode, description will be given independently for each operation mode. However, range selection, mode selection, temperature chamber setup conditions, and predischarge setup function are common to all modes.

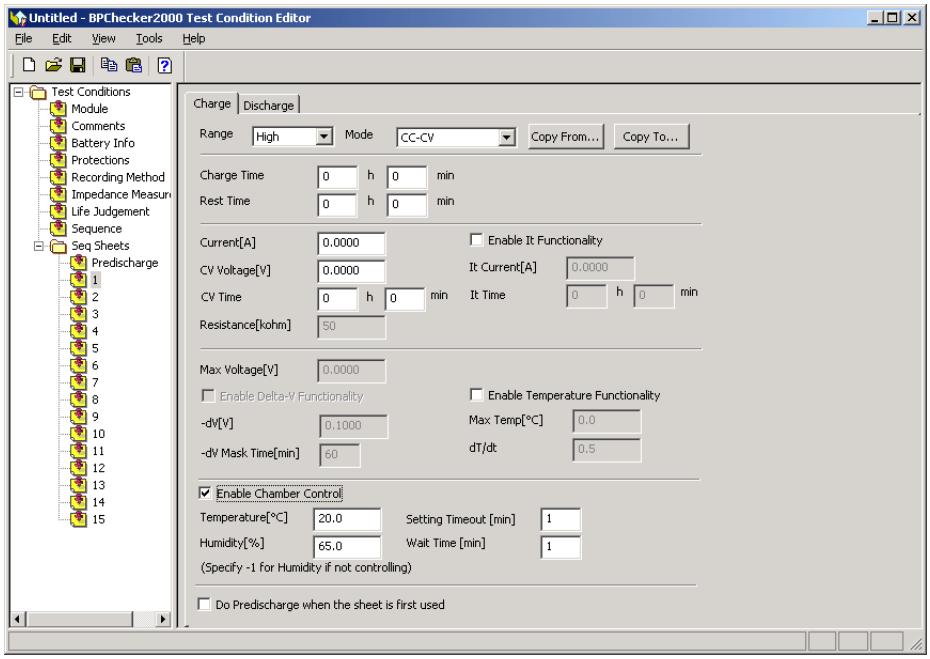


Fig. 5-14 Test Condition > Sequence Sheets

Items independent of the mode setting

Range

You can select the range if you selected the PFX2011 Charge/Discharge Power Supply Unit for “Expected Model” in section 5.3.1, “Module.”

Depending on the range selection, the valid ranges for settings concerning current, capacity, and power vary.

Mode

Select the charge mode. Select CC-CV, CC, or Pulse.

NOTE

- Other modes may be included depending on the Test Condition Editor version. However, they are for special-order features. Dimmed items are not selectable.

Enable Chamber Control

If this item is enabled, temperature chamber settings are performed in the cycle if this sequence sheet is used. In this case, you must also enter Temperature [°C], Humidity [%], Setting Timeout [min], and Wait Time [min].

Temperature [°C]

Specify the temperature setting of the chamber.

Humidity [%]

Specify the humidity setting of the chamber.

Check the control range of the temperature and humidity of the temperature chamber being used. Depending on the performance of the temperature chamber, some humidity ranges may not be possible against the specified temperature. In such case, specify -1 and the humidity control will be disabled.

Setting Timeout [min]

The temperature chamber does not reach the specified condition immediately after the temperature and humidity are set. If the temperature chamber does not reach the target temperature and humidity (within the range specified in system settings) even after the specified time elapses, the setting is considered to have failed.

Wait Time [min]

Even if the temperature chamber reaches the target temperature and humidity, you must allow some time for the battery in the chamber to reach the temperature. This setting specifies the wait time. If testing is performed in synchronization with the temperature chambers, the actual charge starts after the wait time elapses.

For details on synchronized operation of temperature chambers, see section 7.10, “Temperature Chamber Synchronization."

Do Predischarge when the sheet is first used

If this item is enabled, predischarge is executed once when this sequence sheet is used first. Predischarge sequence sheet (sequence sheet #0) is used for the predischarge.

This setting has priority if the **Execute startup discharges** setting that is specified on the sequence page and the execution condition of predischarge conflict with each other. For more details, see “Execute startup discharges” in section 5.3.8, “Sequence.”

5.4.2 CC-CV Charge

Fig. 5-15 shows an illustration of the constant current/constant voltage charge (CC-CV) operation. The figure illustrates the transition of constant current charge → constant voltage charge → CV time → charge rest. (In this example, charge is complete when CV time is reached.)

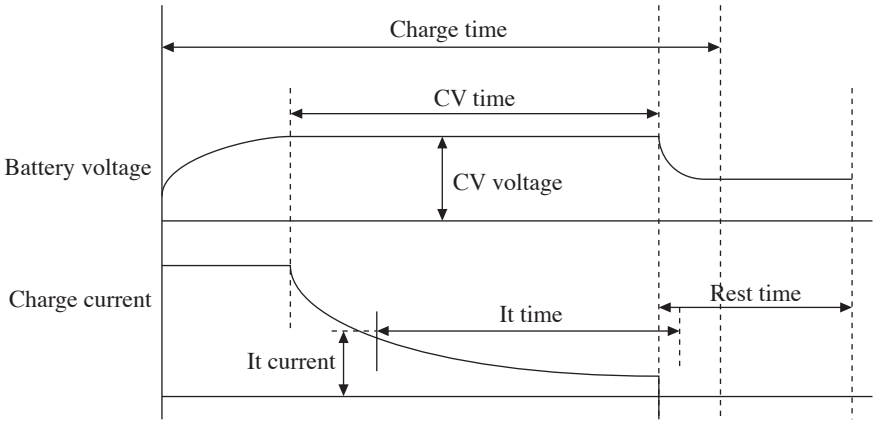


Fig. 5-15 Illustration of Constant Current/Constant Voltage Charge

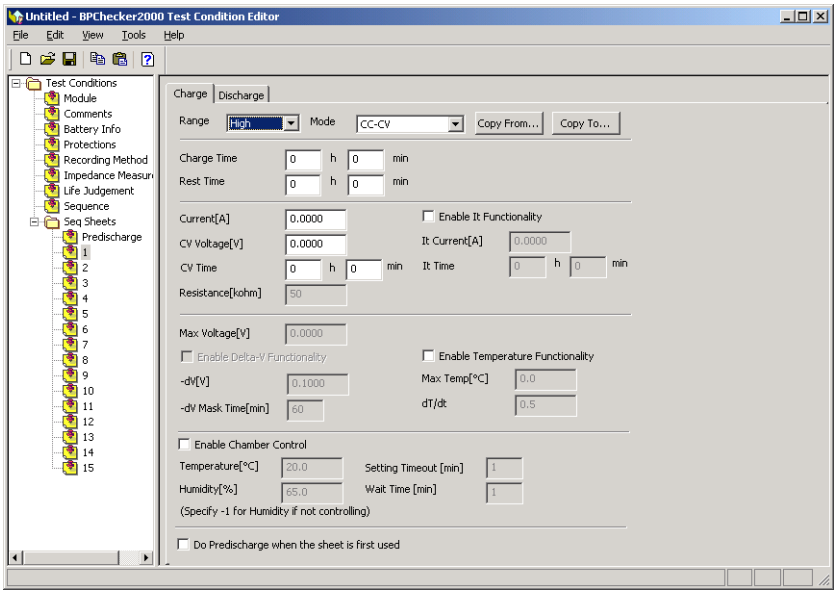


Fig. 5-16 Test Condition > Sequence Sheet (CC-CV Charge)

Charge Time [h:min]

Indicates the maximum time for a charge period. Charge Time is one of the function that terminate charging. Charging stops after this time elapses, if it has not already been ended by another factor. If the entry is 0:00, charge is skipped.

Rest Time [h:min]

Indicates the state in which nothing is performed after charging is finished and before transiting to discharging. If the entry is 0:00, rest is skipped.

Current [A]

Indicates the charge current. The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.

CV Voltage [V]

CV voltage indicates the voltage value at which the battery voltage moves to constant voltage (CV) operation.

CV Time [h:min]

CV time is one of the factors that terminate charging. Charging ends when this CV time elapses after constant voltage (CV) operation has started.

Enable It Functionality

Selecting this checkbox enables you to set It Current and It Time.

It Current [A]

It current is the current value for detecting charge current, which may be arbitrarily set by the user when performing a constant voltage charge. After this current is detected, charging ends once the set It time elapses.

Enter the It current value. Enter the current value to be detected during current voltage (CV) operation.

The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.

It Time [h:min]

It time is one of the factors that terminate charging. Charging ends when this It time elapses after detecting It current.

Max Temp [°C]

Maximum temperature is one of the factors that terminate charging. Charging ends when the battery temperature exceeds the specified value during charging.

5.4.3 CC Charge

Fig. 5-17 shows an illustration of the constant current charge (CC) operation. The figure illustrates the transition of constant current charge → -dV detection → charge termination → charge rest.

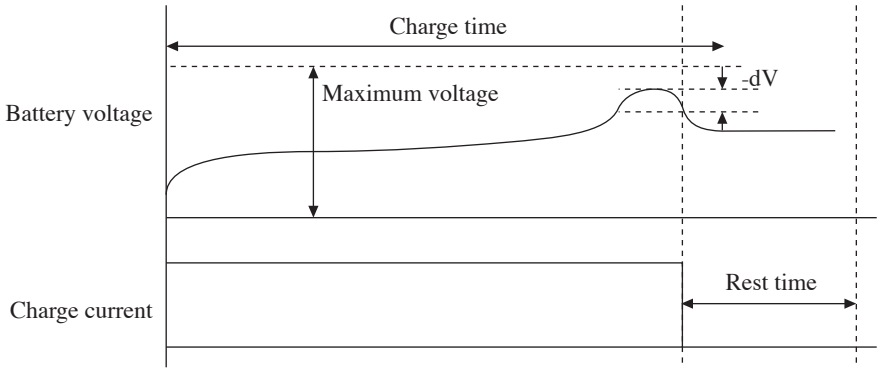


Fig. 5-17 Illustration of Constant Current Charge

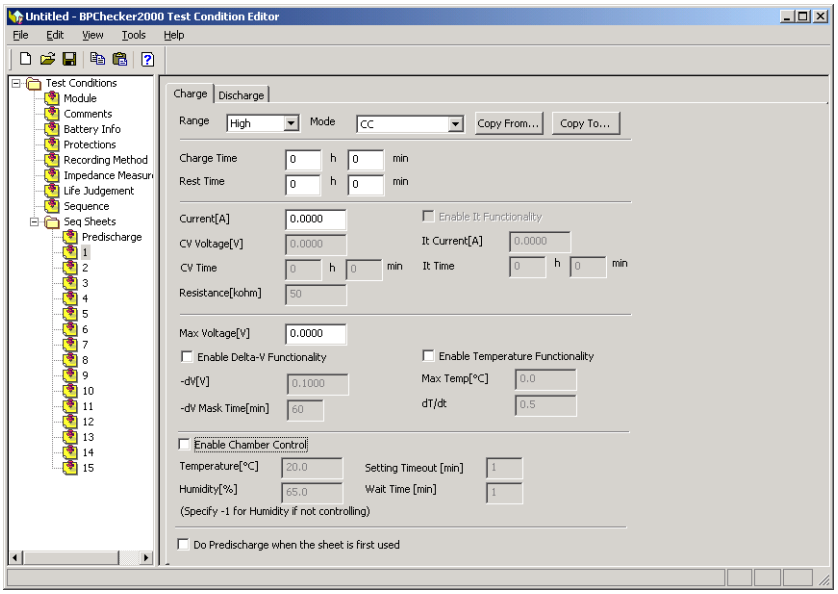


Fig. 5-18 Test Condition > Sequence Sheet (CC Charge)

Charge Time [h:min]

Indicates the maximum time for a charge period. Charge Time is one of the function that terminate charging. Charging stops after this time elapses, if it has not already been ended by another factor. If the entry is 0:00, charge is skipped.

Rest Time [h:min]

Indicates the state in which nothing is performed after charging is finished and before transiting to discharging. If the entry is 0:00, rest is skipped.

Current [A]

Indicates the charge current. The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.

Max Voltage [V]

Maximum voltage is one of the factors that terminate charging. Charging ends when the battery voltage reaches the specified value during charging.

Enable Delta-V Functionality

Select this checkbox enables you to set -dV and -dV Mask Time.

-dV [V]

The value -dV is one of the factors that terminate charging. Charging ends when the battery voltage drops by a value specified by -dV during charging. This detection can be disabled during the -dV mask time.

-dV Mask Time [min]

Enter the -dV mask time. The -dV detection is disabled during this period.

Enable Temperature Functionality

Selecting this checkbox enables you to set Max Temp and dT/dt.

Max Temp [°C]

Maximum temperature is one of the factors that terminate charging. Charging ends when the battery temperature exceeds the specified value during charging.

dT/dt

The value dT/dt is one of the factors that terminate charging. Charging ends when the battery temperature increases by dT/dt within a unit time (1 minute) during charging.

5.4.4 Pulse Charge

Fig. 5-19 shows an illustration of the pulse charge operation. In pulse charge, charging is performed over three periods: constant current charge (CC), constant current/pulse charge (CC-Pulse), and PWM pulse charge (PWM).

Fig. 5-19 illustrates the transition of constant current charge → maximum (transition) voltage detection → constant current/pulse charge → maximum (transition) voltage → Pulse ON current → Pulse OFF current → minimum voltage detection → It time → charge rest.

(when the period from pulse OFF to minimum voltage detection is less than or equal to It time)

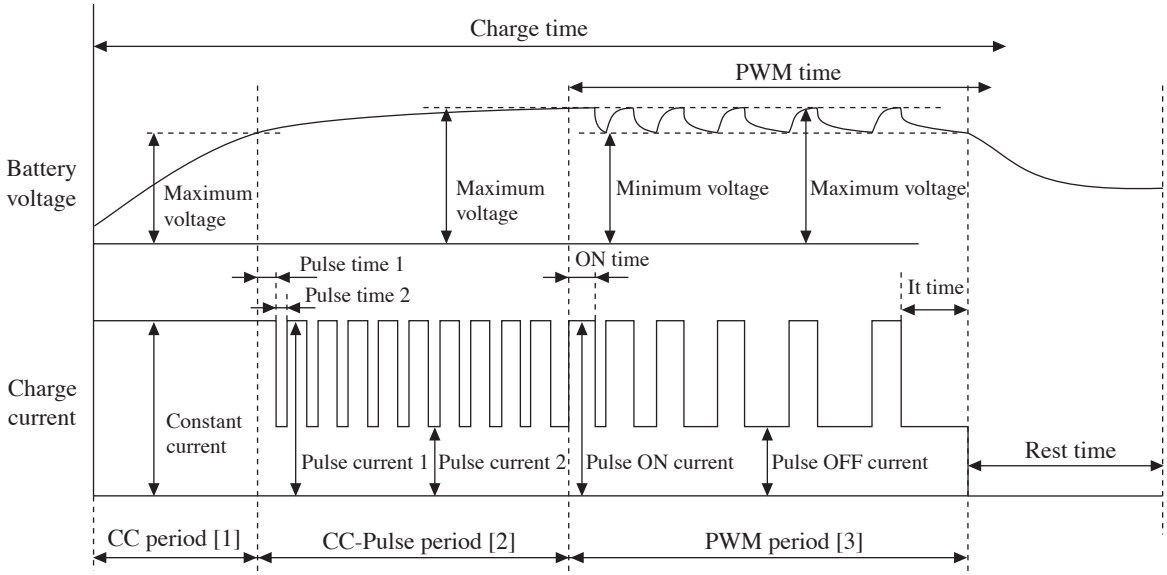


Fig. 5-19 Illustration of Pulse Charge

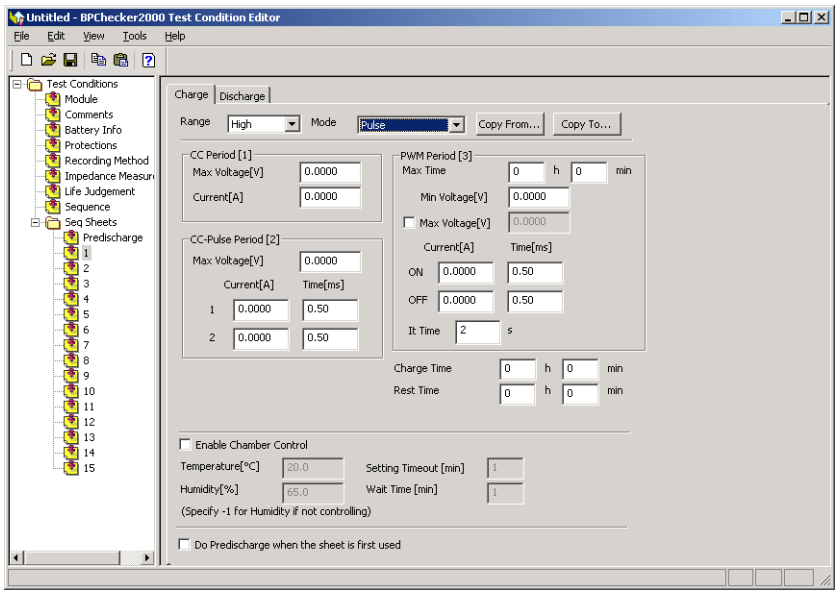


Fig. 5-20 Test Condition > Sequence Sheet (Pulse Charge)

CC Period [1]

- **Max Voltage [V]**

  When the battery voltage reaches this voltage during CC charging, the operation moves to the CC-Pulse period.

- **Current [A]**

  Indicates the charge current during the CC period.

  The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.

CC-Pulse Period [2]

- **Max Voltage [V]**

  When the battery voltage reaches this voltage during CC-Pulse charging, the operation moves to the PWM period.

- **Current [A] (1 and 2)**

  Indicates the pulse current (1 and 2) during the CC-Pulse period.

  The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.

- **Time [ms] (1 and 2)**

  Indicates the pulse time width (1 and 2) during the CC-Pulse period.

PWM Period [3]

- **Max Time [h:min]**

  Indicates the maximum time for the PWM period. When this time elapses, the operation moves to charge rest.

- **Min Voltage [V]**

  When the battery voltages drops to this voltage during pulse OFF current, the operation moves to pulse ON current.

- **Max Voltage [V]**

  When the battery voltages reaches this voltage during pulse ON current, the operation moves to pulse OFF current.

  Selecting the check box enables you to set the maximum voltage. Current control during the PWM period varies depending on the selected/unselected status of this check box. For details, see “Current control during the PWM period” on Page 5-27 .

- **Current [A] (ON and OFF)**

  Indicates the pulse current (ON and OFF) during the PWM period.

  The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.

- **Time [ms] (ON and OFF)**

  Set the pulse time width during the PWM period.

  Current control during the PWM period varies depending on the selected/unselected status of Max Voltage [V] check box. For details, see below “Current control during the PWM period” .

- **It Time [s]**

  When the time for detecting the minimum voltage from starting the pulse OFF current reaches IT time, the operation moves from the PWM period to rest.

Items common to all periods

- **Charge Time [h:min]**

  When the total time of all periods (CC, CC-Pulse, and PWM) exceeds this value, the operation terminates charging and moves to rest. If the entry is 0:00, charging is skipped.

- **Rest Time [h:min]**

  Indicates the state in which nothing is performed after charging is finished and before transiting to discharging. If the entry is 0:00, rest is skipped.

■ Current control during the PWM period

Current control during the PWM period varies depending on the Max Voltage (OFF voltage) check box setting as follows:

When the Max Voltage (OFF voltage) check box is selected

When the battery voltage increases to the OFF voltage*1 or when the ON time elapses during the ON current period, the operation moves to OFF current. If the operation moved to OFF current after the ON time has elapsed, the operation moves to ON current when the OFF time elapses. If the operation moved to OFF current due to the battery voltage rising up to the OFF voltage, the operation moves to ON current when the battery voltage drops to the ON voltage and the OFF time elapses.

*1 Because voltage detection requires at least 0.5 ms, the minimum ON current time is 0.5 ms.

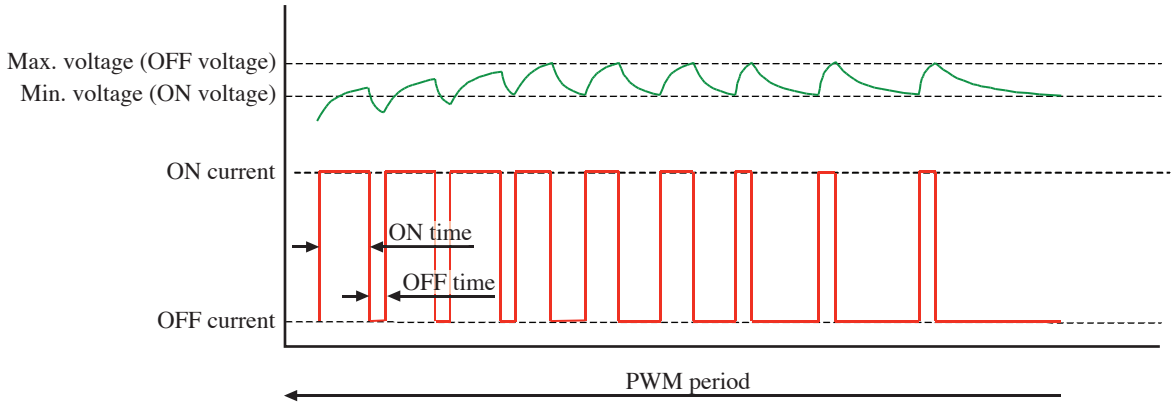


Fig. 5-21 Transition between ON/OFF Current during the PWM Charge Period (When the Check Box Is Selected)

The PWM charge period is controlled by the sequence shown in Fig. 5-22.

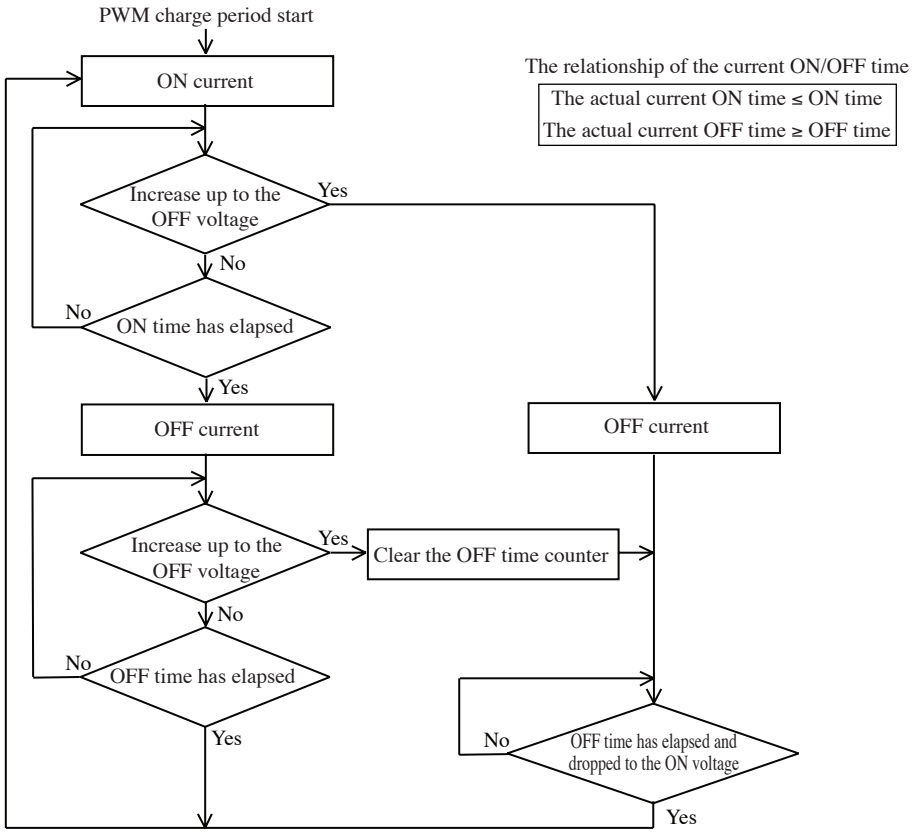


Fig. 5-22 ON/OFF Current Transition Sequence during the PWM Charge Period (When the Check Box Is Selected)

When the Max Voltage (OFF voltage) check box is not selected

When the ON time elapses during the ON current period, the operation moves to OFF current. During the OFF current period, the operation moves to ON current when the battery voltage drops to the ON voltage and the OFF time has elapsed.

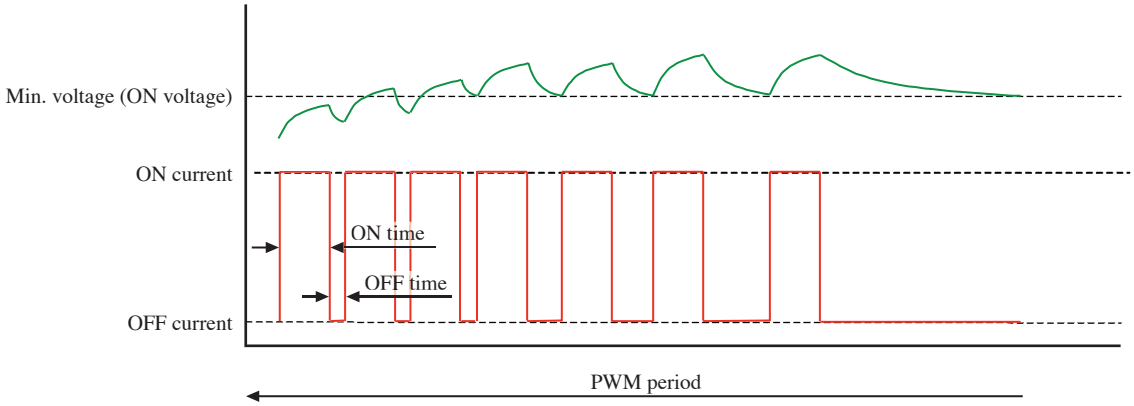


Fig. 5-23 Transition between ON/OFF Current during the PWM Charge Period (When the Check Box Is Not Selected)

The PWM charge period is controlled by the sequence shown in Fig. 5-24.

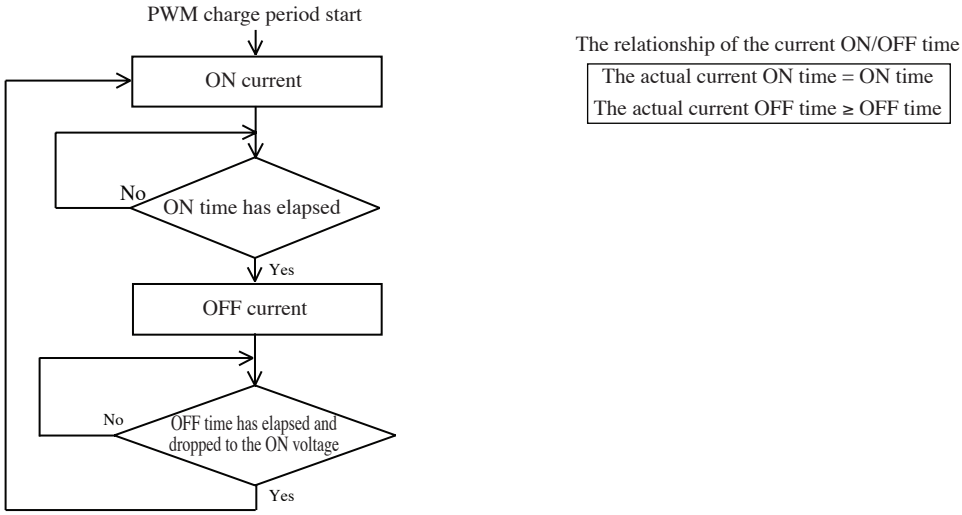


Fig. 5-24 ON/OFF Current Transition Sequence during the PWM Charge Period (When the Check Box Is Not Selected)

5.4.5 Discharge Conditions (Predischarge and Sequence Sheets #1 to #15)

Here, the type of discharge test or predischarge to be executed is specifically defined. Since the items that need to be specified vary greatly depending on the operation mode, description will be given independently for each operation mode. However, range selection, mode selection, capacity voltage, cutoff voltage, and temperature chamber setup conditions are common to all modes.

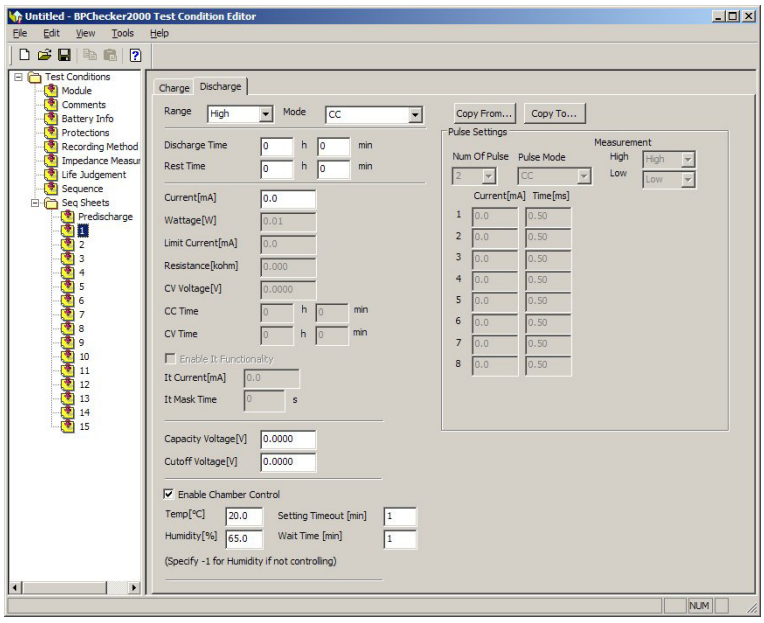


Fig. 5-25 Test Condition > Sequence Sheets

Items independent of the mode setting

Range

You can select the range if you selected the PFX2011 Charge/Discharge Power Supply Unit for “Expected Model” in section 5.3.1, “Module.”

Depending on the range selection, the valid ranges for settings concerning current, capacity, and power vary.

Mode

Select the mode. Select CC, CP, or CC-Pulse.

NOTE

- Other modes may be included depending on the Test Condition Editor version. However, they are for special-order features. Dimmed items are not selectable.

To select CC-Pulse or CP-Pulse, select Pulse here and then select CC or CP for Pulse Mode to the lower right.

Discharge Time [h:min]

Set the discharge time. The discharge time is one of the factors that terminate discharging. Discharging ends when this discharge time elapses. If the entry is 0:00, discharge is skipped.

Rest Time [h:min]

Set the rest time after discharging has ended (state in which nothing is performed after discharging). If the entry is 0:00, rest is skipped.

Capacity Voltage [V]

This function stops the integration of the discharge capacity when the battery voltage, which declines as discharge progresses, falls below the capacity voltage setting.

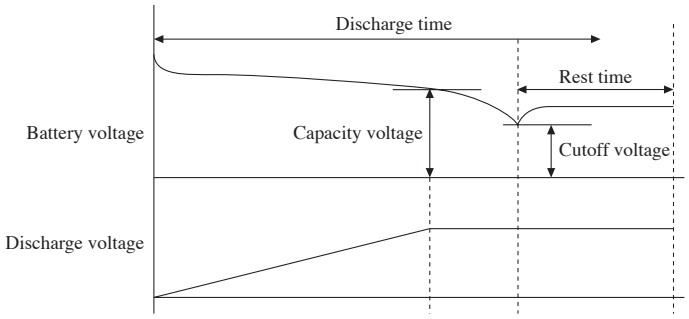


Fig. 5-26 Termination of the Integration of the Discharge Capacity at the Capacity Voltage

Cutoff Voltage [V]

The cutoff voltage is one of the factors that terminate discharging. Discharging ends when the battery voltage falls to this voltage even if discharge time has not elapsed.

Enable Chamber Control

If this item is enabled, temperature chamber settings are performed in the cycle if this sequence sheet is used. In this case, you must also enter Temperature [°C], Humidity [%], Setting Timeout [min], and Wait Time [min].

Temperature [°C]

Specify the temperature setting of the chamber.

Humidity [%]

Specify the humidity setting of the chamber.

Check the control range of the temperature and humidity of the temperature chamber being used. Depending on the performance of the temperature chamber, some humidity ranges may not be possible against the specified temperature. In such case, specify -1 and the humidity control will be disabled.

Setting Timeout [min]

The temperature chamber does not reach the specified condition immediately after the temperature and humidity are set. If the temperature chamber does not reach the target temperature and humidity (within the range specified in system settings) even after the specified time elapses, the setting is considered to have failed.

Wait Time [min]

Even if the temperature chamber reaches the target temperature and humidity, you must allow some time for the battery in the chamber to reach the temperature. This setting specifies the wait time. If testing is performed in synchronization with the temperature chambers, the actual discharge starts after the wait time elapses.

For details on synchronized operation of temperature chambers, see section 7.10, “Temperature Chamber Synchronization."

5.4.6 CC Discharge

Fig. 5-27 shows an illustration of the constant current discharge (CC) operation. The figure illustrates the transition of constant current discharge → voltage drop to the cutoff voltage → discharge termination → discharge rest.

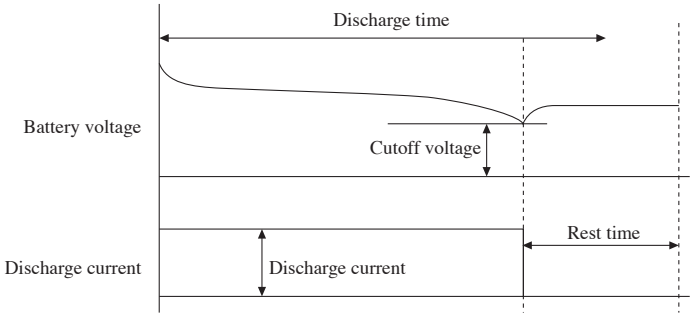


Fig. 5-27 Illustration of Constant Current Discharge

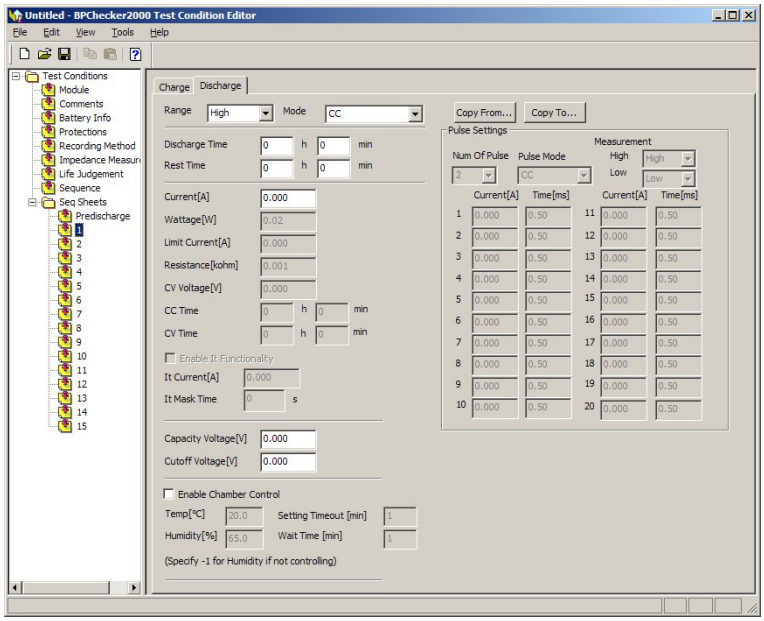


Fig. 5-28 Test Condition > Sequence Sheet (CC Discharge)

Current [A]

Indicates the discharge current.

The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.

5.4.7 CP Discharge

Fig. 5-29 shows an illustration of the constant power discharge (CP) operation. The figure illustrates the transition of constant power discharge → voltage drop to the cutoff voltage → discharge termination → discharge rest.

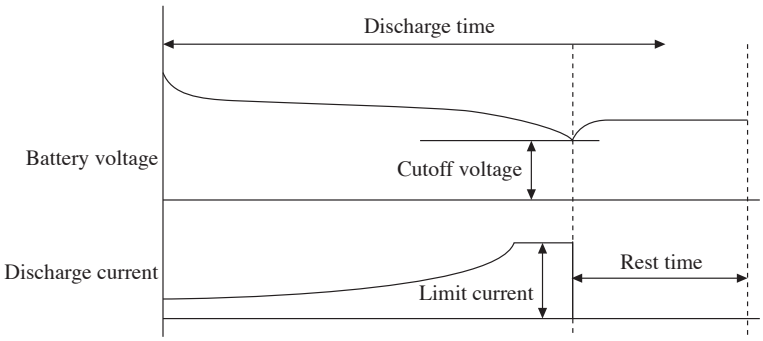


Fig. 5-29 Illustration of Constant Power Discharge

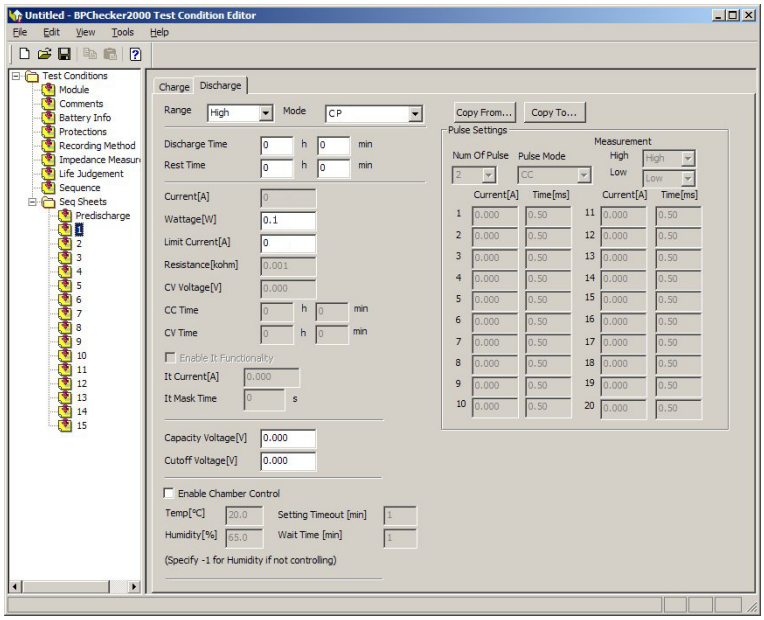


Fig. 5-30 Test Condition > Sequence Sheet (CP Discharge)

Wattage [W]

Indicates the discharge wattage value.

The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.

Limit Current [A]

In constant power discharge, the discharge current increases as the battery voltage drops. The limit current value is the upper limit value for the discharge current.

The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.

5.4.8 CC-Pulse Discharge

Fig. 5-31 shows an illustration of the constant current/pulse discharge operation. The figure illustrates the transition of pulse discharge → voltage drop to the cutoff voltage → pulse discharge termination → discharge rest.

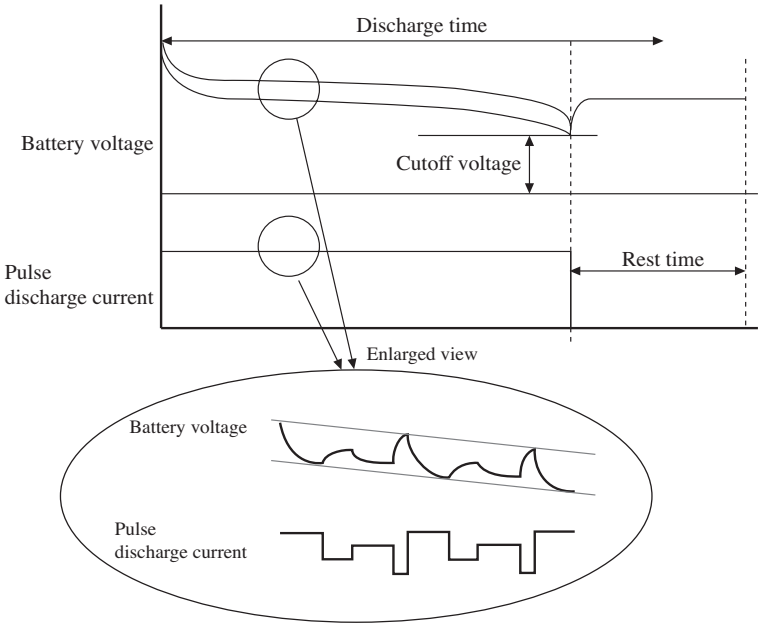


Fig. 5-31 Illustration of Constant Current/Pulse Discharge

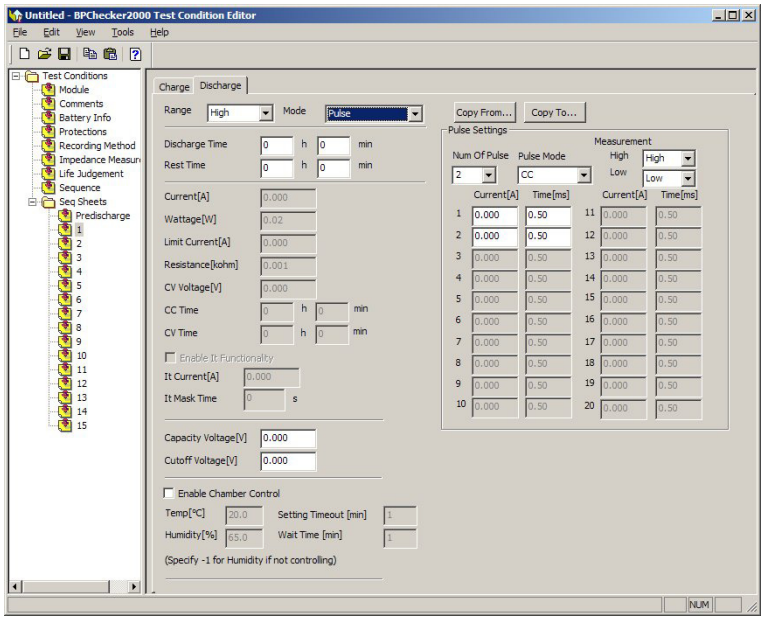


Fig. 5-32 Test Condition > Sequence Sheet (CC-Pulse Discharge)

Pulse Settings

- **Num Of Pulse**

Set the number of pulses per cycle.

You can set up to 8 values on the PFX2011 and 20 values on the PFX2021.

- **Pulse Mode**

To select CC-Pulse mode, select CC.

- **Measurement**

Specify the points for measuring the voltage during pulse discharging. Voltage can be measured at two points.

The discharge cutoff voltage is detected at the lower of the measurement points, Measurement High or Measurement Low for the PFX2011 and at the Measurement Low point for the PFX2021.

High:	Highest voltage point in the cycle
Low:	Lowest voltage point in the cycle
pt1 to ptn:	Point immediately before the switching of each current value

High

Select the voltage measurement point from High and pt1 to ptn (n: number of pulses).

Low

Select the voltage measurement point from Low and pt1 to ptn (n: number of pulses).

- **Current [A]**

Set each current value of pulse discharge. You can set a current value for each pulse value.

The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.

- **Time [ms]**

Set each time width of pulse discharge. You can set a time width for each pulse value.

Cutoff Voltage [V]

The cutoff voltage is one of the factors that terminate discharging. Discharging ends when the battery voltage falls to this voltage even if discharge time has not elapsed. For pulse discharge, discharging is terminated when the lower of the voltage values, Measurement High or Measurement Low, drops to the cutoff voltage for the PFX2011 and when the voltage value of Measurement Low drops to the cutoff voltage for the PFX2021.

CC-Pulse Discharge (continued)

Pulse setting example of the PFX2021

This example is for the case when detecting the discharge cutoff voltage on the high end using two pulses.

Pulse Settings

Number of pulses: 2

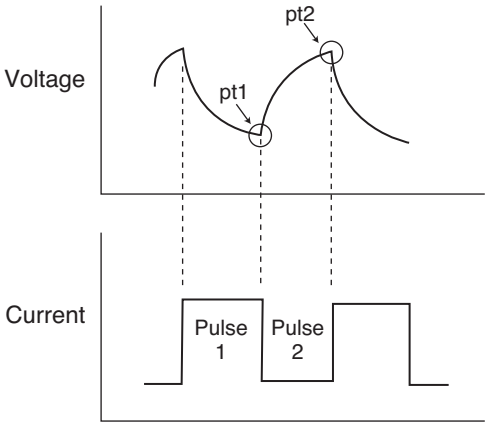
Pulse mode: CC

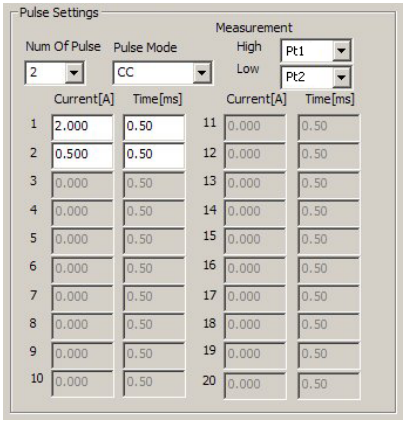
Measurement High: Pt1

Measurement Low: Pt2

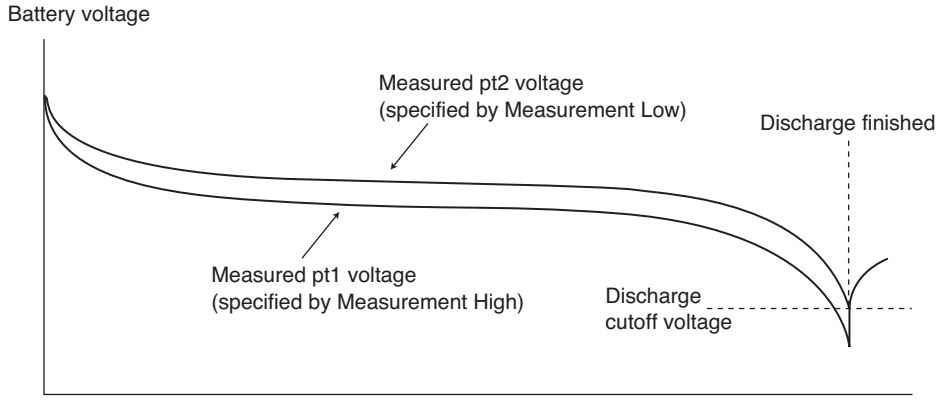
Current 1: 2.000A, current 2: 0.500 A

Time 1: 0.50 ms, Time 2: 0.50 ms





Pulse operation and voltage measurement



Charge operation

Fig. 5-33 Pulse operation, voltage measurement, and charge operation

If you set Measurement High to "High," the voltage of Pt2 is retrieved. The data is the same as the measured voltage of Measurement Low, and the graphs overlap.

The sampling interval of the pulse voltage varies depending on the specified pulse time. For details, see "Measurements during pulse charge/discharge operation" in the PFX2000 Series Instruction Manual.

5.4.9 CP-Pulse Discharge

You can select the CP-Pulse discharge if you selected the PFX2021 Charge/Discharge Power Supply Unit for “Expected Model” in section 5.3.1, “Module.”

Fig. 5-34 shows an illustration of the constant power pulse discharge operation. The figure illustrates the transition of constant power pulse discharge → voltage drop to the cutoff voltage → pulse discharge termination → discharge rest.

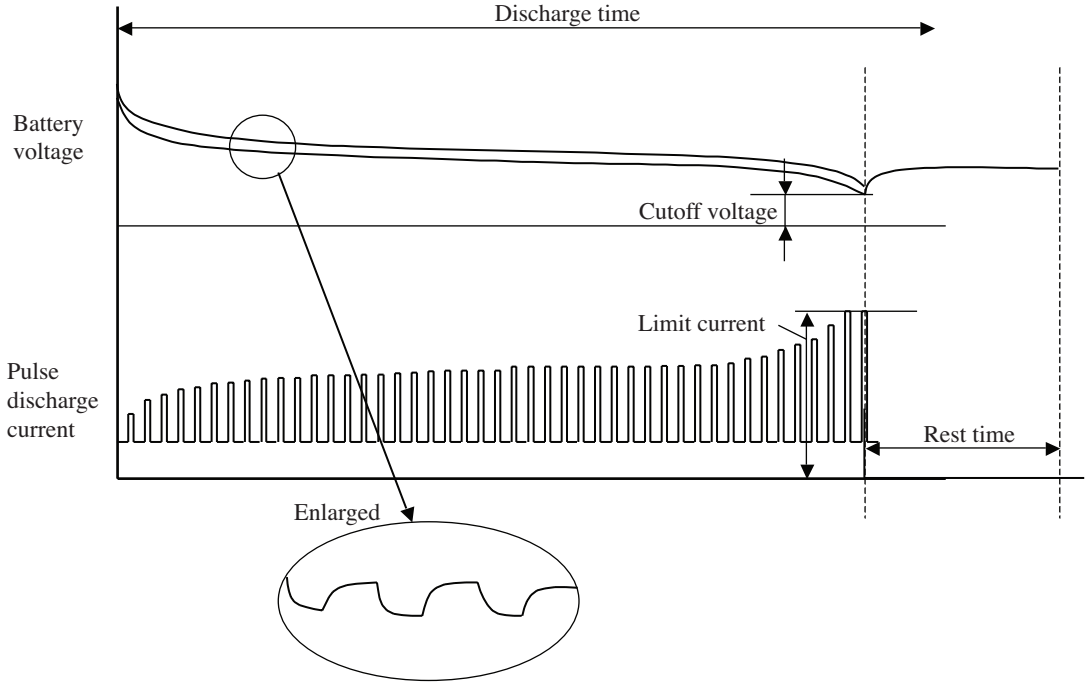


Fig. 5-34 Illustration of Constant Power Pulse Discharge

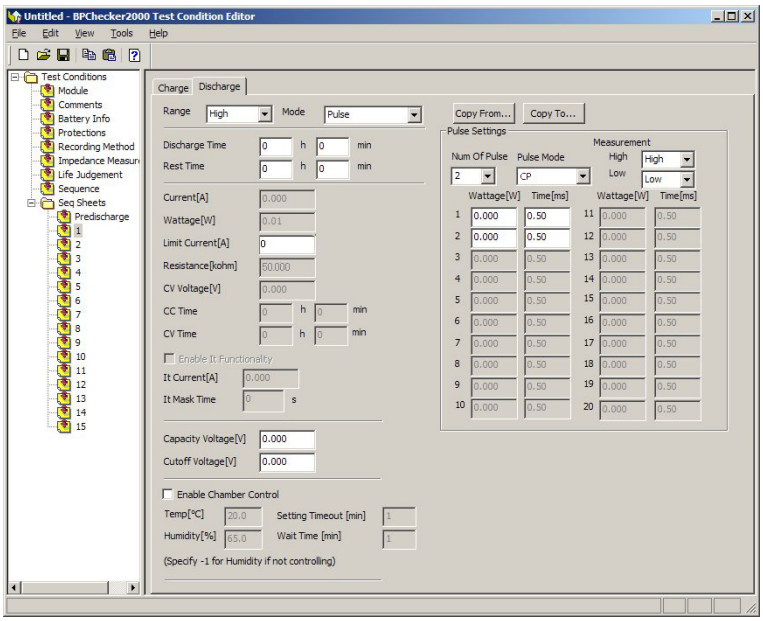


Fig. 5-35 Test Condition > Sequence Sheet (CP-Pulse Discharge)

Pulse Settings

For the setting example, see the pulse setting example for CC-Pulse discharge.

- **Num Of Pulse**

Set the number of pulses for pulse discharge.

- **Pulse Mode**

To select CP-Pulse mode, select CP.

- **Measurement**

Specify the point for measuring the voltage during pulse discharging. Voltage can be measured at two points.

The discharge cutoff voltage is detected at the lower of the measurement points, Measurement High or Measurement Low for the PFX2011 and at the Measurement Low point for the PFX2021.

High:	Highest voltage point in the cycle
Low:	Lowest voltage point in the cycle
pt1 to ptn:	Point immediately before the switching of each current value

High

Select the voltage measurement point from High and pt1 to ptn (n: number of pulses).

Low

Select the voltage measurement point from Low and pt1 to ptn (n: number of pulses).

- **Power [W]**

Set each power value of pulse discharge. You can set a power value for each pulse value.

- **Time [ms]**

Set each time width of pulse discharge. You can set a time width for each pulse value.

- **Limit Current [A]**

In constant power discharge, the discharge current increases as the battery voltage drops. The limit current value is the upper limit value for the discharge current.

Cutoff Voltage [V]

The cutoff voltage is one of the factors that terminate discharging. Discharging ends when the battery voltage falls to this voltage even if discharge time has not elapsed. In pulse discharge, discharging ends when the Low voltage of Fig 5-34 falls to the cutoff voltage.

Update time

In CP-Pulse discharge, the discharge current is controlled by software computation. The settling time (update time) from the voltage measurement by the ADC to the computation and the assignment of the discharge current is constant (2 ms typ.), independent of the pulse time width. For pulse discharge, discharging is terminated when the lower of the voltage values, Measurement High or Measurement Low, drops to the cutoff voltage for the PFX2011 and when the voltage value of Measurement Low drops to the cutoff voltage for the PFX2021.

5.5 Copy Function of Test Conditions between Sheets

On the sequence sheet edit screens, charge and discharge settings can be copied and pasted.

■ Copying the contents of the current sheet to other sheets

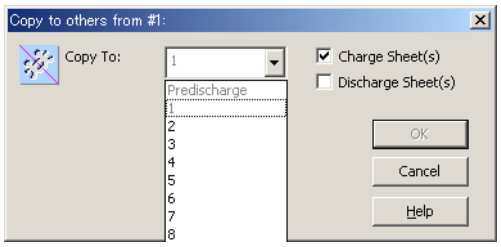


Fig. 5-36 Copying to Other Sheets

To copy the contents of the sheet that you are currently editing to other sheets, click the **Copy To** button on the sheet edit screen. A dialog box for selecting the copy destination appears. Select the copy destination sheet number or (All) and then click **OK**. Select the Charge Sheet(s) or Discharge Sheet(s) checkbox or both checkboxes. The selected items (charge/discharge) are copied to the specified sheet numbers.

■ Copying the contents of another sheet to the current sheet

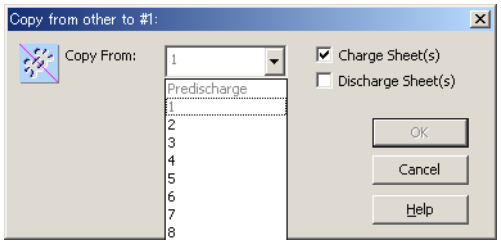


Fig. 5-37 Copying from Another Sheet

To copy the contents of the another sheet to the sheet that you are currently editing, click the **Copy From** button on the sheet edit screen. A dialog box for selecting the copy source appears. Select the copy source sheet number and then click **OK**. Unlike the copy function to other sheets, (All) is not available as a selection. Select the Charge Sheet(s) or Discharge Sheet(s) checkbox or both checkboxes. The selected items (charge/discharge) are copied from the specified sheet number.

5.6 Preference Settings of the Test Condition Editor

You can set the preference settings of the Test Condition Editor by choosing **Options** from the **Tools** menu.

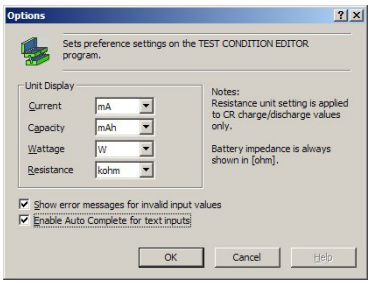


Fig. 5-38 Preference Settings

Unit Display

Select the unit displayed on the Form Pane.

	Selection
Current	A or mA
Capacity	mAh or Ah
Wattage	W or mW
Resistance	Ω or kΩ

NOTE

- The resistance unit setting is applied only to the CR charge/discharge value.
- The battery impedance is always displayed in [Ω].

Show error messages for invalid input values

If this checkbox is selected, an error message is displayed when you enter a value outside the input range. If this checkbox is not selected and you enter a value outside the input range, the value is highlighted to indicate that it is not valid.

Enable Auto Complete for text inputs

If the check box is selected, the auto complete function is enabled. If you enable this function, text you entered referred to the history of initial character of the text entered in the past.

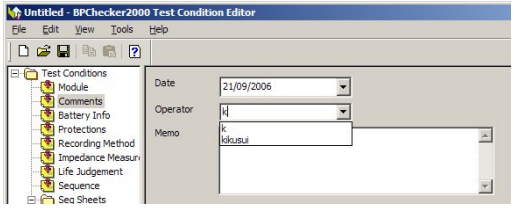


Fig. 5-39 Auto complete function example

6

Chapter 6 Preparations for Test Execution

This chapter describes items that you should check and items you need to configure before starting the actual test.

6.1 Test Executive

The Test Executive is a program that executes charge/discharge tests according to the test conditions file that you created using the Test Condition Editor.

Starting the Test Executive

To start the Test Executive, double-click the shortcut icon of the Test Executive program from the Windows desktop folder or program folder.

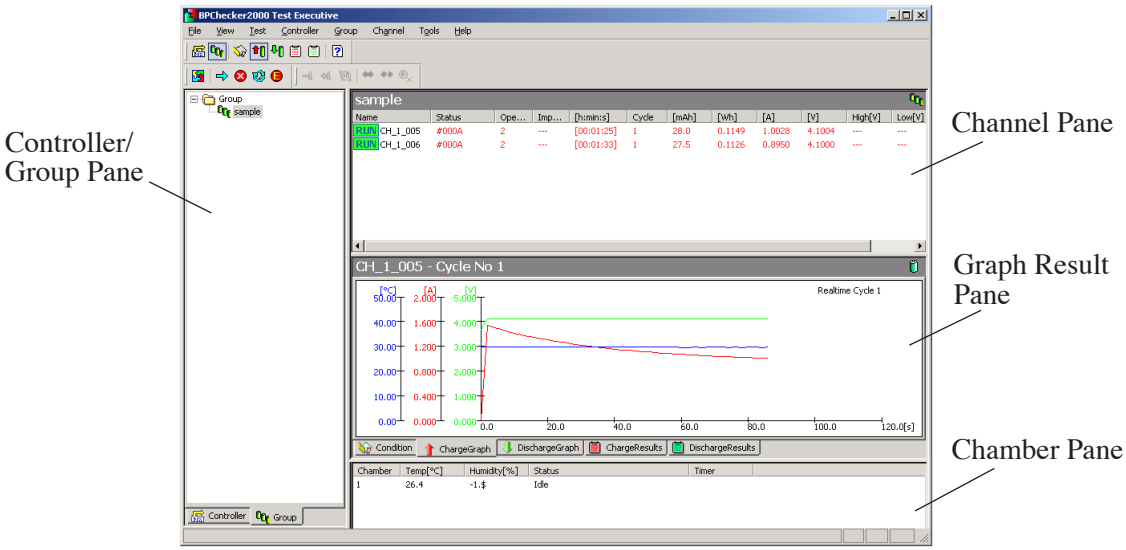


Fig.6-1 Test Executive Screen

The Test Executive consists of four panes.

Controller/Group Pane

The pane on the left side of the screen is called the Controller/Group Pane.

You can switch between controller view mode that organizes information according to the system of control unit connections and group view mode that organizes information according to test execution groups.

To switch the display mode, click the Controller tab or Group tab at the bottom section of the Controller/Group Pane on the left side of the screen.

Channel Pane

The pane at the upper right of the screen is called the Channel Pane. This pane displays all the channels that belong to the controller or group that is selected (highlighted) in the Controller/Group Pane and their execution status. The displayed contents vary between controller view mode and group view mode.

Graph Result Pane

The pane at the lower right of the screen is called the Graph Result Pane. This pane displays a summary of the realtime graph, the test conditions that are used, and the test results for the channel that is selected (highlighted) in the Channel Pane. The summary is not displayed for channels whose test is not in progress.

The current status is indicated by the displayed color of the list as follows:

Red:	Charging
Green:	Discharging
Orange:	Resting
Normal color:	Some other status

Chamber Pane

The Chamber Pane shows the temperature chamber operation. This pane does not appear, if the number of controllers is set to 0 (indicating that the temperature chamber is not used) in the dialog box that appears when you select **System Config** from the **Tools** menu.

For details on synchronized operation of temperature chambers, see section 7.10, “Temperature Chamber Synchronization”s."

6.2 Start Conditions and Troubleshooting

When you start the Test Executive, the previous start conditions are restored. Here, “condition” refers to the connection status of each hardware, group binding status, test progress status of each channel, the assignment status of test conditions, and other status.

When starting the Test Executive for the first time, it is recommended that the hardware be configured in advance using the Hardware Configuration Wizard program. If the Test Executive is started after executing the Hardware Configuration Wizard, the program will start using the conditions created by the Hardware Configuration Wizard (controller and channel identification) and the group created by the Group Administrator or the Test Condition Editor.

While starting up, the Test Executive program connects to the control units (1 or 2) that were configured by the Hardware Configuration Wizard via the USB and initializes the channels.

The program will start normally, if there is no change to the hardware configuration specified by the Hardware Configuration Wizard. However, if the specified conditions and the actual hardware configuration differ when the Test Executive is started, any of the following communication errors may occur.

- USB communication error with the controller
- I/O communication error with channels
- I/O communication error with the impedance units
- Communication error with the temperature chamber

If the Test Executive detects the entire hardware configuration correctly, the names of the detected control units and channels appear on the Test Executive screen. If there is a problem with the detection at startup, the behavior of the Test Executive varies depending on the location of the problem.

To check the control units and channels after the Test Executive is started, select (highlight) the corresponding unit or group on the Controller/Group Pane.

6.2.1 If the Test Executive Cannot Identify Controllers

In this case, the Test Executive displays an error message at startup. When you click **OK** to close the error message, the Test Executive shows the normal screen. Since the controller unit has not been identified, no icons are displayed in the controller view of the Controller/Group Pane. (Normally an icon and instrument ID are displayed.)

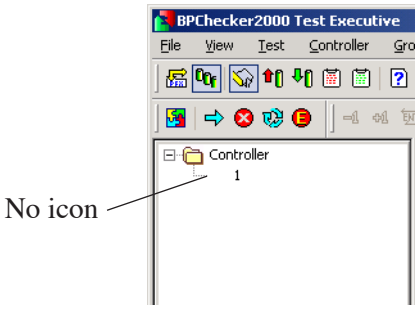


Fig. 6-2 Condition in Which Controller Units Are Not Identified

It is often the case that the control units are not identified by the PC as USB devices. In this case, first check that the USB cable is connected properly. If it is, start Device Manager from Windows Control Panel, and check that the control unit is identified as a USB device. If it is being identified properly, you can view the Instrument ID by displaying the properties of the device. Check that the setting is correct. The proper ID setting is 1 if there is one control unit, 1 and 2 if there are two control units.

If you correct the problem and the PFX2121 device is identified properly, display the properties of the control unit on the Test Executive. To show the properties of the control unit, right-click the corresponding control unit and select **Properties** from the shortcut menu. The dialog box displays the Model Name as (ID number) and the Status as Unplugged.

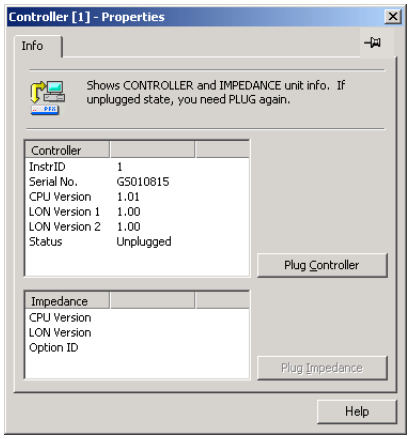


Fig. 6-3 Unplugged example

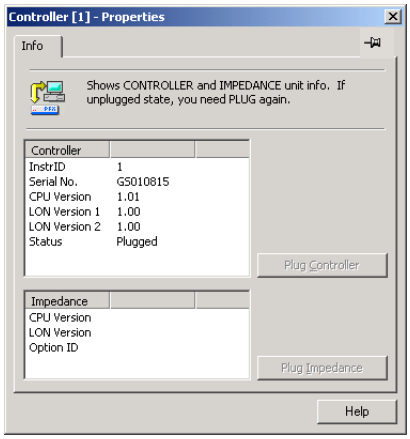


Fig. 6-4 Plugged example

To reconnect, click **Plug Controller**. If the Status changes to Plugged a few seconds later, reconnection is complete.

If the connection still does not work, it is recommended that you exit the Test Executive; reset the control unit (remove the USB cable and reconnect); and then start the Test Executive again.

6.2.2 If the Test Executive Identifies Controllers But Not the Channels

In this case, the Test Executive does not display an error message at startup. However, in most cases, the program takes longer to start (more than 10 s) than in the normal case. This is because the control unit takes longer in identifying the channels via the TP-BUS. The Test Executive shows the normal screen, even if it fails to identify the channels.

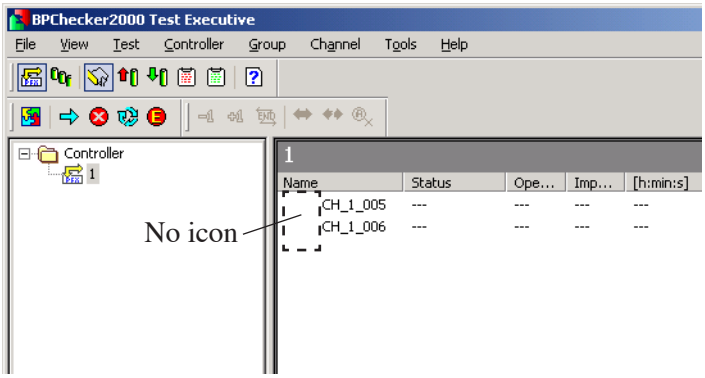


Fig. 6-5 Condition in Which the Channels Are Not Identified

In this case, the name of the control unit is displayed properly. Click the control unit name. The Channel Pane displays a list of channels that should be connected to the control unit. Note that icons are not displayed to the right of the channels that are not identified.

The possible reasons for this type of problem are improper connection of the TP-BUS or improper insertion of charge/discharge power supply units in the frame. Check these connections again.

After correcting the problem, carry out manual identification on a channel basis. Click the name of the channel with the problem to select it and then right-click to display the shortcut menu. And choose **Recognize** from the menu. Identification is performed on the selected channel.

If the identification succeeds, a OFF icon is displayed to the left of the channel name.

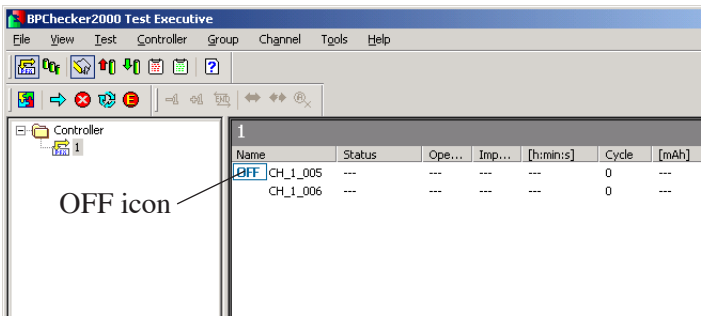


Fig. 6-6 Identification on a Channel Basis

6.2.3 If the Test Executive Cannot Identify Impedance Measurement Units

If the impedance measurement unit is selected in the system configuration, the Test Executive checks the connection of the impedance measurement unit that is connected to the corresponding controller at startup. If the identification fails, the Test Executive displays an error message. When you click **OK** to close the error message, the Test Executive shows the normal screen.

The frequent causes of this error message are the improper TP-BUS connection between the impedance measurement unit and the control unit and the impedance measurement unit not being powered up.

After correcting the problem, display the control unit properties. To show the properties of the control unit, right-click the control unit to which the impedance measurement unit is connected and select **Properties** from the shortcut menu. The dialog box shows that the controller itself is plugged, but the impedance measurement unit is unplugged. Click **Plug Impedance** to connect the impedance measurement unit.

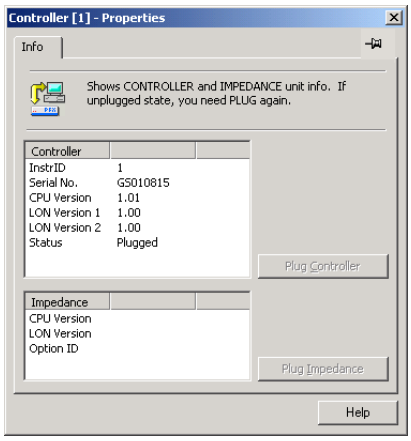


Fig. 6-7 Connection of the Impedance Measurement Unit

It the connection still does not work, it is recommended that you exit the Test Executive once, wait a few seconds, and start the Test Executive again.

6.2.4 If the Test Executive Cannot Identify Temperature Chambers

If the number of temperature chambers is set to 1 or greater in the system configuration, the Test Executive communicates with the temperature chambers to identify them at startup. If the temperature chambers are not connected correctly via GPIB or RS232C or if VISA is not set setup correctly, identification fails, and the Test Executive displays an error message. When you click **OK** to close the error message, the Test Executive shows the normal screen. Because the temperature chambers have not been identified, a communication error is displayed in the Chamber Pane.

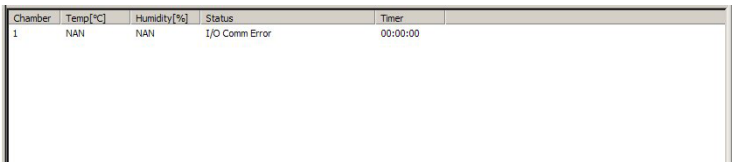


Fig. 6-8 Communication error with the temperature chambers

See the respective instruction manual and connect the temperature chambers correctly.

After connecting the temperature chambers correctly, right-click on the Chamber Pane and choose **Recover Connection**. The communication resumes, and the temperature chambers are identified. If the temperature chambers fail to be identified even when you choose **Recover Connection**, close the Test Executive once, wait a few seconds, and restart the Test Executive.

6.3 Creating Groups and Binding Channels

On the Test Executive, all actions concerning test execution are performed against groups or channels bound to groups. You cannot assign test conditions to or execute tests on channels that are not bound to any groups. In addition, such channels do not appear on the screen in group view mode. Therefore, channels on which you wish to execute tests must be bound to some group.

6.3.1 Creating Groups

Though not really necessary if groups have been created using the Group Administrator or the Test Condition Editor, you can also create new groups or delete existing groups while the Test Executive is running.

To create or delete groups, use the Group Administrator. From the **Group** menu of the Test Executive, choose **Launch Group Administrator**.

The changes to the group binding made using the Group Administrator are not immediately applied on the Test Executive screen. You can refresh the screen by choosing **Refresh** from the **View** menu of the Test Executive.

6.3.2 Binding Channels to Groups

Simply creating groups using the Group Administrator or Test Condition Editor does not bind the channels to the groups. Therefore, you must first bind the channels to a certain group.

To bind channels to a group, choose **Bind/Unbind Channels** from the **Test** menu in group view mode. A dialog box used to bind and unbind channels appear. Use this dialog box to bind the channels.

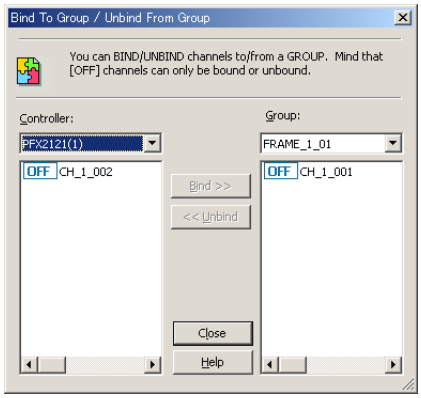


Fig. 6-9 Bind To Group/Unbind From Group

The left side is a list of channels as viewed from the controller. However, channels that are already bound to a group are not displayed. The right side is a list of channels as viewed from the group. Select one or more channels you wish to bind or unbind and click **Bind** or **Unbind** as necessary.

The list on the controller side displays all the channels controlled by the corresponding controller that are not bound to any group.

On the group side, channels that are bound to the corresponding group are displayed. However, only those channels that can be unbound (those that can be unbound without causing a problem) are displayed. Since channels that have test conditions assigned to them and are in a monitor loop or those that are executing the test (normally indicated by IDLE or RUN icons) cannot be unbound, they are not displayed even through they are bound to the group.

However, channels that are indicated as IDLE can be bound or unbound if the test conditions have not been assigned to them (simply moved to plugged status).

Chapter 7 Executing Tests

This chapter describes the procedures for starting the actual tests.

Refer to the previous chapter for items that should be checked before starting the tests as necessary.

7.1 Test Execution Panel

The Test Execution Panel is a panel (dialog box) that is frequently used in the Test Executive program. All operations for starting and stopping tests are performed from this panel.

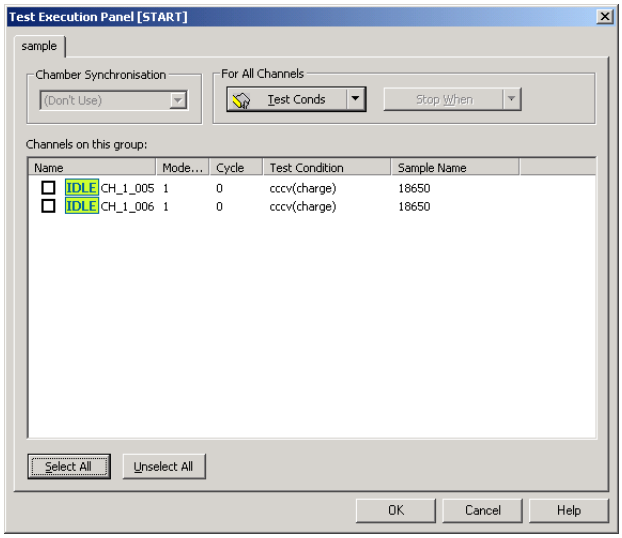


Fig.7-1 Test Execution Panel

Below are the four types of operations concerning test execution.

Table7-1 Operation Concerning Test Execution

Start	Starts the tests. This includes restarting of tests that are currently stopped.
Stop	Stops the tests. You can restart tests that are stopped.
Empty	Clears the test data and prepares for a new test to be started. The record of test results is moved to the backup folder.
Reset Alarm	Resets the alarms on channels whose alarms are activated. Channels are automatically stopped when alarms occur.

These operations are carried out from the **Test** menu or the **Toolbar**.

The Test Execution Panel screen is similar for all operations. However, an indication such as [START] and [STOP] is added to the end of the title (on the title bar).

The Test Execution Panel is displayed with the groups divided into tabs. The items on the panel are explained below.

Chamber Synchronization

When performing synchronized operation with temperature chambers, the selected temperature chambers are assigned at the group level.

For details on synchronized operation of temperature chambers, see section 7.10, “Temperature Chamber Synchronization."

For All Channels Test Conds

Assigns the selected test conditions to all channels in the group.

For All Channels Stop When

Specifies the process timing for stopping tests on all the channels in the group.

Channels on this group

This large list displays all the channels that are bound to the current displayed group (selected by the tab).

The boxes at the left end function like checkboxes. However, the checkboxes for lines (channels) whose characters appear dimmed cannot be selected.

The icons to the right of the checkboxes are the same as those shown in the Channel Pane. The icon is followed by the channel name, Model ID, and cycle number. If the channel is executing the test, the cycle number indicates the number of the cycle that is currently being executed. Otherwise, cycle indicates the number of the cycle of the test that has been completed. On channels starting a new test, 0 is displayed. To the right of the cycle is the name of the test condition that is assigned to the channel.

Select All

Selects all the displayed channels. This is equivalent to selecting all the channels one by one (selecting the checkboxes at the left end). However, channels that appear dimmed are not selected.

Determines whether the action (start operation in the case of Test Execution Panel [START]) is executed on the selected channel.

Unselect All

Clears all the selected channels at once. However, channels that appear dimmed are not cleared.

7.2 Starting the Tests

You must assign test conditions before starting the tests. This is done on the Test Execution Panel [START].

7.2.1 Assigning Test Conditions

There are two methods for assigning test conditions.

- Assign the same test conditions collectively to all the channels in the group.
- Assign different test conditions for each channel.

Choose **Start** from the **Test** menu to display the Test Execution Panel [START].

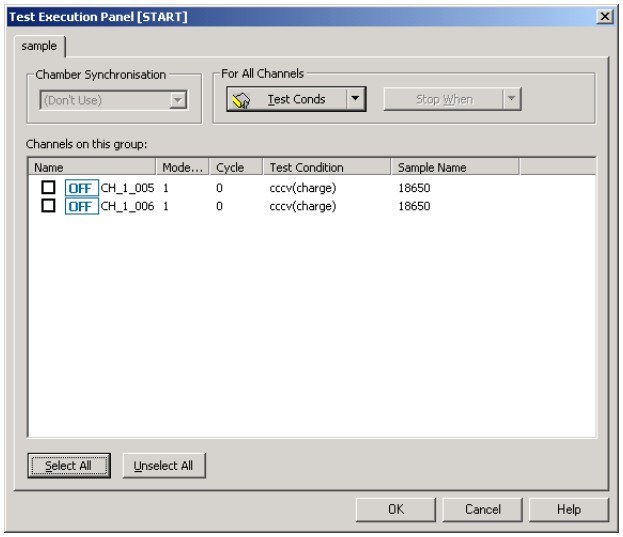


Fig. 7-2 Test Execution Panel [START] (Test Conditions Not Assigned)

When performing tests in synchronization with the temperature chambers

If you are performing tests in synchronization with the temperature chambers, you must specify the number of the temperature chamber you wish to assign to this group from the **Chamber Synchronization** box. For details on synchronized operation of temperature chambers, see section 7.10, “Temperature Chamber Synchronization”.

NOTE

- Assign temperature chamber numbers before assigning test conditions.
  If the test conditions are assigned first, the **Chamber Synchronization** box will appear dimmed, and you will not be able to specify it.

■ Assigning the same test conditions collectively to all the channels in the group.

Click **Test Conds** to open a dialog box used to select the test conditions that have been created before. Select a single test conditions file. The selected test conditions are assigned to all the channels in the group.
However, assignment is not made on channels that are already executing the test. In addition, if the cycle number display is 1 or more (1 or more cycles of the test have been completed), the assignment is not made (because it would change the assignment of the test conditions in the middle of the test).

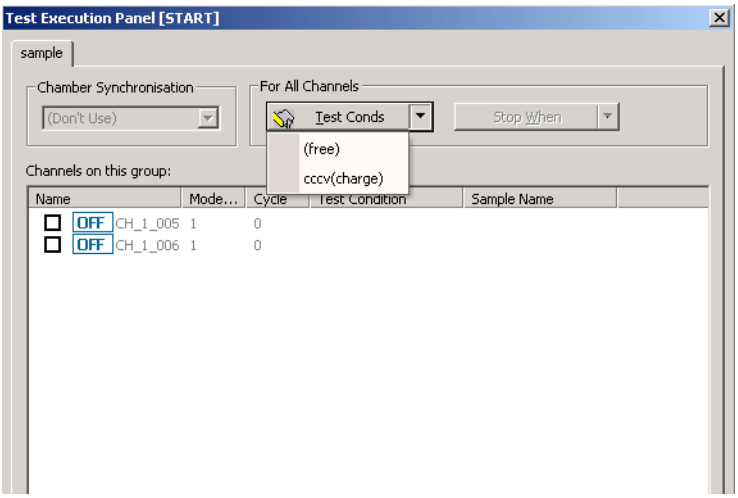


Fig. 7-3 Collective Assignment of Test Conditions

■ Assigning different test conditions for each channel

To assign different test conditions to each channel, first click the desired channel to select it. A menu button is added to the Test Condition item of that channel. Click the button and select the test conditions you wish to assign from the menu. Choosing a blank test conditions name frees the test conditions.

However, you cannot change the assignment of the test conditions or free the test conditions on channels that are currently executing the test or those that are stopped after completing one or more cycles (cycle display is 1 or more).

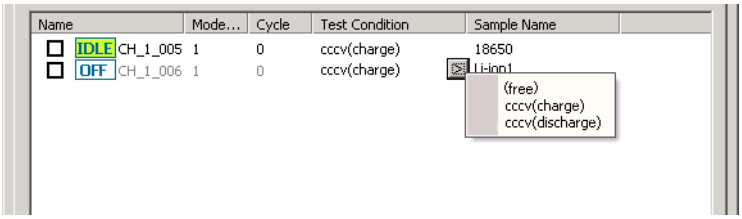


Fig. 7-4 Assignment of Test Conditions to Each Channel

Test conditions that have been assigned can be changed before the execution of the tests. Therefore, if you wish to assign the same test conditions to all the channels except one channel, you can click **Test conditions** to collectively assign the test conditions to all the channels and then change the test conditions of a particular channel separately.

NOTE

- If test conditions cannot be assigned to a channel

  Check the status display in the Channel Pane. Test conditions cannot be assigned to channels that have #0002 or #0003 shown. These status codes indicate warnings. For conditions that cause warnings to appear, see appendix A.2.1, "Alarm and Warning Concepts."

  Warnings can also be confirmed on the panel LED of the charge/discharge power supply unit.

■ Changing the sample name for each channel.

By default, the sample name of each channel that is displayed in the channel list is the name that was entered at the battery info of the Test Condition Editor. This sample name can be changed for each channel.

If you highlight the desired channel, the Sample Name item turns into a combo box. Enter the new name in the box. The entered name is displayed in a list, and you can select it from that point.

7.2.2 Executing Tests

You can either operate all channels collectively or each channel individually (or a mixture of the two). Assign the test conditions to channels on which you wish to execute the test. Channels that are assigned test conditions immediately become plugged status (connected status) and enter the monitor loop. At this point the icon display changes to IDLE.

The display of the line corresponding to channels that are indicated with the IDLE icon change from dimmed to normal (black), and the checkbox becomes selectable. In rare cases, some channels remain dimmed (unselectable) even when test conditions are assigned. On such channels, some type of warning is in effect concerning the test execution (hardware protection warning, connection check warning, etc.). Tests cannot be executed on such channels.

Finally, select the channels (select the checkboxes) on which you wish to start the test and click **OK**.

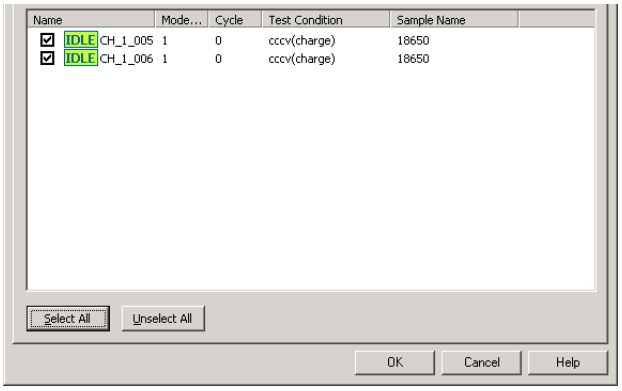


Fig. 7-5 Selection of Corresponding Channels

Overwriting of existing test data

If a test has already been executed and you attempt to execute another test without clearing the data as described in section 7.5, “Deleting the Test Data Contents,” a data storage warning dialog box appears.

Fig. 7-6 Data Storage Warning Dialog Box

When a test is started or re-executed, the Test Executive always checks to see if there are files present in the test data generation folder. This is to prevent overwriting existing test data inadvertently. The warning will appear if there are any files in the test data generation folder. If the test data generation folder is deleted, a folder is created.

If a presence of a file is detected, the Test Executive displays the data storage warning dialog box. The data storage warning box appears for all channels that fail the check.

In the dialog box, you select whether to back up the data folder. The default setting is to back up the data folder.

Which action do you take?

- Do not proceed test

If you select this action, nothing is executed. This is the same as clicking **Cancel** on the Test Execution Panel [START].

- Backup existing data, then proceed test (default)

If you select this action, the data folder is renamed, and all of the test data in the data folder are backed up.

- Proceed test overwriting existing data

If you select this action, the data folder is not backed up, and the existing test data is deleted.

- View Folder

If you click this button, Windows Explorer starts displaying the corresponding data folder.

Backup Options

If you selected **Backup existing data, then proceed test** (default), you will be able to enter the Folder Suffix and Memo boxes.

The folder suffix is a name that is added when the data folder is renamed. By default, the folder suffix is set to the date/time when the dialog box was opened.

Memo is for writing a comment for the backup action. A text file containing the memo is created in the folder that is backed up.

When multiple channels fail the check

The data storage warning box appears for all channels that fail the check. If you wish to change the back up procedure for each channel, you will need to set each dialog box and click **OK**.

If you wish to perform the same backup procedure for all selected channels, you can use the two options at the bottom of the first dialog box to omit the rest of the operations.

If you select the **Apply the same action for all channels** checkbox, the action of the next dialog box is set to the same action selected previously. In addition, the **Do not show this dialogue for subsequent channels** checkbox becomes available. If you apply this option, the following dialog boxes do not open, so you only have to enter settings on one dialog box.

7.3 Stopping Tests

In the stop operation, you must specify the timing when the stop process is actually applied. This operation is performed on the Test Execution Panel [STOP]. There are two methods for specifying the timing.

- Specify the same timing to all the channels.
- Specify the timing individually on each channel.

To stop the tests, choose **Stop** from the **Test** menu. Test Execution Panel [STOP] appears.

■ Specify the same timing to all the channels.

Click the **Stop When** button at the top section of the screen. A menu appears of the button. The following 4 menu commands are available.

Table 7-2 Menu of Stop When

Don't Stop	Selected by default. You can select Don't Stop, if you do not wish to stop the channel that is already scheduled to stop. * 1
Immediately	The test is immediately stopped regardless of the progress status of the test. (The test does not stop simply by selecting the menu.)
Phase End	The stop process is performed when the current charging or discharging is finished, and the test stops after the phase (charge or discharge phase) being executed has been completed. (The test is not immediately stopped.)
Cycle End	The stop process is performed at the end of the current cycle, and the test stops after the current cycle (one of the test condition patterns) has been completed. (The test is not immediately stopped.)

*1 Scheduled stop indicates the method of stopping the test. It is specified on a channel that continues the test even when it is instructed to stop (channel that is instructed to stop at the end of the phase or cycle).

After deciding on the action concerning the stopping of the test, select the channels you wish to stop (or channels you wish to enable scheduled stop) (select the check-boxes) and click **OK**. This will carry out the stop process.

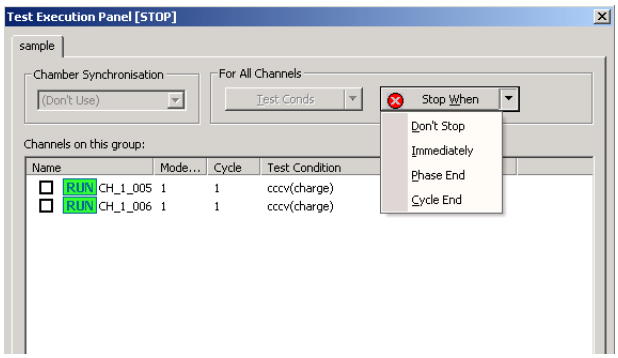


Fig. 7-7 Specifying Stop When Collectively

■ Specifying the timing for each channel individually

First click the desired channel to select it. A menu button is added to the Stop When item. Click the button and select when to stop the test from the menu. The Stop When selections are the same as with the all-channel operation.

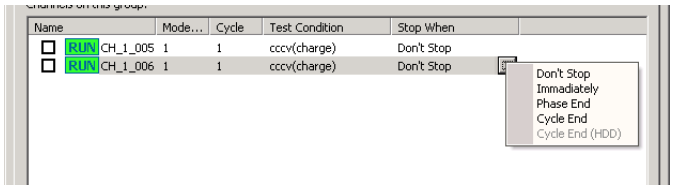


Fig. 7-8 Specifying Stop When Individually

7.4 Terminating Tests

Test termination signifies the completion of all test cycles that are scheduled by the test conditions. Normally, the end of the test is reached automatically by performing all test schedules.

When all test cycles have been completed, the channel is indicated as END and is removed from the monitor loop. Therefore, in normal cases, you do not have to specifically carry out a test termination operation. However, there are cases when you wish to forcibly terminate the tests (handle the tests as terminated). In such cases, carry out the procedures described here.

To terminate the test, the channels that you wish to terminate must be stopped. For the procedure in stopping the test, see section 7.3, “Stopping Tests.”

To terminate the tests, select the desired channels from the Channel List Pane, and choose **Toggle End Mark** from the **Channel** menu. This operation can also be used to remove the END marks from the channels that already have END marks.

7.5 Deleting the Test Data Contents

There may be instances when you wish to clear the existing test data and execute a new test on the same channel. Such examples include the case when you wish to execute the test from scratch after performing a test run on the DUT (battery) or the case when you wish to execute a test on a new DUT (battery) on the same channel after wrapping up the previous test.

In such cases, you must clear the data on the corresponding channels to free them. This operation achieves the task.

To clear the test data, choose **Empty** from the **Test** menu. Test Execution Panel [EMPTY] appears.

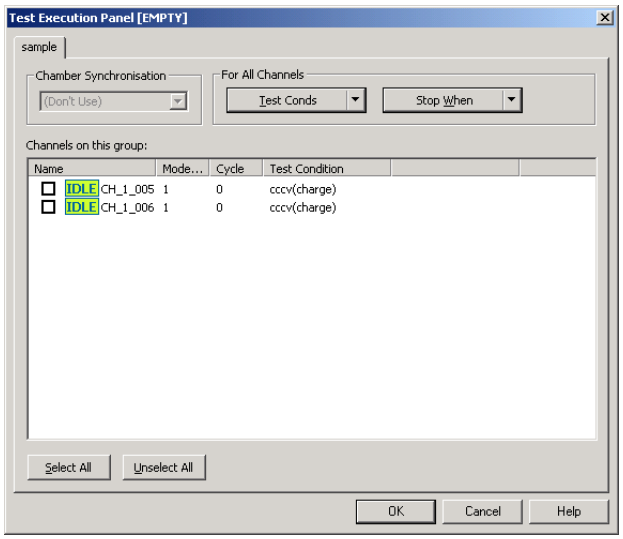


Fig. 7-9 Test Execution Panel [EMPTY]

The operation here simply selects the channel on which you wish to empty the data (multiple selections possible). Channels that are executing the test appear dimmed and cannot be selected.

Click **OK** to display the data backup dialog box of the selected channels.

In the dialog box, you select whether to back up the data folder.

The default setting is to back up the data folder.

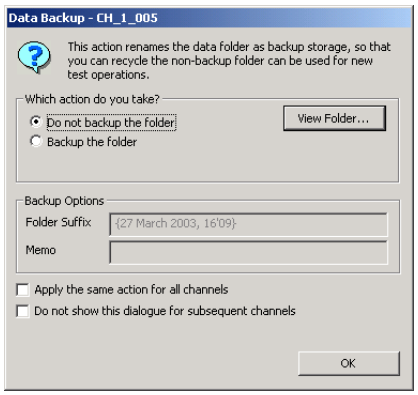


Fig. 7-10 Data Backup Dialog Box

Which action do you take?

- Do not backup the folder

If you select this action, the data folder is not backed up, and the existing test data is deleted.

- Backup the folder (default)

If you select this action, the data folder is renamed, and all of the test data in the data folder are backed up.

- View Folder

If you click this button, Windows Explorer starts displaying the corresponding data folder.

Backup Options

If you selected **Backup the folder**, you will be able to enter the Folder Suffix and Memo boxes.

The folder suffix is a name that is added when the data folder is renamed. By default, the folder suffix is set to the date/time when the dialog box was opened.

Memo is for writing a comment for the backup action. A text file containing the memo is created in the folder that is backed up.

When multiple channels whose data is to be deleted are selected

The data backup dialog box appears for all selected channels. If you wish to change the back up procedure for each channel, you will need to set each dialog box and click **OK**.

If you wish to perform the same backup procedure for all selected channels, you can use the two options at the bottom of the first dialog box to omit the rest of the operations.

If you select the **Apply the same action for all channels** checkbox, the action of the next dialog box is set to the same action selected previously. In addition, the **Do not show this dialogue for subsequent channels** checkbox becomes available. If you apply this option, the following dialog boxes do not open, so you only have to enter settings on one dialog box.

■ Using the test data that has been backed up

The test data folder that has been backed up is renamed by adding a folder suffix and is distinguished from the group and channels with the same names currently executing the test. You can analyze the backup data using the Graph Viewer even after the data is moved. In addition, you can copy the test data that has been backed up to a removable media such as MO and CD-R as necessary. If the backup data is not necessary, simply delete the data. Carry out these operations using Windows Explorer.

■ Executing a new test

The channels whose test data has been emptied are reset (completed cycle number is 0 and test conditions not assigned). However, the channel name and group binding remain. To execute a new test, follow the procedures given in section 7.2, “Starting the Tests.”

7.6 Resetting Alarms

If an alarm occurs during the test, the test on the corresponding channel is automatically stopped at the charge/discharge power unit. The test results of the phase currently in execution (either charge result data or discharge result data) are retrieved and saved to a file. The icon of the channel on which an alarm occurred changes to ALM. You must correct the cause of the alarm on such channels and execute the test again.

There are two methods for resetting the alarm.

Using the Test Execution Panel [RESET ALARM]

From the **Test** menu, choose **Reset Alarm**. Test Execution Panel [RESET ALARM] appears.

There are no detailed settings in the operation of resetting alarms. Simply click the Select **All** button to collectively select all the channels or select the channels individually, and then click **OK**.

This method is convenient when alarms occur on all the channels and you wish to select all the channels to be reset. However, you must open the Test Execution Panel [RESET ALARM].

Using reset alarm on the toolbar

Select the channel whose alarm is to be reset on the Channel Pane, and click the reset alarm icon on the toolbar.

This method allows you to reset alarms without opening the Test Execution Panel [RESET ALARM].

Fig. 7-11 Toolbar

7.7 Restarting Tests

To restart the test when the test has been stopped or when you reset the alarm after an alarm occurrence, carry out the same procedure as starting the test. Choose **Start** from the **Test** menu to display the Test Execution Panel [START].

Confirmation before restarting the test

Note the cycle numbers indicated on the screen. For channels whose test is in progress (indicated by a RUN icon), the number shows the number of the cycle that is currently being executed; for other channels, the number shows the number of the cycle that has been completed. For example, if the channel whose test is not in progress is indicated as 1, the completed cycle is 1. This means that the number of the cycle at which the test should be restarted is 2. If the number is 0, it indicates that there are no completed cycles. Channels that are indicated as 0 are handled exactly the same as a new execution. In this case, the assigned test conditions can be

changed. For other cases, the assigned test conditions cannot be changed, because there are cycles that have been completed already.

Even in the case in which the assigned test conditions cannot be changed, the contents of the test conditions concerning the successive cycles can be changed if they are within the same test conditions. For details on changing the test conditions, see section 7.9, “Changing the Test Conditions during the Test."

In addition, completed cycle numbers can be changed by choosing **Increment Cycle Number +1**, **Decrement Cycle Number -1**, or **Enter Cycle Number** on the Channel toolbar or menu.

Fig. 7-12 Channel toolbar

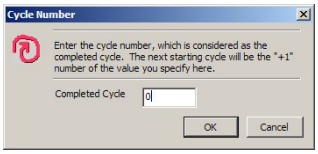


Fig. 7-13 Entering a completed cycle number

Restarting Tests

To restart the test, click the **Select All** button at the bottom section of the screen to collectively select all channels or select the channels individually, and then click **OK**.

When you click **OK**, the data storage warning dialog box appears.

This dialog box is used to determine the handling of the existing test data. For details on the dialog box, see “Overwriting of existing test data” in section 7.2.2, “Executing Tests.”

7.8 Emergency Stop Function

The Test Executive provides a function for stopping all charging/discharging operations for emergency situations. Choose **Emergency Stop** from the **Test** menu. In this case, the Test Execution Panel does not appear. The charging/discharging operation is immediately stopped on all the channels.

7.9 Changing the Test Conditions during the Test

The Test Executive provides a function for changing the test conditions of channels whose test is already in progress.

This function does not reassign a different test conditions file to the channel that is executing the test. Rather, this function changes the contents of the test conditions for the following cycles within the same test conditions file.

To change the test conditions, select the desired channel and then choose **Edit Test Conditions** from the **Channel** menu. The Test Condition Editor starts with the test conditions assigned to that channel loaded. Change the test information as necessary and save (overwrite) the file. The new test conditions are applied when charging is started on the next cycle or when you restart the test after stopping it once.

Constraints on Changing Test Conditions during the Test

There are constraints on changing test conditions while the test is in progress. Use caution when using this function.

The changes made to the test conditions are not applied immediately.

The new test conditions are applied when charging is started on the next cycle or when you restart the test after stopping it once. They are not changed immediately while the test is in progress. The changes cannot be applied at the discharge section within the cycle.

The assignment of test conditions cannot be changed.

Only the test conditions within the same file name can be changed. Once the test is started, you cannot assign a different test conditions file.

The changes apply to all the channels sharing the same test conditions.

If the same test conditions are shared among multiple channels, changing the test conditions affect all the channels sharing them. Changes cannot be made to individual channels.

Does not affect cycles that have already been completed.

Changes cannot be made on the cycles that have been executed already. For example, suppose cycle 20 uses test conditions sequence sheet #2. Even if you change the contents of test conditions sequence sheet #2 while cycle 20 is in progress, cycle 21 will not accept the changes if cycle 21 is set to use sequence sheet #3. However, you can also change the repeat settings of a sequence while test is in progress. In this case, you can change the information. By the same token, if the total number of cycles after the change is smaller than the number of the cycle that is currently being executed, the entire test is terminated when the test moves to the next cycle.

When using a common sequence template, other test conditions are affected

If you change items such as the sequence, repeat loops, and temperature chamber setup conditions in test conditions using a common sequence template, other test conditions that use the same template are also changed. In this case, other channels using the affected test conditions are also affected.

Scheme of Changing Test Conditions

When the test is executed, the Test Executive loads the test conditions and creates a copy of the information for execution at the point the cycle starts (charging starts). The Test Executive refers to the copy while the cycle is being executed. When the cycle is complete, the Test Executive creates a test result file. The test condition data that is included in the file is also the copy of the information.

On the other hand, the changes you make using the Test Condition Editor while the test is in progress apply to the original file, not the copy. The Test Executive is not affected while the test is in progress, because it does not refer to the original file. It creates a copy from to the original file at the start of the next cycle or when the test is restarted from the stopped status. This is the reason why the changes to the test conditions are applied to the next cycle or when the test is restarted. In addition, because the original test conditions that are assigned to multiple channels are read simultaneously, changing the test conditions affect all relevant channels.

7.10 Temperature Chamber Synchronization

You can perform synchronized tests with temperature chambers at the group level using the Test Executive.

7.10.1 Overview of Performing Tests in Synchronization with the Test Chambers

The charge/discharge test progresses while the channels in the same group controls the temperature chambers according to the specified temperature and humidity settings. The starting of the charge/discharge is always synchronized within the same group.

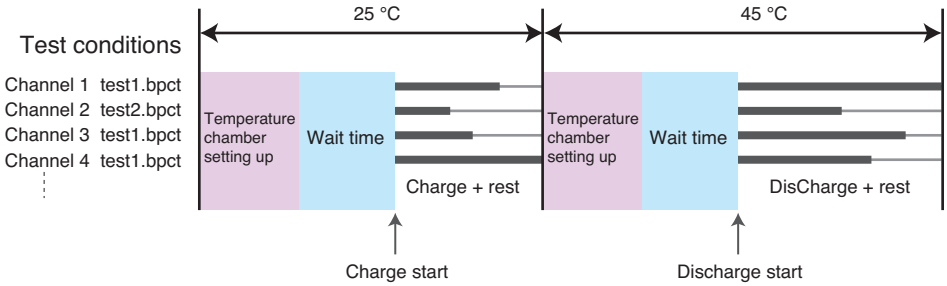


Fig. 7-14 Synchronized operation of temperature chambers

"Temperature chamber setting up" indicates the state until the monitored temperature and humidity in the chamber enter the specified margin range.

The wait time is the time until the specified temperature and humidity stabilize, and the DUT warms up.

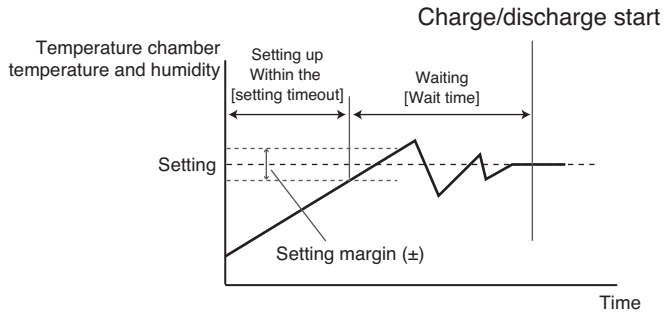


Fig. 7-15 Temperature chamber setting up, waiting, and charge/discharge start

If the setting timeout is exceeded while setting up, the Test Executive determines that the temperature chamber is abnormal and aborts the test.

Set the setting timeout value and wait time in the Charge or Discharge tab in Test Conditions > Seq Sheets. See section 5.4, “Seq Sheets."

If you set the wait time to 0 min, a wait time of 30 seconds is inserted internally.

If you set the charge (discharge) time + rest time to 0 min, a rest time of 59 seconds is inserted internally.

Set the temperature and humidity margins in the temperature chamber configuration of the Hardware Configuration Wizard. See section 3.2, “Configuring the Hardware."

You can set the temperature and humidity of the temperature chamber when the test is completed. Set the room temperature to prevent unnecessary damage to the DUT. See section 5.3.8, “Sequence."

7.10.2 Required Equipment

Temperature chambers by Espec Corporation are supported.

Up to six temperature chambers can be controlled using the following interface.

- RS232C interface
- GPIB interface

For details, see "Communications with the temperature chamber" on page P-4.

When the working environment is ready, turn on all protocol converters, RS485-to-RS232C adapters, and temperature chambers before starting the Test Executive. The Test Executive performs control taking Num of Chambers specified on the temperature chamber configuration screen of the Hardware Configuration Wizard to be the upper limit.

7.10.3 Common Sequence Templete

To perform the test in synchronization with the temperature chamber, all the channels that are to be synchronized must belong to the same group. Moreover, the test conditions of all the channels that are to be synchronized must have unified sequence information and temperature chamber setup information. For example, test conditions in which the temperature setting differs among channels cannot be executed simultaneously.

BPChecker2000 manages the settings related to the sequence function and the settings related to the temperature chamber in separate files (common sequence template files) so that the information can be shared among multiple test conditions files. Different test conditions can be mixed within the group that is performing synchronized temperature chamber control, and yet prevent discrepancies in the settings related to the sequence repetition and the temperature chamber information. If all the synchronized channels are to use the same test conditions, there is no need to use the common sequence template file.

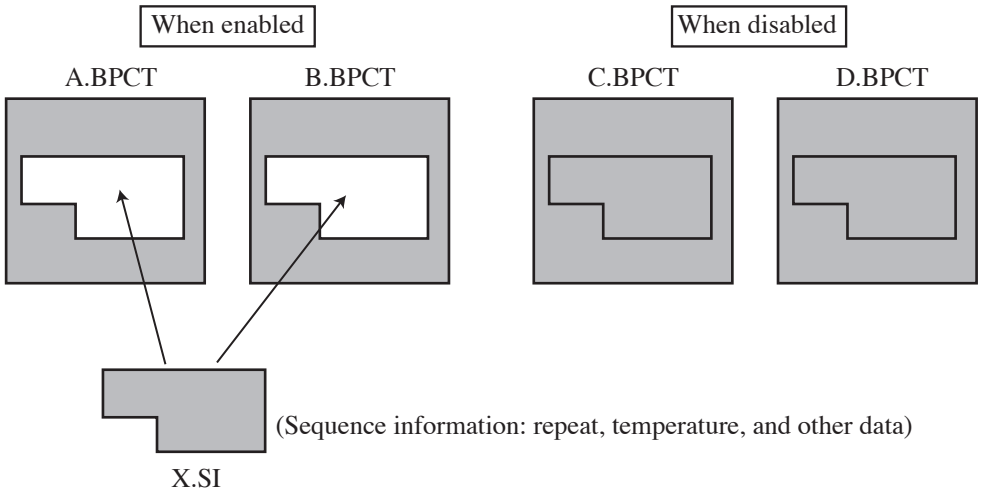


Fig. 7-16 Separation of Sequence Information

The settings of the following items are stored in a common sequence template file.

Test Conditions > Sequence

Test Sequence

Perform Startup Discharges

Set Chamber When Finished/Aborted

Test Conditions > Seq Sheet > Charge/Discharge

Enable Chamber Control

Do Predischarge when the sheet is first used

The Common Sequence Template is used in the following cases when performing tests in synchronization with the temperature chambers.

- When simultaneously executing tests with different test conditions in a group using the same temperature chamber.
- When simultaneously executing tests using different power supply modules (PFX2011 and PFX2021) in a group using the same temperature chamber.

Creating a Common Sequence Template

1. Set the test conditions you want to save in the Common Sequence Template.
2. In Test Conditions > Sequence, select the **Use Common Sequence Info** check box.
3. Enter the sequence information name (file name).

   Enter the name using 1 to 63 characters. Characters that are improper for file names (<>.,/+- etc.) cannot be used.

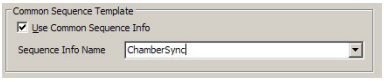


Fig. 7-17 File name "ChamberSync" example

4. To save the file, choose **Save** or **Save As** from the **File** menu.

   The Common Sequence Template file is created automatically in the same folder as the normal test conditions file (.bpct extension) with the name <SequenceInfoName>.si (SequenceInfName is the name specified for the sequence information name).

Using the Common Sequence Template File

1. Create a test conditions file on which you want to use the common sequence template file.

   Create the file in the same folder (group) as the common template file to be used.
2. To perform tests in synchronization with the temperature chambers, change "Expected Model" under Test Conditions > Module.

   See section 5.3.1, “Module."
3. In Test Conditions > Sequence, select the **Use Common Sequence Info** check box.
4. Enter the common template file name to be used.

   Click the ▼ at the right of the combo box to show the sequence information names that were saved in the past.

   If test conditions that are different from the template file are specified, they are changed to the settings of the common template file before the common template file name is entered.
5. On the **File** menu, choose **Save** or **Save As** to save the file.

   The settings are saved (.bpct extension). The common template file is overwritten (.si extension). If you change the test conditions related to the template file after specifying the template file, the common template file is changed to the new test conditions.

If you move the Common Sequence Template file (.si) from the folder containing the test conditions file or delete it, an error message is displayed when you open a test conditions file that uses the template file. If this happens, close the test conditions file, move the template file back to the original folder, and open the test conditions file again.

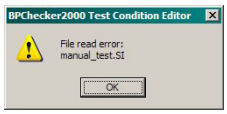


Fig. 7-18 Message that appears when the template file is missing

7.10.4 Assigning Temperature Chambers to Groups

If Num of Chambers is set to 1 or greater on the temperature chamber configuration screen of the Hardware Configuration Wizard, you can assign the temperature chambers at the group level.

If Num of Chambers is set to 0, this item is unavailable.

You can assign temperature chambers at the group level on the Test Executive. This means that all the channels in the group share the same temperature chamber. The test runs at the same temperature (and same humidity) along a synchronized test schedule. The Test Execution Panel [START] is used to assign temperature chambers to groups.

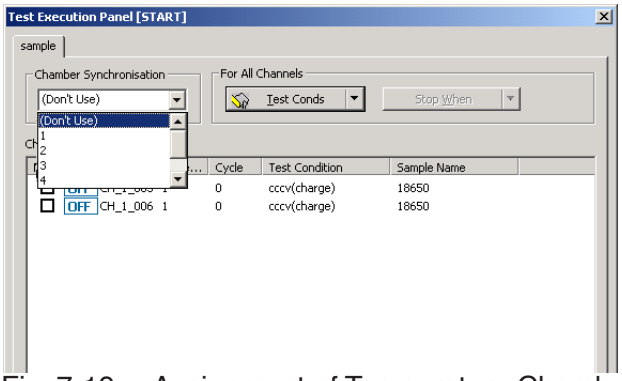


Fig. 7-19 Assignment of Temperature Chambers to Groups

If temperature chambers can be used, you can select the temperature chamber number from the Chamber Synchronization list. The selectable numbers range from 1 to up to 6. These numbers correspond to the temperature chamber subaddress that the protocol converter manages. Select **Don't Use** if you are not synchronizing a temperature chamber. You cannot select a number of a temperature chamber that is already assigned to another group. In addition, select the temperature chamber before assigning the test conditions. The Chamber Synchronization list will appear dimmed (unavailable) after the test conditions have been assigned.

If the temperature chamber is assigned, all the channels in the group operate in sync. You cannot select an individual channel to be executed. If you select a single channel, all the channels in the group that are executable are selected.

Mixing different test conditions within the group using the Common Sequence Template

After you assign the temperature chamber number, select the test conditions. The general rule is to collectively assign the same test conditions to all the channels in the group when a temperature chamber is synchronized. However, you can exceptionally mix different test conditions in the group (and still synchronize a temperature chamber). In such case, a problem arises in the setup conditions of the temperature chamber. The setup conditions of a temperature chamber is written on the charge/discharge sheets in the test conditions. If you mix different test conditions within the same group, this results in a mixture of different setup conditions of temperature chambers and different test sequences of charge/discharge sheets. However, such discrepancy is not allowed in temperature chamber synchronization. If you use a Common Sequence Template file that is managed using the Test Condition Editor, inconsistencies in the sequence information and temperature chamber setting information can be avoided. For details on the Common Sequence Template, see section 7.10.3, “Common Sequence Templete"

Requirements for performing tests in synchronization with the temperature chambers

The Test Executive allows synchronized operation only when all the channels in the group that is synchronizing the temperature chamber are sequentially consistent. In summary, the following two conditions are required when assigning test conditions on the Test Execution Panel [START] for synchronized operation of temperature chambers.

1. The same test conditions or different test conditions that share the same common template are assigned to all the channels in the group.
2. The number of cycles that have been completed is the same for all the channels.

If no discrepancies exist in the test conditions and the completed cycle number, you can select channels on the Test Execution Panel [START]. However, because the temperature chamber is synchronized, you cannot select the channels individually (mix selected and unselected channels).

If you select a single channel, all channels are selected automatically at once.

If you cannot select channels, discrepancies due to reasons described above exist.

7.10.5 Status Display of Temperature Chambers

If the number of chambers is set to 1 or greater in the Hardware Configuration Wizard, the Chamber Pane is displayed at the lower right of the screen when the Test Executive is started. For the setup procedure of temperature chambers, see section 3.2, “Configuring the Hardware."

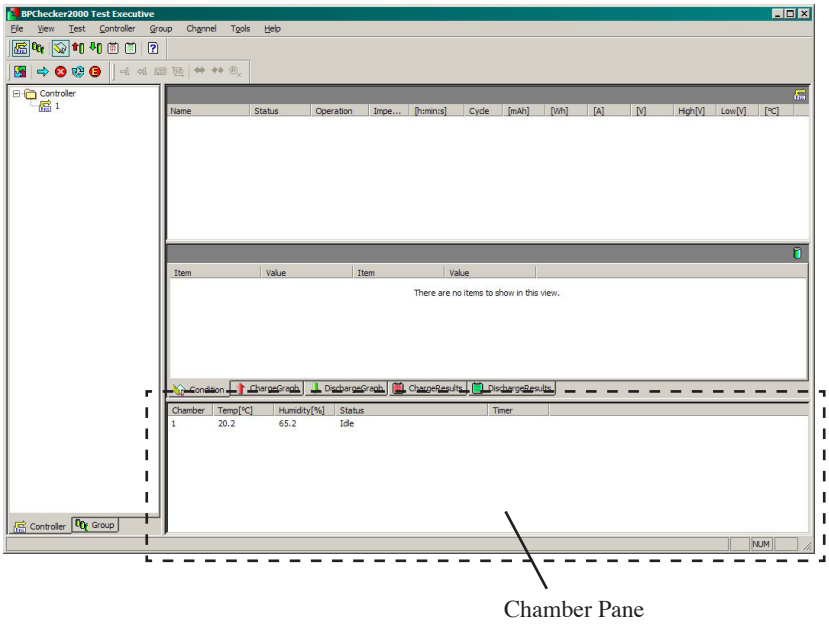


Fig. 7-20 Chamber Pane

Temperature Chamber

The number of the test chamber assigned in the Hardware Configuration Wizard.

Temperature [˚C]

Temperature monitored in the temperature chamber.

Humidity [%]

Humidity monitored in the temperature chamber.

Status

•Idle

Condition in which the temperature chamber is identified. This status is displayed while charging/discharging and resting.

- **Setting xx˚C**

  Status from when the temperature is set until the monitored temperature of the temperature chamber reaches the setting margin. If the specified temperature is not reached after the setting timeout elapses, the test is aborted as a setting error. The time until the monitored temperature reaches the setting margin varies depending on the performance of the temperature chamber.

•Waiting

Waiting status until the DUT warms up to the specified temperature with the temperature chambers stable at the specified temperature. After the wait time elapses, charge/discharge operation starts.

•I/O communication error

Status in which communication cannot be performed with the temperature chamber. See section 6.2.4, “If the Test Executive Cannot Identify Temperature Chambers."

Timer

Counts down from the specified time while it is in setting or waiting status.

7.10.6 Behavior When Alarms Occur during Synchronized Operation with Temperature Chambers

When an alarm occurs on a channel during synchronized operation with temperature chambers, the test on the channel is automatically aborted on the charge/discharge power unit. You can preset how the test is to proceed in such cases for other channels in the same group.

Choose **Options** in the **Tools** menu to display the Options dialog box and then click the **Alarm Sync** tab. The following three choices are available.

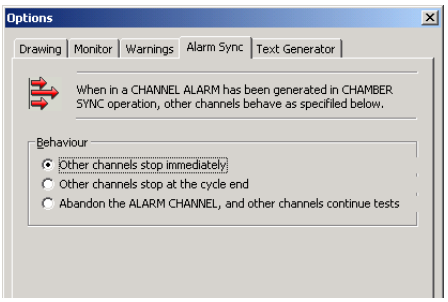


Fig. 7-21 Tools > Options > Alarm Sync

Behaviour

- **Other channels stop immediately (default)**

If you select this behavior, all the channels in the group stop immediately. This means that the data of the cycle when the alarm occurred is discarded also on normal channels. However, if you reset the alarm on the corresponding channel, you can restart the test on all channels from the beginning of the cycle at which the alarm occurred.

- **Other channels stop at the cycle end**

In this case, normal channels do not stop immediately. They automatically stop after completing the discharge phase of the cycle in the current test. This means that the data of the cycle at the time the alarm occurred can be retrieved on normal channels.

To restart the test, wait for the normal channels to automatically stop and reset the alarm on the corresponding channel. Then, increment the cycle number of the channel on which the alarm occurred by 1. (To adjust the cycle number, right-click on the Channel Pane and then choose **Increment Cycle Number +1** from the shortcut menu.) This action is required because the channel on which the alarm occurred could not complete the test cycle and is 1 cycle behind other channels. After adjusting the cycle, the test can be restarted (because the cycle numbers on all channels match).

Note that in this case, the channel on which the alarm occurred will have one cycle of data missing. The test restarts from the next cycle number after the cycle on which the alarm occurred.

- **Abandon the ALARM CHANNEL, and other channels continues tests**

If you select this behavior, normal channels continue the test without stopping. This means that the data after the alarm occurrence is not retrieved on the channel on which the alarm occurred.

7.11 Impedance Measurement

The Test Executive enables you to measure the impedance of the battery under test using the impedance measurement unit that is connected to the controller. A single impedance measurement unit can be connected to each controller. When using two controllers, connect a total of two impedance measurement units.

Configuration related to impedance measurement units is set using the Hardware Configuration Wizard. If you choose **Hardware Configuration** from the **Tools** menu of the Test Executive, you can only check the configuration.

Impedance Measurement Operation

Impedance measurement is performed immediately after charge, immediately after charge rest, immediately after discharge, immediately after discharge rest, or combination of these points according to the test conditions.

The impedance measurement unit can only measure the impedance one channel at a time. However, all the channels belonging to the same controller share the same impedance measurement unit. Therefore, the Test Executive performs impedance measurement on a first-come-first-serve basis. For example, if multiple channels attempt to move to the impedance measurement process approximately at the same time, the earliest channel is processed first while others are forced to wait until the measurement on the earlier channel is finished. As a result, the impedance measurement may be delayed by up to tens of seconds depending on the waiting condition. (In principle, the measurement must be performed immediately after charge, discharge, or rest.)

The Test Executive holds the channels whose impedance measurement has not been finished from moving to the next process. However, this applies only to impedance measurements performed immediately after charge rest (followed by discharge) or immediately after discharge rest (followed by charge of a new cycle). For measurements immediately after charge or immediately after discharge (followed by rest), the phase moves to rest even if the impedance measurement has not been performed. This is because the PFX2000 system hardware automatically processes the transition, and the Test Executive has no control over it.

The impedance measurement is performed only at the timing (immediately after charge, immediately after charge rest, immediately after discharge, or immediately after discharge rest) specified in the test conditions. However, if the impedance measurement unit is not connected to the controller to which the channel belongs, the setting is ignored and the process moves on without making the impedance measurement.

The measured impedance values cannot be monitored in realtime (while the test is in progress) on the Test Executive. The values are displayed on the ChargeResults or DischargeResults page on the Graph Result Pane after the completion of the charge or discharge phase. You can also view the values by analyzing the results using the Graph Viewer.

7.12 Screen and Other Functions

7.12.1 Controller/Group Pane

There are two view modes available on the Test Executive: Controller View Mode and Group View Mode. To switch the display mode, click the **Controller** tab or **Group** tab at the bottom section of the Controller/Group Pane on the left side of the screen.

Controller View Mode classifies the display by the controller units that are connected to the PC. When you click the control unit from the controller tree view, the Channel Pane on the right shows only the channels that are connected to the corresponding control unit.

Group View Mode classifies the display by groups irrespective of the connection status of control units. When you click a group name from the group tree view, the Channel Pane on the right shows only the channels that are bound to the corresponding group.

7.12.2 Channel Pane

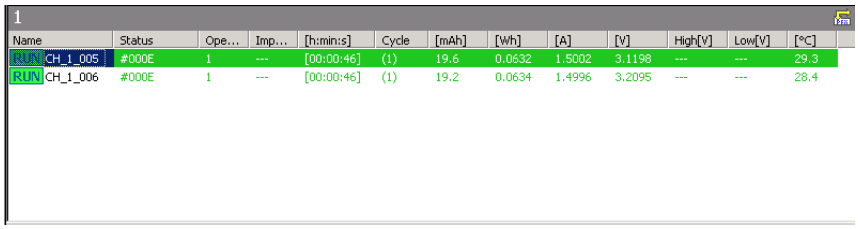


Fig. 7-22 Channel Pane

About the icon display

An icon indicating the channel status is displayed at the left of each channel display. Table 7-3 shows the icon types.

Table 7-3 Icon Display

Icon Display Name	Description
None	The channel is not recognized by the controller. This status is not allowed for operating the system normally.
OFF	The internal power supply of the channel is OFF.
IDLE	The internal power supply of the channel is ON, and the channel is in the monitor loop.
RUN	The test is running.
END	The test process is finished.
ALM	Alarm is occurring.

Channel Pane screen configuration

The current selected control unit (When Controller View Mode) or group (When Group View Mode) is displayed at the top section on the left.

The displayed information of each channel is as follows:

You can show or hide some of these items as necessary. There are items that you cannot hide.

Name This is the name of the channel. Right-clicking the item shows a shortcut menu that you can use to add/delete channels, bind the channel to a group, and change the individual connection status.

Status Displays the status of the channel. Normally, the status is indicated by a number. However, you can display a mnemonic of the status on the tool tip by placing the cursor over the item.

Operation Displays information concerning the electrical operation currently in progress (such as charging). Normally, the operation is indicated by a number. However, you can display a mnemonic of the operation on the tool tip by placing the cursor over the item.

Impedance The word “Measuring” appears while the impedance measurement unit is making a measurement on the corresponding channel. Otherwise, nothing is displayed.

[h:min:s] Indicates the lapsed time since the test phase was started. During charging, this is the time elapsed since charging was started; during discharging, this is the time elapsed since discharging was started. The lapsed time includes the rest section. The time is not reset when charging/discharging moves to rest. Note that this is not the integrated lapsed time since the start of the first cycle.

Cycle Displays the current cycle number, if the test is in execution (RUN icon). Otherwise, the number of the cycle has been completed is displayed. If the test is in execution and the number is indicated in parentheses, this indicates predischarging. For example, predischarging for cycle number 10 is indicated as (10). Initial predischarging is indicated as (1). If the entire process has been completed or if you terminate the test, the cycle number is enclosed in brackets and END appears to the left. For example, END[25] indicates that all 25 cycles of the process have been completed or that you terminated the process that is longer than 25 cycles at 25 cycles.

[mAh] Displays the current measured capacity.

[Wh] Displays the current measured wattage.

[A] Displays the current measured current.

[V] Displays the current measured voltage.

High[V] Displays the measured value at the HIGH point of voltage measurement. Displays the voltage at the HIGH measurement point during pulse charging and the voltage at the measurement point (HIGH, 1 to 8) that was specified in the test conditions during CC-Pulse discharging. For other modes of discharging, “---” is displayed.

Low[V] Displays the measured value at the LOW point of voltage measurement. Displays the voltage at the LOW measurement point during pulse charging and the voltage at the measurement point (LOW, 1 to 8) that was specified in the test conditions during CC-Pulse discharging. For other types of discharging, “---” is displayed.

[˚C] Displays the current measured battery temperature.

7.12.3 Graph Result Pane

The lower right (or middle) section of the screen is the Graph Result Pane. The Graph Result Pane shows the realtime graph, the test conditions, and the summary of test results for the channel that is selected in the Channel Pane. You can switch the display as necessary using the Condition, ChargeGraph, DischargeGraph, ChargeResults, and DischargeResults tabs. The top section of the Graph Result Pane always shows the name of the channel selected in the Channel Pane regardless of the tab that is selected.

Condition page

This page shows a summary of the test conditions. The test conditions consist of 15 types of sequence sheets and a predischarge sheet dedicated for initial charging. However, this page displays only the information of the sheet that is used in the current cycle in progress. The number of the sheet that is actually used is indicated by Sheet No at the top section. For details on each item, see the description of the Test Condition Editor.

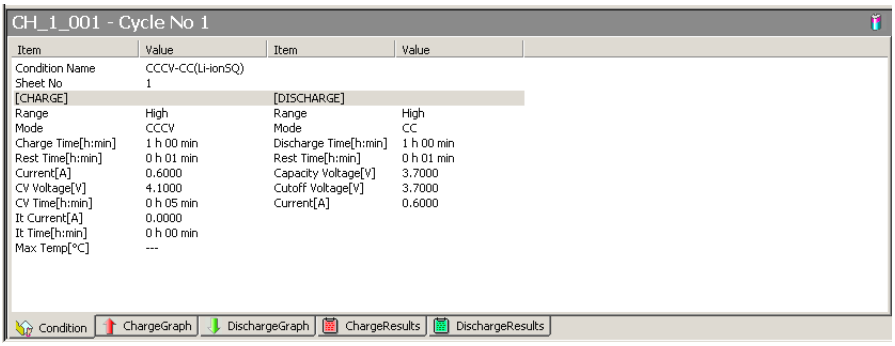


Fig. 7-23 Condition Page

ChargeGraph/DischargeGraph page

This page shows a realtime graph during charging or Discharging. The voltage and current are displayed. Scaling is done automatically. You can change the drawing style such as the color and line type of graphs and the number of divisions within the scale by choosing **Options** from the **Tools** menu and then selecting the **Drawing** tab.

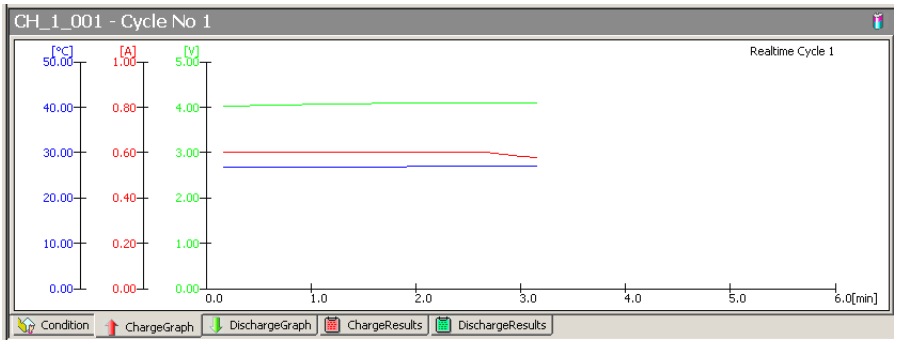


Fig. 7-24 ChargeGraph Page

ChargeResults/DischargeResults page

Summary of the charge results and discharge results is displayed.

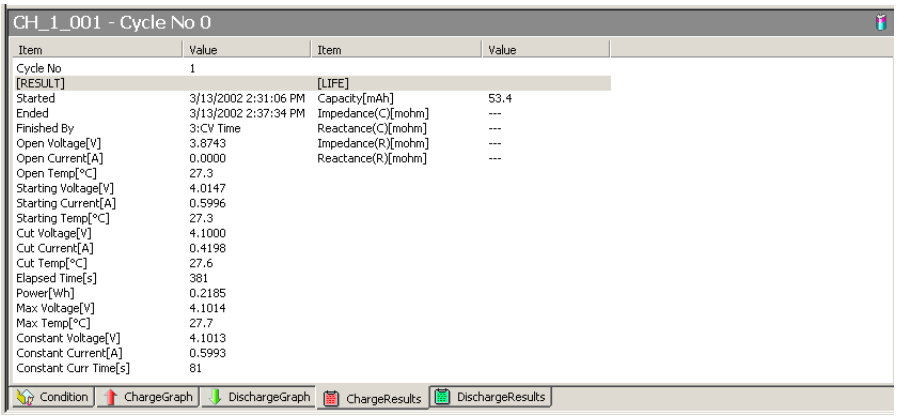


Fig. 7-25 ChargeResults Page

7.12.4 Properties Display

You can display properties of the controllers, groups, and channels on the Test Executive. The properties display contains detailed information of each item and various functions that you cannot control from other screens.

Because the properties sheets are modeless dialog boxes, you can operate the main screens of the Test Executive and menus while they are open. Normally, when you click another section on the Test Executive screen while the properties sheets are open, the sheets close immediately. However, you can leave them open by pressing in the pin button at the upper right corner of the dialog boxes.

Controller properties display

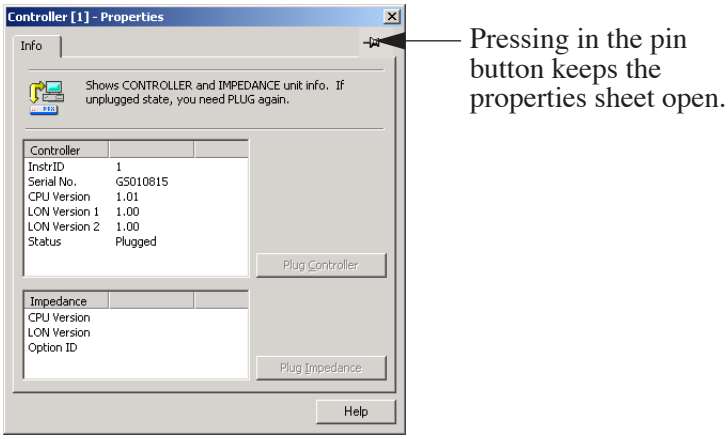


Fig. 7-26 Controller Properties

To display the controller properties, right-click on the Controller/Group Pane or choose **Properties** from the **Controller** menu in Controller View Mode (select the Controller tab on the Controller/Group Pane). The properties sheet displays the model name, serial number, CPU version, LON version (1st and 2nd internal sys-

tems), and the connection status (plugged or unplugged) of the current identified control unit. If the status indicates unplugged, the controller is not identified properly. Click the controller name and click **Plug Controller** to reconnect it.

If you are using an impedance unit, its information is also displayed. To disconnect and reconnect the impedance unit, click **Plug Impedance**.

Group properties display

To display the group properties, right-click on the Controller/Group Pane or choose **Properties** from the **Group** menu in Group View Mode (select the Group tab on the Controller/Group Pane). The properties sheet displays the name and temperature chamber information of the current identified group.

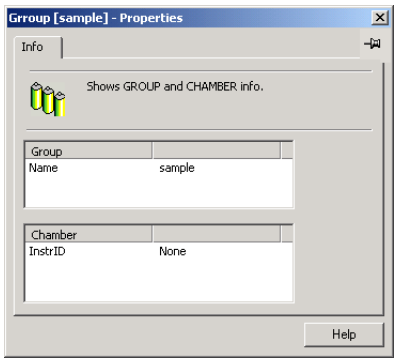


Fig. 7-27 Group Properties

Channel properties display

The channel properties display consists of three properties sheets that you can switch using tabs.

Info page

Displays the details of the charge/discharge module.

The Module section displays the model name, CPU version, LON version, and option ID. The option ID is normally 1.

The Channel section displays the name assigned to the channel and the position of the connection (instrument ID and node number).

The System section displays the settings of DUT check, auto fine, and moving average. These items are set as a part of the test conditions. However, during test execution, the items are set on the actual hardware when the test conditions are assigned (when entering the monitor loop). Therefore, these items are displayed only on channels that are displaying the IDLE or RUN icon. For all other cases, blank is displayed.

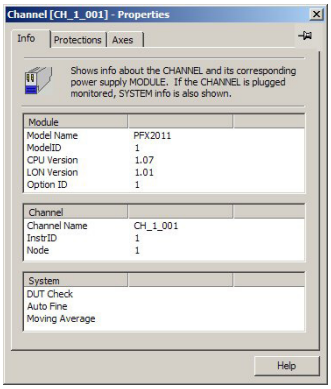


Fig. 7-28 Channel Properties > Info example

Protections page

This page is used to set the hardware overcharge protection (H OVP) and overdischarge protection (H UVP).

■ On the PFX2011 Charge/Discharge Power Supply Unit

To set the hardware protection functions, turn the H OVP and H UVP variable resistors on front panel of Charge/Discharge Power Supply Unit for adjustments. The specified values are displayed in the Actual Setting boxes. In addition, by using Assist Mode, you can check whether the specified value is within the appropriate range without looking at the display.

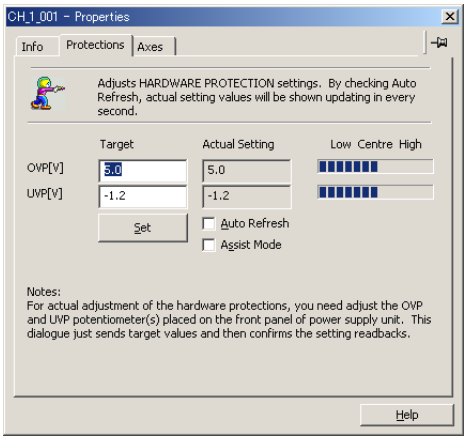


Fig. 7-29 Channel Properties > Protections

Target

Enter the voltage values you wish to assign for H OVP and H UVP. These values are used as a reference for judging whether the value specified on the charge/discharge power supply unit is within the appropriate range. The judgment result is displayed on a bar graph and the panel LED of the charge/discharge power supply unit (when in Assist Mode).

The entered values become new references by clicking the Set button.

Actual Setting

Displays the actual H OVP and H UVP voltage values assigned to the charge/discharge power supply unit. The bar graph on the right indicates whether the actual value is appropriate with respect to the target. If the bar graph is at the center, the setting is appropriate with respect to the target.

Auto Refresh

If you select the check box, the Actual Setting display is refreshed at approximately 0.5 s intervals.

Assist Mode

When this mode is enabled, the LEDs on the charge/discharge power supply unit are used to indicate whether the actual value is appropriate with respect to the target. This mode is useful when the PC display is far away from the charge/discharge power supply unit.

When the check box is selected, the front panel LEDs on the charge/discharge power supply unit function as indicated in Table 7-4.

Table 7-4 Functionality of the LED in Assist Mode

LED	Description
POWER/STANDBY	Blinks in orange and indicates that the LED is in assist mode.
CHG/DISCH/REST	Lights in green when the hardware OVP setting is within the appropriate range.
CC/CV/CP	Lights in green when the hardware UVP setting is within the appropriate range.
ALARM/WARNING	Same function as in the normal mode.

If you clear the **Assist Mode** checkbox, you can escape from assist mode. Assist mode is also disabled when you close the properties sheet, open a properties sheet of another channel, or execute the test on the channel in assist mode.

NOTE

- After entering a voltage in the Target box, be sure to click the Set button. The value is transmitted to the charge/discharge power supply unit when the button is clicked.
- The indicators will work properly only if appropriate values are entered in Target boxes.

■ On the PFX2021 Charge/Discharge Power Supply Unit

The setting of the hardware protection functions on this charge/discharge power supply unit is automatic. When you enter the desired voltages for H OVP and H UVP in the Target boxes, the internal variable resistors are automatically adjusted.

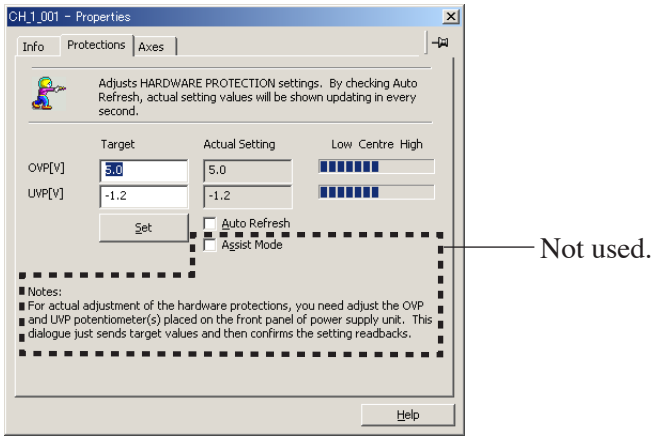


Fig. 7-30 Channel Properties > Protections

Target

Enter the desired voltages for H OVP and H UVP and click the Set button. The protection functions are automatically adjusted internally on the charge/discharge power supply unit.

Auto Refresh

If you select the check box, the Actual Setting display is refreshed at approximately 0.5 s intervals.

Assist Mode

Assist Mode is not used.

NOTE

- After entering a voltage in the Target box, be sure to click the Set button. The value is transmitted to the charge/discharge power supply unit when the button is clicked.
- If the Assist Mode check box is selected even for the PFX2021, the panel LED display will change to Assist Mode.

Axes page

This page is used to set the axes of the realtime graph display (charge graph and discharge graph on the Graph Result Pane).

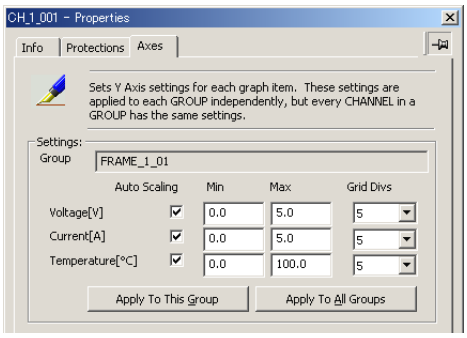


Fig. 7-31 Channel Properties > Axes

7.12.5 Display Options

You can change the display settings for the Test Executive using the dialog box that opens when you choose **Options** from the **Tools** menu. The Options dialog box consists of five pages.

Drawing page

This page is used to set the realtime graph drawing options

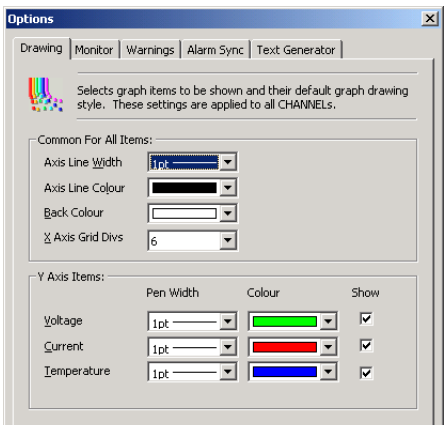


Fig. 7-32 Tools > Options > Drawing

Monitor page

This page is used to set the displayed items and the unit used on the Channel Pane.

You can select code or mnemonic for the State, Operation, and Impedance displays. Select Mnemonic to use easy-to-understand displays such as Charge and CC.

If you select the **Reset Column Width** checkbox, the column width of the items such as names and status displayed on the Channel Pane is reset to its default value.

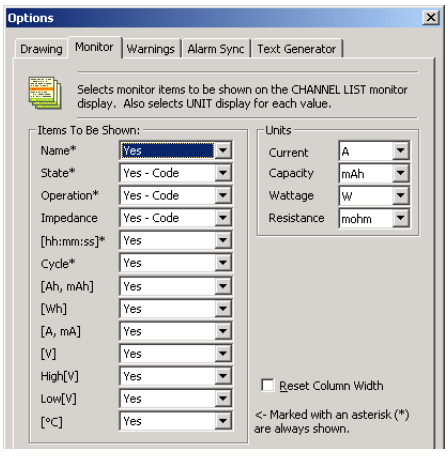


Fig. 7-33 Tools > Options > Monitor

NOTE

- The resistance unit setting is applied only to the CR charge/discharge value.
- The battery impedance is always displayed in [Ω].

Warnings page

This page is used to set the warning style.

If you select the **Show execution prompt messages** checkbox, a confirmation message is displayed when you click the **OK** button on the Test Execution Panel.

If you set the System Resource Warnings, the test automatically stops when the free disk space is less than equal to the specified value.

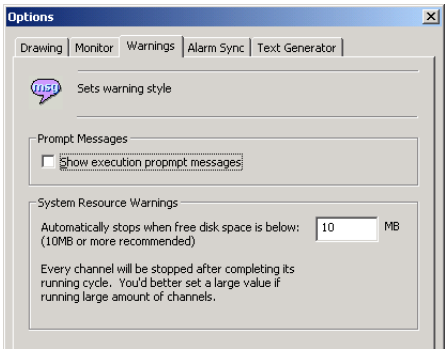


Fig. 7-34 Tools > Options > Warnings

Alarm Sync page

For details on the Alarm Sync page, see section 7.10.6, “Behavior When Alarms Occur during Synchronized Operation with Temperature Chambers.”

Text generator page

Sets the format of the text that is generated as test data.

If you select the **Generate Text Files** checkbox, a test data file in text format is generated in addition to the test data file in binary format used by the Graph Viewer program.

The data file is saved only if the **Record** check box is selected in Test Conditions > Sequence in the Test Condition Editor. See section 5.3.8, “Sequence."

This option can be used when you wish to perform your own data analysis.

If you wish to use a tab as a separator, enter “\t”.

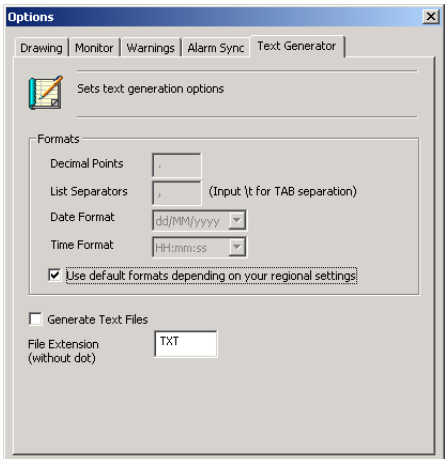


Fig. 7-35 Tools > Options > Text Generator

Do not use the same character for the decimal point and the separator.

Normally, use the default values that depend on the regional setting of Windows.

Chapter 8 Analyzing Test Results

This chapter describes the Graph Viewer, a tool for analyzing test results.

8.1 Graph Viewer

The Graph Viewer is a program used to display graphs of the test data created by the Test Executive on the screen and print the graphs. In addition to the test data graphs, the Graph Viewer displays numerical values of the test data, computed values derived from the test data such as energy, test conditions, and other information. This enables you to analyze the data comprehensively.

The Graph Viewer creates the following two types of graphs. These two graphs can be created arbitrary for the DUT (battery) that is included in the selected project. You can also superimpose the battery graphs on top of each other, if the graphs are of the same type.

Cycle life characteristics (Life) graph

This graph indicates the changes in the capacity of the DUT (battery) with respect to the number (cycle) of charge/discharge tests. A graph is drawn using the test data from the first cycle to the last cycle for a given battery.

Charge/Discharge characteristics (C/D) graph

This graph indicates the charge/discharge characteristics of the battery over an arbitrary cycle of the charge/discharge test (cycle) performed on a given battery. A graph is drawn using the test data of the selected cycle.

Starting the Graph Viewer

To start the Graph Viewer, double-click the shortcut icon of the Graph Viewer program from the Windows desktop folder or program folder.

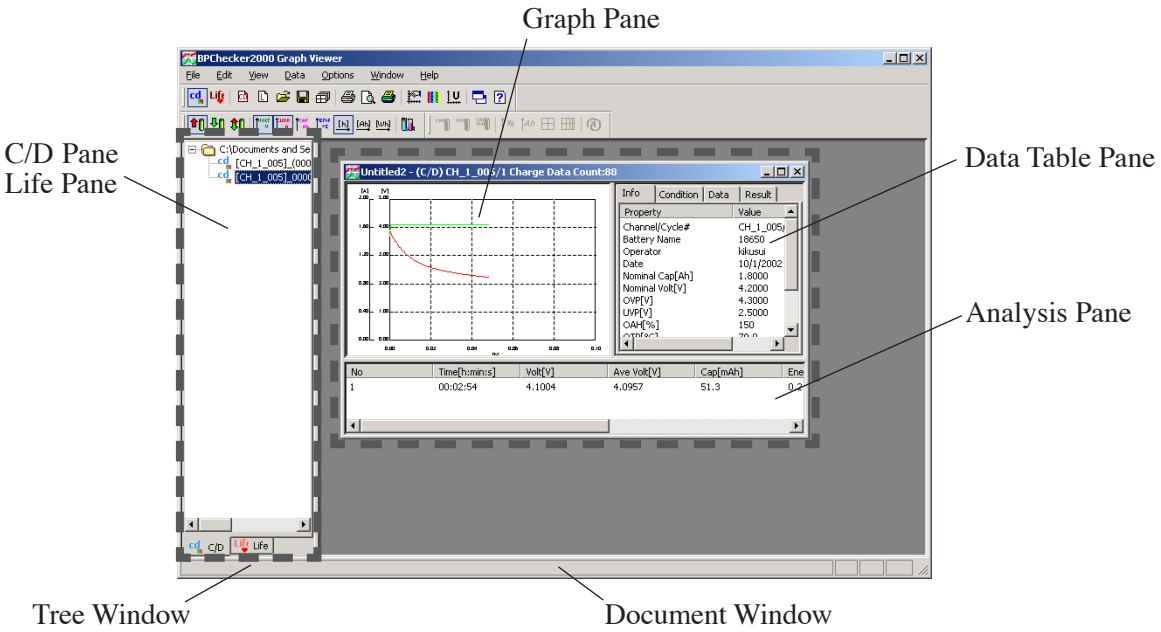


Fig.8-1 Graph Viewer Window

Below is the construction of the Graph Viewer screen.

Tree window

The window displayed on the left side of the application screen used to switch tabs. This window is always displayed while the Graph Viewer is running regardless of whether graph documents are present.

Clicking the C/D tab shows the C/D Pane, and a list of C/D graph data (charge/discharge data) that can be displayed is shown.

Clicking the Life tab shows the Life Pane, and a list of Life graph data (life characteristics data) that can be displayed is shown.

The ones shown in the list are not all the test data that can be displayed. The ones shown here are only those that are assumed to be frequently used (the folder specified in advance).

Document Window

A Document Window opens each time a graph document of cycle life characteristics (Life) or charge/discharge characteristics (C/D) is created. Since graphs are not displayed immediately after the Graph Viewer is started, the Document Window is not displayed.

The screen construction is the same for C/D and Life graphs. It is divided into the Graph Pane at the upper left, the Data Table Pane at the upper right, and the Analysis Pane at the bottom.

The Graph Pane shows the cycle life characteristics (Life) or charge/discharge (C/D) graph. The Data Table Pane shows test information, test conditions, test data, and test results. The Analysis Pane shows the analysis data determined by computing the test data using sequence numbers. The DUT name is displayed along with the sequence number for easy distinction of batteries.

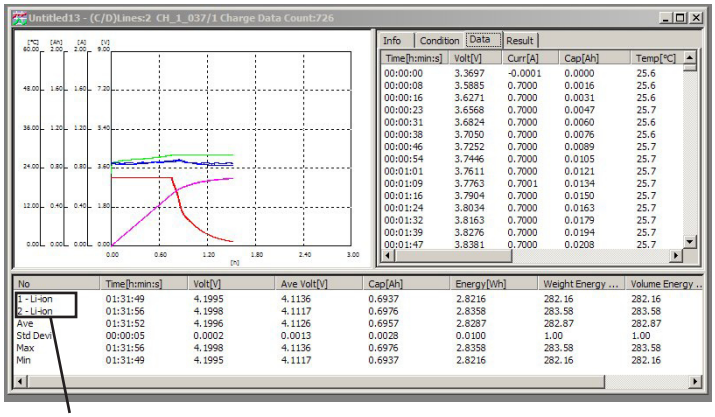


Fig. 8-2 Example of DUT names displayed along with the sequence numbers

8.2 Displaying Graphs

There are three methods for displaying the charge/discharge characteristics (C/D) graph or the cycle life characteristics (Life) graph or superimposing the same type of graphs.

- Using the Select Graph dialog box
- Using the tree window
- Using Windows Explorer

Folder containing the graph data file you wish to display

To display graphs, you must select the folder containing the graph data file you wish to display. The hierarchy of the selected folder varies between C/D graphs and Life graphs.

The folder that should be selected for each type of graph is explained using Fig. 8-3.

There is a folder named cccv (test conditions) that contains the test results obtained by using a test conditions file named cccv in a group folder named bpc2000(cccv).

Within the cccv folder are folders [CH_n_nnn] for 10 channels. In the channel 1 folder [CH_1_001] are C/D graph data and Life graph data.

For each channel, a C/D graph data file is created for each test cycle that is performed as well as 1 charge data file and 1 discharge data file for the Life graph. For details on the folders and files that are created, see appendix section A.4, “Folders and Files.”

For example, to display the C/D graph corresponding to the second cycle of channel 1, you select the [CH_1_001] folder. To display the Life graph of channel 1, you select the cccv (test conditions) folder that is one folder higher than channel 1.

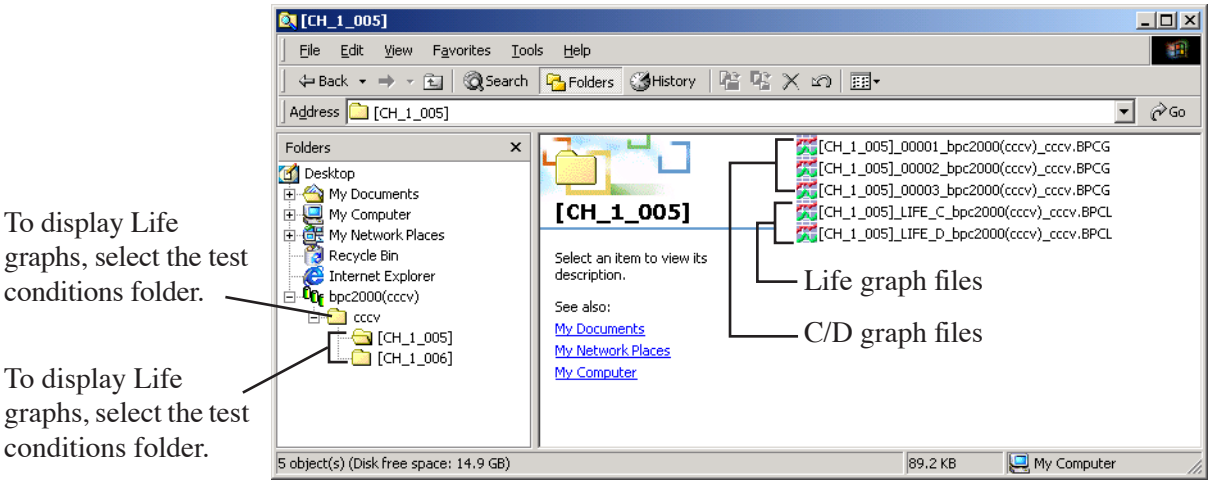


Fig. 8-3 Folder Selected When Displaying Graphs

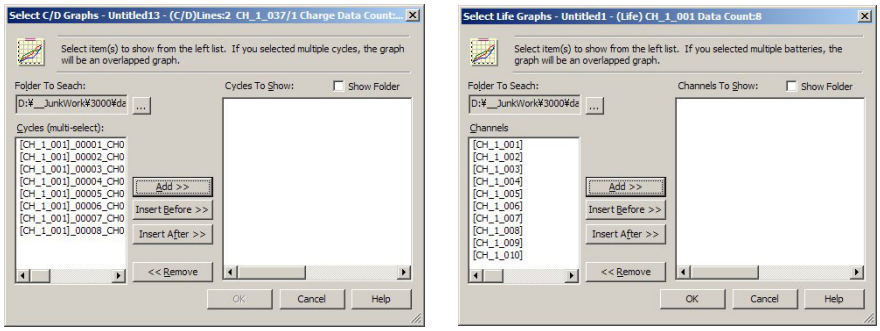
8.2.1 Methods of Displaying Graphs

■ Using the Select Graph dialog box

If the Show Folder check box is selected, the files are displayed using full path in the Cycle to Show and Channels to Show boxes. If the check box is not selected, BPCG files are displayed for the C/D graph and the channel folder names are displayed for the Life graph.

1. From the **File** menu, point to **New** and then choose **C/D Graph** or **Life Graph**.

   The Select Graph dialog box appears.



C/D Life

Fig. 8-4 Select Graph Dialog Box

2. Click the [...] button of Folder To Search, and select the folder containing the graph you wish to display.

   For a description of the folder you should select, see “Folder containing the graph data file you wish to display” in the previous section.

   For C/D graphs, a list of BPCG files is displayed in the Cycle box of the dialog box.

   For Life graphs, a list of channel folder names is displayed in the Channel box of the dialog box (not a list of BPCL files).

3. Select the items you need from the Cycle box or Channel box, and click **Add>>**, **Insert Before>>**, or **Insert After>>**.

   The selected items moves to the Cycle to Show or Channel to Show box. The graph of the items in this box will be displayed.

   Click **Add>>** to add the item at bottom.

   If you click **Insert Before>>** or **Insert After>>** after selecting an item in the Cycle to Show or Channel to Show box, the item is inserted before or after the selected item.

   If you select items in the right box and click **Delete**, the items are removed from being displayed.

4. Click **OK**.

■ Using the tree window

1. From the tree window on the left side of the Graph Viewer screen, select the C/D Pain or the Life Pain.
2. Right-click the top section of the tree display.

   A shortcut menu appears.
3. From the shortcut menu, choose **Change Folder**.

   A dialog box used to select the folder appears.

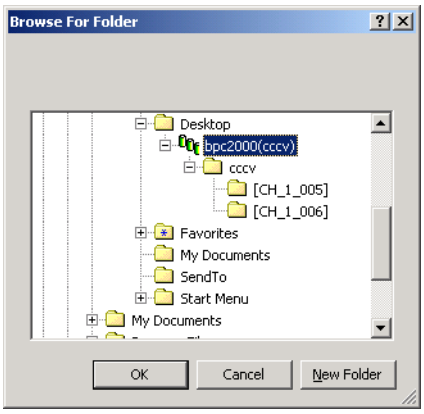


Fig. 8-5 Browse For Folder Dialog Box

4. Select the folder containing the graph you wish to display.

   For a description of the folder you should select, see “Folder containing the graph data file you wish to display” in the previous section.

   For C/D graphs, a list of BPCG files in the selected folder is displayed in the tree window.

   For Life graphs, a list of channel folder names in the selected folder is displayed (not a list of BPCL files).
5. Select the graphs you wish to display from the tree display.
6. Drag and drop the objects outside the document window (dark gray area)

■ Using Windows Explorer

1. Open Windows Explorer.
2. Select one or multiple graph data files you wish to display.

   For C/D graphs, select files with .BPCG extension.

   For Life graphs, select files with .BPCL extension. You can select either Life_C.BPCL or Life_D.BPCL.
3. Drag and drop the objects outside the document window (dark gray area)

   If a single file is selected, one graph is displayed; if multiple files are selected, multiple graphs are displayed superimposed.

8.2.2 Superimposing Graphs

When a new C/D graph or Life graph is displayed, you can display the graph as an independent graph or as an superimposed graph. On graphs that are already displayed, you can superimpose more graphs or remove unneeded superimposed data.

NOTE

- You cannot superimpose C/D graphs and Life graphs together.
  You can use drag and drop to increase the data to be superimposed, but you must use the Select Graph dialog box when removing the superimposed data.

■ Using the Select Graph dialog box

1. Activate the graph document you wish to superimpose.
2. From the **Data** menu, choose **Select Graph**.
   The Select Graph dialog box (the same dialog box when you open a new graph) appears.
3. In the dialog box, add the graphs to be superimposed or remove the superimposed graphs, and click **OK**.

■ Using the tree window

1. Activate the graph document you wish to superimpose.
2. From the tree window, select the Graph Pane of the same type (C/D or Life).
3. Drag and drop the graphs you need from the list onto the document window that is already opened.

■ Using Windows Explorer

1. Activate the graph document you wish to superimpose.
2. Open Windows Explorer.
3. From Explorer, select the graph data files or folder you wish to display.
   For C/D graphs, select BPCG files.
   For Life graphs, select BPCL files or a channel folder.
4. Drag and drop the selected items onto the document window that is already opened.

■ Using Graph Explorer

Only an English version of Graph Explorer is available. The program can handle Japanese file names.

1. Choose **Graph Explorer** from the **Option** menu.
   Graph Explorer starts.
2. Search the test data by using the file extension, instrument ID, channel number, and cycle number as keywords.
3. Drag and drop the search result onto the Graph Viewer.

8.2.3 Operations of the C/D graph

Graph type

You can select one of the following three types of graphs by choosing **Graph** from the **View** menu.

- Charge/Discharge graph
- Charge graph
- Discharge graph

The charge graph displays only the charge characteristics; discharge graph displays only the discharge characteristics.

The charge/discharge graph displays the charge characteristics followed by the discharge characteristics as shown in Fig. 8-6.

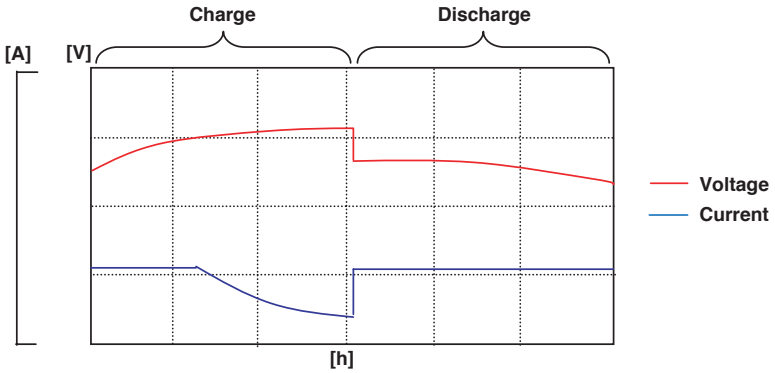


Fig. 8-6 Charge/Discharge Graph

X axis and Y axis

You can select the X axis display from time, capacity, and watthour. Choose **X Axis** from the **View** menu.

You can select the Y axis display from voltage, current, capacity, and temperature. Choose **Y Axis** from the **View** menu.

Scale

Choose **Scale** from the **View** menu to set the minimum, maximum, and step for each axis.

Enter values for minimum and maximum; drag the slide bar on the right to set the step.

The scale setting can be saved. Enter the name in the **Save To** box and click **Save**. Once saved, you will be able to select the name of the saved setting from the **Load From** box. Click **Load** to load the setting.

To delete the settings that you saved, select the name to be deleted in the Load From box, and click **Delete**.

The default setting to be loaded is Auto Scale. Auto Scale automatically sets the scale to the best-suited setting for the data. To change the default setting to be loaded, select the setting you wish to make the default from the **Load From** box and click **Load**.

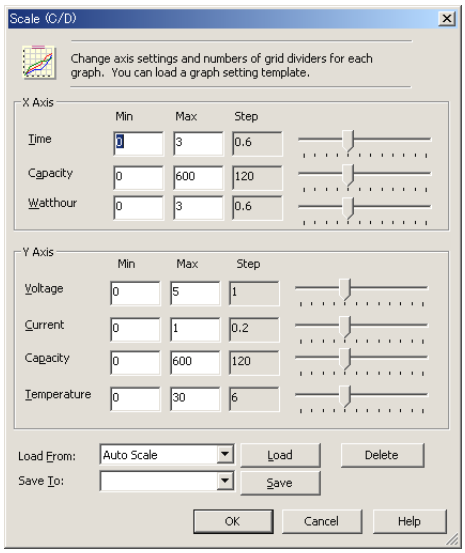


Fig. 8-7 Scale Setting of C/D Graphs

Drawing style

Choose **Drawing Style** from the **Options** menu to specify the pen width and color for each line. You can also show or hide the lines.

The **No.** (line number) setting is applied when graphs are superimposed. Select the desired line number to set the line width and pen color. The line number corresponds to the No item shown on the Analysis Pane.

If you select the **Show Rest Data** checkbox, the data that is measured during rest is displayed on the graph.

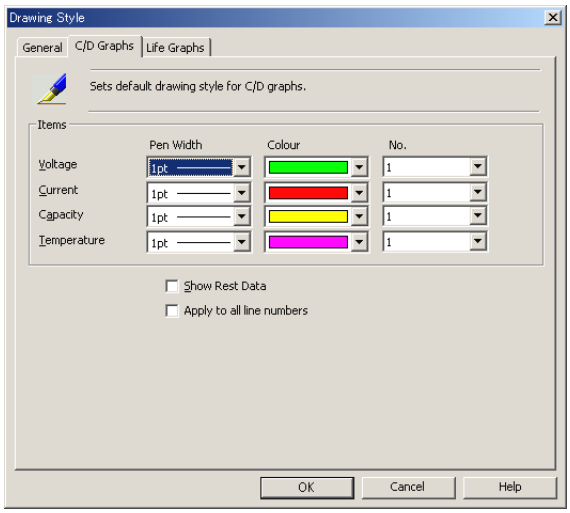


Fig. 8-8 Drawing Style of C/D Graphs

If more than 100 graphs are superimposed, the settings are applied again from line number 1. For example, the settings (pen width and color) of graph number 101 are the same as those of graph number 1.

Setting analysis data

Choose **Set Analysis Data** from the **Data** menu to display the Analysis Data dialog box.

On the Analysis Input Data page, you can change the information used to calculate the voltage, weight energy density, and volume energy density that are displayed on the Analysis Pane. By default, the test conditions information you entered on the Test Condition Editor is used.

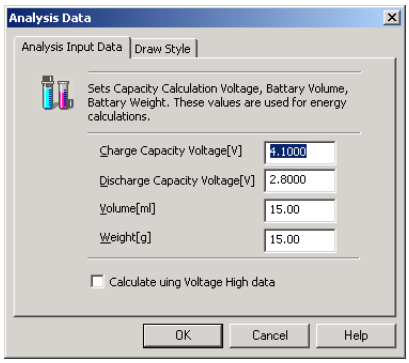


Fig. 8-9 Changing of the Calculation Reference

On the Draw Style page, you can set the charge capacity calculation voltage and discharge capacity calculation voltage to be displayed on the graph. Selecting the **Show Line** checkbox turns ON the graph. You can also specify the line width and color.

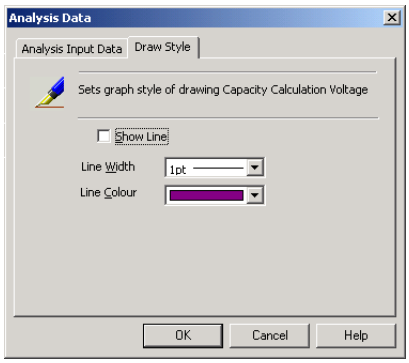


Fig. 8-10 Display Setting of the Capacity Calculation Voltage

Changing the drawing unit

Choose **Drawing Unit** from the **Options** menu to change the unit of C/D graphs.

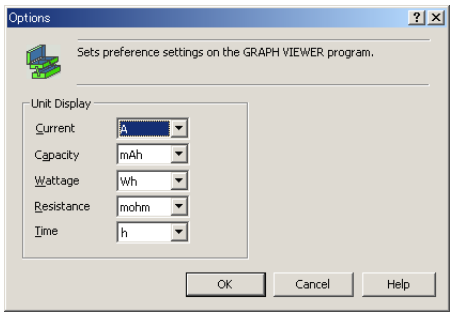


Fig. 8-11 Changing of the Unit

8.2.4 Operation of the Life graph

Graph type

You can select one of the following three types of graphs by choosing **Graph** from the **View** menu.

- Capacity/Impedance graph
- Capacity graph
- Impedance graph

The capacity graph consists of two lines, one for charge capacity and the other for discharge capacity.

The impedance graph consists of lines for the following four points: Immediately after charge is finished, immediately after charge rest is finished, immediately after discharge is finished, and immediately after discharge rest is finished. These four lines are drawn for each of the four display items, R, JX, Z, and θ. The four items, R, JX, Z, and θ can be shown or hidden. Thus, if all items are shown, 16 lines are displayed. Fig. 8-12 shows the case when you select capacity/impedance graph, and only R is displayed.

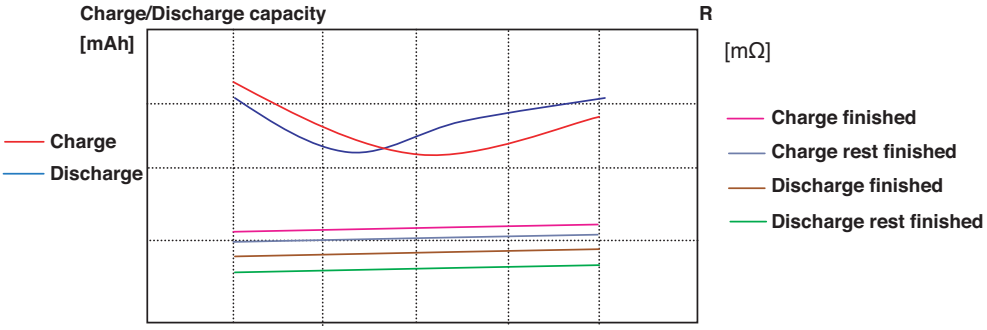


Fig. 8-12 Capacity/Impedance Graph

In the Graph Viewer, the displayed unit for measured impedance is [mΩ].

X axis and Y axis

The X axis shows the cycle. Choose **X Axis** from the **View** menu bar to select linear display or logarithmic display.

The Y axis shows the capacity. Choose **Y Axis** from the **View** menu bar to select capacity value or capacity ratio.

If you select capacity ratio, the change in the capacity is displayed with respect to the specified cycle. To specify the reference cycle, choose **Capacity R**

atio Reference Cycle from the **Data** menu.

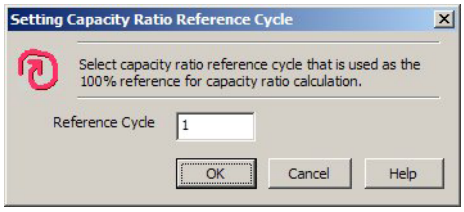


Fig. 8-13 Setting Capacity Ratio Reference Cycle

Scale

Choose **Scale** from the **View** menu to set the minimum, maximum, and step for each axis.

Enter values for minimum and maximum; drag the slide bar on the right to set the step.

The scale setting can be saved. Enter the name in the **Save To** box and click **Save**. Once saved, you will be able to select the name of the saved setting from the **Load From** box. Click **Load** to load the setting.

To delete the settings that you saved, select the name to be deleted in the **Load From** box, and click **Delete**.

The default setting to be loaded is Auto Scale. Auto Scale automatically sets the scale to the best-suited setting for the data. To change the default setting to be loaded, select the setting you wish to make the default from the **Load From** box and click **Load**.

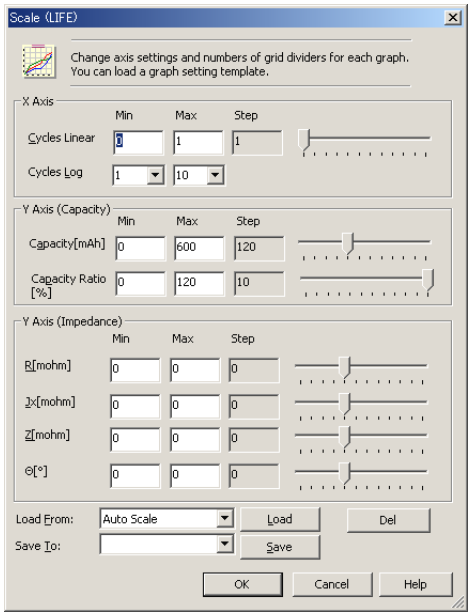


Fig. 8-14 Scale Setting of Life Graphs

Drawing style

Choose **Drawing Style** from the **Options** menu to specify the pen width and color for each line. You can also show or hide the lines.

If you clear the **Show** box, the corresponding will not be displayed.

The **No.** (line number) setting is applied when graphs are superimposed. Select the desired line number to set the line width and pen color. The line number corresponds to the No item shown on the Analysis Pane.

You cannot show or hide line numbers individually. The Show box applies to all line numbers.

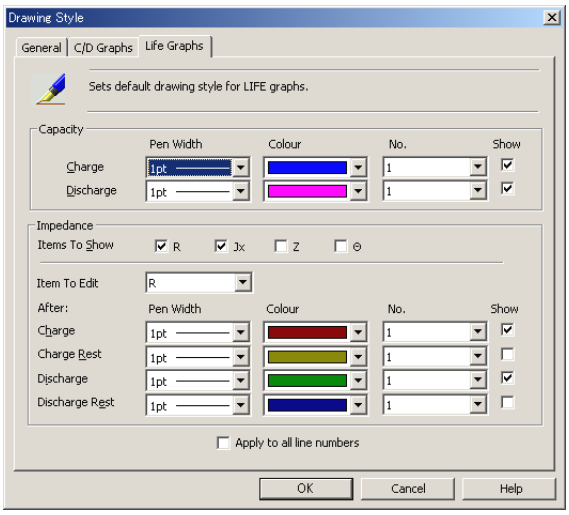


Fig. 8-15 Drawing Style of Life Graphs

8.2.5 Setting Comments on Graphs

You can enter comments on the graph. Select the graph on which you wish to enter a comment and choose **Set Comments** from the **Data** menu.

The text that you enter in the Set Comments dialog box appears on the graph. This comment also appears when you print the graph. See Fig. 8-18.

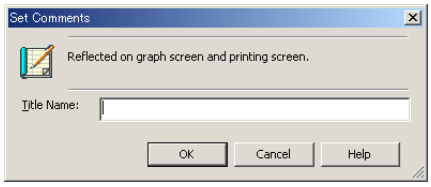


Fig. 8-16 Setting of Comments

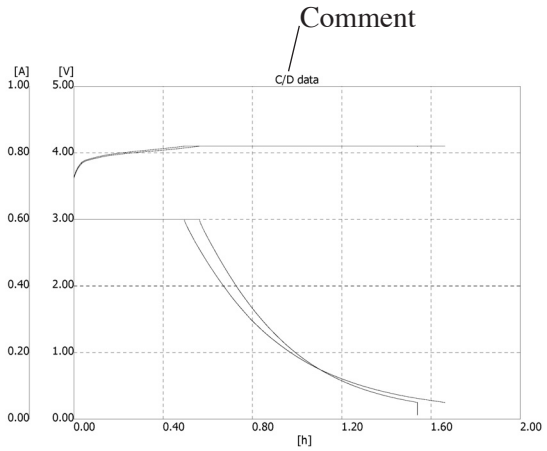


Fig. 8-17 Comment Entry Example

8.3 Printing Graphs

To print graphs, select the window containing the graph you wish to print and then choose **Print** from the **File** menu. If you wish the check the printed image on the screen beforehand, choose **Print Preview** from the **File** menu.

Fig. 8-18 shows a printed image of C/D graphs. If superimposed graphs are printed, data like the one shown in Fig. 8-18 page 2/2 that is displayed on the Analysis Pane are also printed.

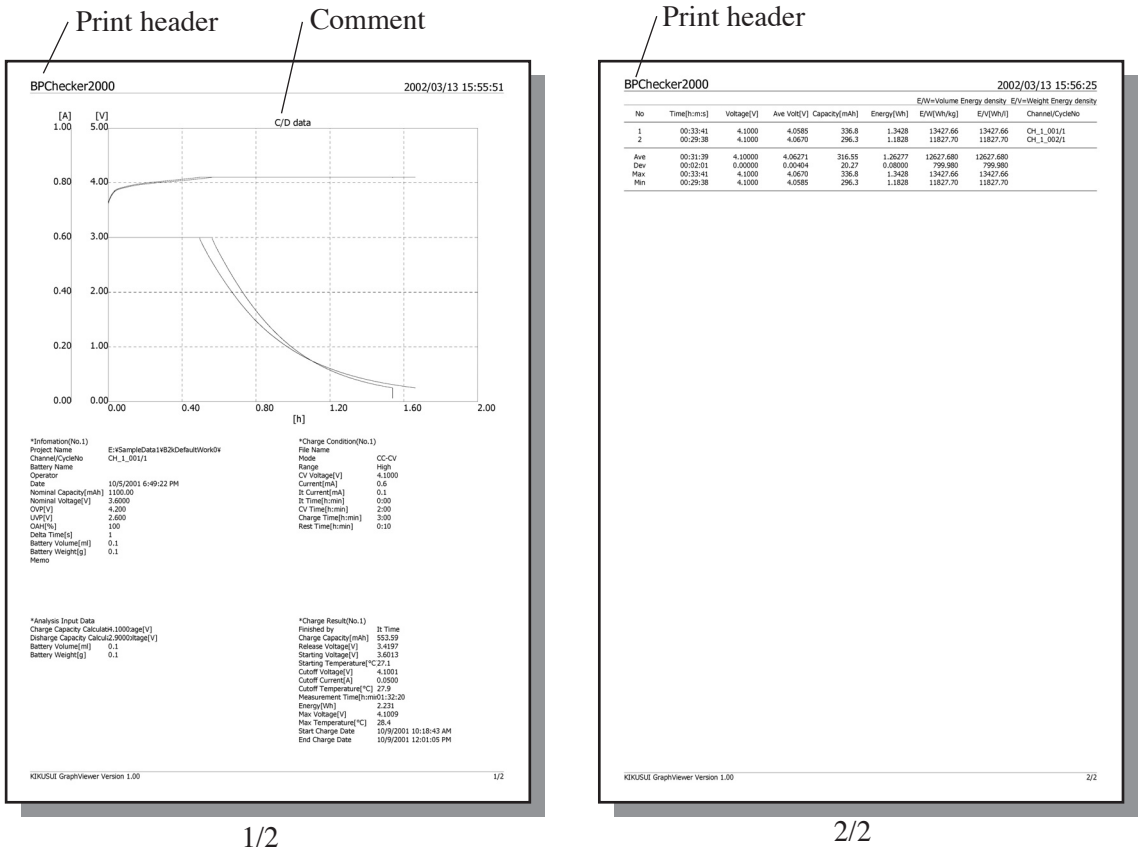


Fig. 8-18 Print Image of C/D Graphs

Setting print headers

You can print a header at the top left of the page as shown in Fig. 8-18. Select the desired graph and choose **Set Print Header** from the **Data** menu.

The text that you enter in the **Printer Header** dialog box appears on the printed page.

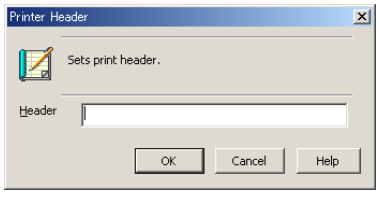


Fig. 8-19 Entry of the Print Header

Switching between color printing and black and white printing

The graphs can be printed in color.

Choose **Colour Printing** from the **File** menu to switch between color printing and black and white printing. If the printer icon before the Colour Printing command appears pressed in, color printing is possible.

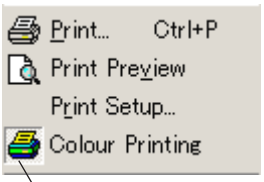


Fig. 8-20 Switching between Color Printing and Black and White Printing

8.4 Saving Graphs

■ Saving graphs

You can save graphs to a file by assigning a name.

To save graphs, select the window containing the graph you wish to save and then choose **Save** from the **File** menu. A Save dialog box appears. Enter the file name.

To open a saved graph, choose **Open** from the **File** menu. An Open dialog box appears. Enter the file name.

You can also copy the graph image to other documents via the clipboard. To copy the graph to the clipboard, select the window containing the graph you wish to copy and then choose **Copy Graph** from the **Edit** menu.

■ Saving graphs as text

You can save the graph data in text format (separated by tabs).

To save graphs in text format, select the window containing the graph you wish to save and then choose **Save Text** from the **File** menu. A Save dialog box appears. Enter the file name.

You can also copy the data on the Data Table Pane to other documents via the clipboard. To copy the data to the clipboard, select the window containing the graph you wish to copy and then choose **Copy Data** from the **Edit** menu.

Appendix

The appendix provides explanation of recovery after power failures, alarms, operation when connections are improper, and folders and files that are created. It also provides a list of the menus and the range of test condition settings.

A.1 Recovery after Power Failures

This section describes the behavior of the PFX2000 system when a power failure occurs while using the system.

A.1.1 When a Power Failure Occurs on the Charge/Discharge Power Supply Unit

If a power failure occurs on the charge/discharge power supply unit while the host PC is running normally, the behavior of the Test Executive varies depending on the operation status of the charge/discharge power supply unit. The operation status of the charge/discharge power supply unit is indicated on the Channel Pane using icons. Here, explanation will be given for each icon display.

If a power failure occurs on a charge/discharge power supply unit displaying a RUN icon

1. If a power failure occurs on a channel, the Test Executive will detect a communication error within approximately 10 s. The icon corresponding to the channel changes to an I/O icon as shown in Fig. A-1. (This is the same if the power failure recovers within 10 s.)
2. After the power failure recovers (or after turning on the power), reset the alarm.
   For details on resetting the alarm, see section 7.6, “Resetting Alarms.”
3. After the alarm is reset, the status of the corresponding channel changes to an IDLE icon.
   The cycle number displayed at this point corresponds to the cycle that was being executed when the power failure was detected.
4. If you restart the test, the test is executed from the start of the cycle that was being executed when the power failure was detected.
   If **Perform Startup Predischarge** checkbox is selected in the test conditions, the test starts with predischarge.

If a power failure occurs on a charge/discharge power supply unit displaying an IDLE icon

1. The icon corresponding to the channel changes to an I/O icon as shown in Fig. A-1.
2. After the power failure recovers (or after turning on the power), reset the alarm.
   For details on resetting the alarm, see section 7.6, “Resetting Alarms.”

3. After the alarm is reset, the status of the corresponding channel returns to an IDLE icon.
   The cycle number displayed at this point corresponds to the cycle that was already completed when the power failure was detected. If the test has not been executed yet, the cycle number is 0.

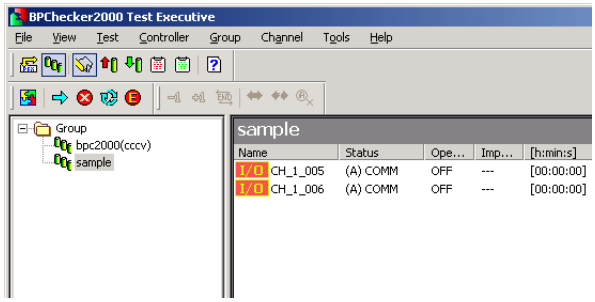


Fig.A-1 Communication Error

If a power failure occurs on a charge/discharge power supply unit displaying an END icon

1. The Test Executive is not monitoring the channel when the channel is in the END icon status.
   After the power failure recovers (or after turning on the power), the status indication of the channel retains the OFF icon.
2. You can execute the test as in the normal case.

If a power failure occurs on a charge/discharge power supply unit displaying an OFF icon

1. The OFF icon status indicates that you can deliberately insert or remove the unit. Therefore, the Test Executive cannot determine whether the condition in which the power is not supplied to the unit is due to a power failure or because the unit is removed from the frame.
2. The Test Executive is not monitoring the channel when the channel is in the OFF icon status.
   After the power failure recovers (or after turning on the power), the status indication of the channel retains the OFF icon.
3. You can execute the test as in the normal case.

NOTE

- If you execute the test while the unit is not available (power is not supplied), an error occurs.

A.1.2 When a Power Failure Occurs on the Host PC

If a charge/discharge power supply unit executing a test (RUN icon indication) exists when the power failure occurs

1. The unit executing the test continues the test until the phase (charge or discharge) that was running at the time of the power failure is finished. If the unit is charging, the test continues until the end of charge rest.

2. If you restart the PC and restart the Test Executive, the Test Executive stops the operation of all units.
   The test in progress on channels is aborted, and the status changes to the IDLE icon. This is also true if the phase had already been finished when the Test Executive is started.
3. The test while the PC is down is discarded, because no data is present. This means that channels showing the IDLE icon had stopped one cycle before the point when the PC went down.
4. If you restart the test, the test is executed from the start of the next cycle (cycle that was being executed when the power failure occurred).
   If **Perform Startup Predischarge** checkbox is selected in the test conditions, the test starts with predischarge.

If a charge/discharge power supply unit that is not executing a test exists when the power failure occurs

1. All units recover to the status that they were in when the power failure occurred.

A.1.3 When a Power Failure Occurs on Both the Charge/Discharge Power Supply Unit and PC

1. Immediately after the power to the hardware recovers, all charge/discharge power supply units enter the STANDBY status.
2. When you start the Test Executive, the Test Executive recovers the charge/discharge power supply units to the status that they were in when the power failure occurred.
3. The status of the channels that were executing tests when the power failure occurred becomes IDLE icon. They are stopped one cycle before the point when the power failure occurred.

A.1.4 When a Power Failure Occurs on the Control Unit (USB Connection Dropped)

1. The Test Executive detects an USB communication error within approximately 10 s. All the channels of the corresponding controller change to the I/O icon. However, unlike the I/O communication error of individual channels, the controller icon also disappears.
2. Display the properties of the controller that produced the communication error and reconnect. You do not have to reset alarms on channels individually.
3. After the alarm is reset, the status of the corresponding channel changes to an IDLE icon.

A.2 Alarms

This section describes the alarms and warnings of the PFX2000 Series Charge/Discharge Battery Test System.

A.2.1 Alarm and Warning Concepts

The charge/discharge battery test system must perform unmanned cycle tests stably and safely for an extended time period. Therefore, this system is equipped with multiple protection functions that cover all the dangerous conditions that can be assumed.

There are two types of protection functions.

(1) Those in which the user specifies values according to the DUT and activate using the specified values as references.

(2) Those that activate using fixed values that are assigned within the system as references

Protection functions of type (1) require correct understanding and application of each alarm and warning. In addition, knowing the conditions that activate the protection functions of type (2) will help in preventing the alarm from occurring.

Alarms and warnings are summarized in Table A-1 to A-3 by type. Please refer to them for your understanding and correct application of the alarms and warnings.

NOTE

- If alarms and warnings are not set correctly, problems will occur. The protection function may fail to trip when abnormal conditions occur (when necessary), and the DUT may break. Or, the test may be aborted even when there is no abnormal condition.

TableA-1 Protection Functions That Require the User to Set Appropriate Values (Alarms)

Type	Description	Usage	Note
S_OVP	When the DUT voltage is greater than or equal to the specified voltage, an alarm occurs and the output is turned OFF.	Since accurate detection is possible, you usually set the voltage relatively close to the cutoff voltage or CV voltage for charging.	Accurate overvoltage detection is possible, because the detection accuracy is the same as the normal voltage measurement accuracy. However, the detection speed is slow at 150 ms (maximum).
H_OVP		Set a voltage that is higher than S_OVP to prevent erroneous operation due to noise and by taking the detection accuracy (±100 mV) into consideration.	A comparator is used at the detection section and the circuit is independent from the internal microcomputer control. The detection speed is fast at 100 μs (maximum).
S_UVP	When the DUT voltage is less than or equal to the specified voltage, an alarm occurs and the output is turned OFF.	Since accurate detection is possible, you usually set the voltage relatively close to the cutoff voltage for discharging.	Accurate undervoltage detection is possible, because the detection accuracy is the same as the normal voltage measurement accuracy. However, the detection speed is slow at 150 ms (maximum).
H_UVP		Set a voltage that is lower than S_UVP to prevent erroneous operation due to noise and by taking the detection accuracy (±100 mV) into consideration.	A comparator is used at the detection section and the circuit is independent from the internal microcomputer control. The detection speed is fast at 100 μs (maximum).
OAH	When the charge or discharge capacity exceeds the specified capacity value (nominal capacity multiplied by ### %), an alarm occurs and the output is turned OFF.	This protection operates correctly only when the nominal capacity in Battery Info test conditions is specified.	–
OTP	When the DUT temperature exceeds the specified temperature, an alarm occurs and the output is turned OFF.	Specify an appropriate value by taking the temperature measurement error and ambient temperature fluctuation into consideration.	If you are not performing temperature measurements (includes the case when a thermistor is not connected), disable OTP.
Comm	The difference in the electric potential between the output cable and voltage sensing wire is measured immediately before the start of the test. If the difference is greater than or equal to the specified value, an alarm occurs.	To enable this alarm, enable the DUT connection check function in the Module test conditions settings.	The difference in the electric potential is not measured during the test.

Table A-2 Protection Functions with Fixed Values (Alarms)

Type	Description	Usage	Note
OHP	When the temperature of the internal circuit continuously increases and reaches the prescribed temperature (95 °C to 100 °C), an alarm occurs and the output is turned OFF.	The detection of this alarm is always in progress. The user does not have to set it.	If OHP trips continuously even when no abnormal conditions exist in the ambient temperature, dust filter, and so on, disable it.
S_OCP	If the charge/discharge current exceeds the constant current preset value, an alarm occurs and the output is turned OFF.	The detection of this alarm is always in progress. The user does not have to set it.	An alarm occurs when a current that exceeds the constant current preset value by 100 mA is detected.
Comm	When the communication between the control unit and the charge/discharge power supply unit is not working properly, an alarm occurs.	The detection of this alarm is always in progress. The user does not have to set it.	Even if an alarm occurs, the test continues until the phase currently in progress (charge or discharge) ends.
AC_OFF	If the input line voltage drops or a short interruption occurs, an alarm occurs and the output is turned OFF.	The detection of this alarm is always in progress. The user does not have to set it. If an error is detected and the alarm trips, the alarm cannot be reset using alarm reset.	An alarm occurs when the input line voltage is less than or equal to 180 V or when the short interruption lasts longer than or equal to 50 ms.
CD/B	If constant current or constant voltage control does not work correctly because the resistance in the DUT or output cable is large, an alarm occurs and the output is turned OFF.	The detection of this alarm is always in progress. The user does not have to set it.	The CD/B alarm may occur if the DUT is not connected or the output cable breaks in the middle of the test.
PS/B	When the internal power supply circuit section is abnormal (overvoltage or overheat), an alarm occurs and the output is turned OFF.	The detection of this alarm is always in progress. The user does not have to set it. If an error is detected and the alarm trips, the alarm cannot be reset using alarm reset.	The alarm is cleared when you recycle the power to the frame. If an alarm occurs again, stop using the unit and request repairs.

Table A-3 Warnings

Type	Description	Usage	Note
Idle (DUT Connection Warning)	A warning occurs if the difference in the electric potential between the output cable and the voltage sensing wire is greater than or equal to the prescribed value in idle status.	This warning operates only when the DUT connection check function is enabled in the Module test conditions settings.	You cannot start the test when a warning is activated. (Test conditions cannot be assigned.)
Idle (Protection Warning)	A warning occurs when the DUT voltage is in the H_OVP or H_UVP trip range in idle status.	The detection of this warning is always in progress. The user does not have to set it.	You cannot start the test when a warning is activated. (Test conditions cannot be assigned.)

A.2.2 List of Status Codes

Table A-4 shows a list of codes (or mnemonics) that are displayed under Status on the Channel Pane of the Test Executive. Codes that are #8000 or above indicate that an alarm is occurring. Fig. A-2 through Fig. A-4 show the cause of the alarms and the way to correct them.

Switching between code and mnemonic displays

The status can be displayed using a code (hexadecimal code) or mnemonic. On the **Tools** menu of the Test Executive, choose **Options** and click **Monitor**.

Select **Yes - Code** for the State item to display the status using codes; select **Yes - Mnemonic** to display using mnemonics.

State status codes

For details on the #0002 and #0003 warnings, see Table A-3.

Table A-4 Status Code of status in the Channel Pane

Status		Description
Code*1	Mnemonic	
#0000 (#0100)	Stand-by	Standby status (internal power supply OFF)
#0001 (#0101)	Idle	Idle status (test execution possible)
#0002 (#0102)	Idle (DUT Connection Warning)	Idle status (test execution not possible/abnormal connection)
#0003 (#0103)	Idle (Protection Warning)	Idle status (test execution not possible/protective function activated)
#0004 (#0104)	H Protection	Hardware OVP/UVP setup mode
#000A (#010A)	Charge	Charging
#000B (#010B)	Charge Rest	Charge rest
#000C (#010C)	Charge SYNC	Charge rest (synchronization)
#000D (#010D)	Charge End	Charge finished
#000E (#010E)	Discharge	Discharging
#000F (#010F)	Discharge Rest	Discharge rest
#0010 (#0110)	Discharge SYNC	Discharge rest (synchronization)
#0011 (#0111)	Discharge End	Discharge finished

*1.The codes inside the parentheses are for the low range setting.

Alarm status codes

Alarms are displayed by converging 16-bit data to hexadecimal code.

The displayed error code is the logical sum of the bits.

When displaying the status using mnemonics, Low Range (bit 8) and ALM (bit 15) are not displayed.

For details on alarms, see Table A-1 and Table A-2.

Table A-5 Status codes of alarms in the Channel Pane

Status			Description
Bit	Bit Weight	Mnemonic	
0	1	Conn	Abnormal connection
1	2	S_OVP	Software overvoltage protection
2	4	S_UVP	Software undervoltage protection
3	8	S_OCP	Overcurrent protection
4	10	OTP	Overtemperature protection
5	20	OAH	Overcharge/Overdischarge protection
6	40	Comm	Communication error detected
7	80	AC_OFF	Abnormal AC line detected
8	100	Low Range	Set when the current range is set to low.
9	200	H_OVP	Hardware overvoltage protection
10	400	H_UVP	Hardware undervoltage protection
11	800	ETC	Reserved
12	1000	CD/B	Abnormal internal charge/discharge unit (electronic load section)
13	2000	PS/B	Abnormal internal charge/discharge unit (power supply section)
14	4000	OHP	Overheat protection
15	8000	ALM	Alarm occurrence

Example) If status code #9300 is displayed

This indicates that CD/B (1000) and H_OVP (200) alarms (8000) occurred simultaneously while operating in low range (100).

A.2.3 Cause of Alarms and Their Correction

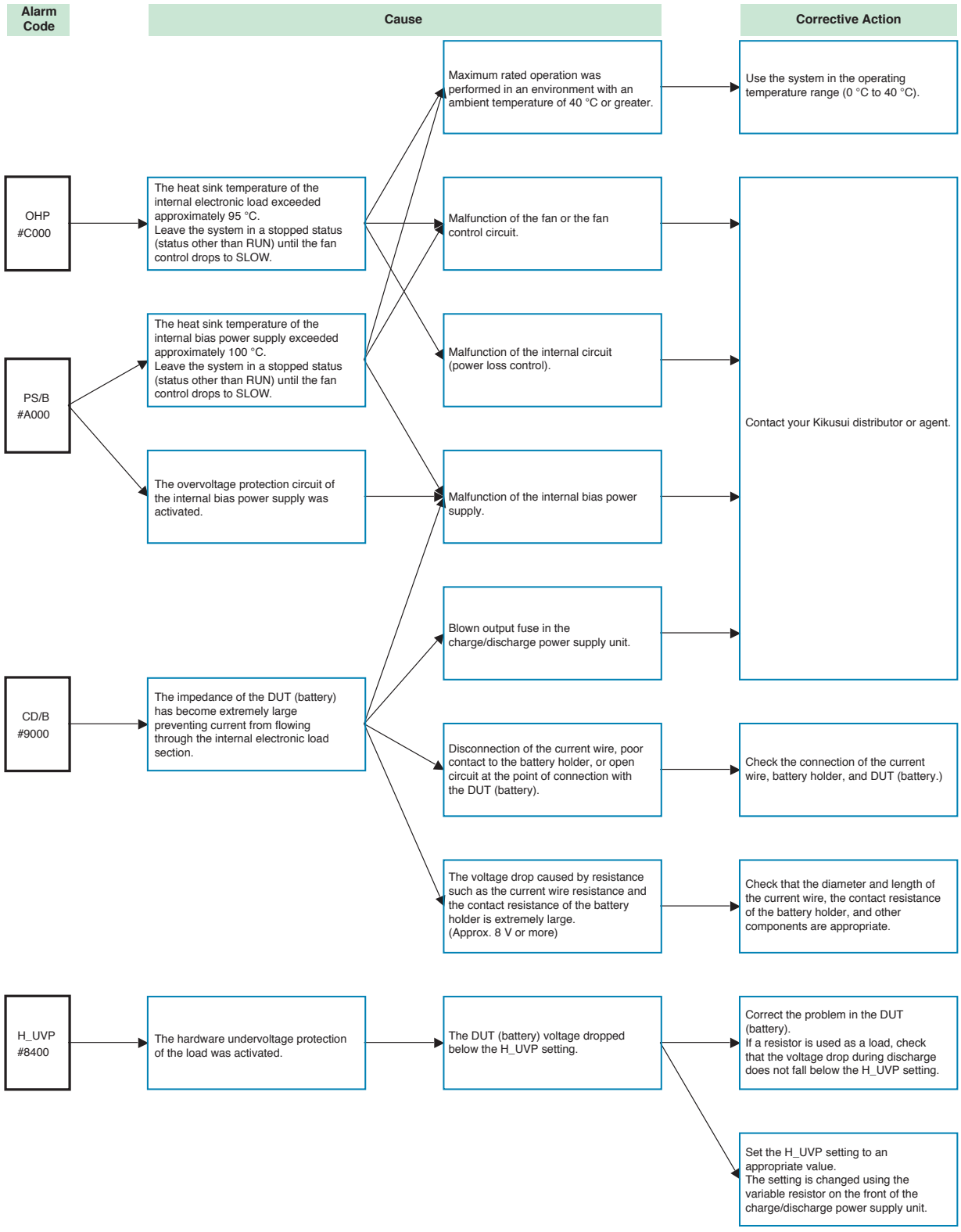


Fig. A-2

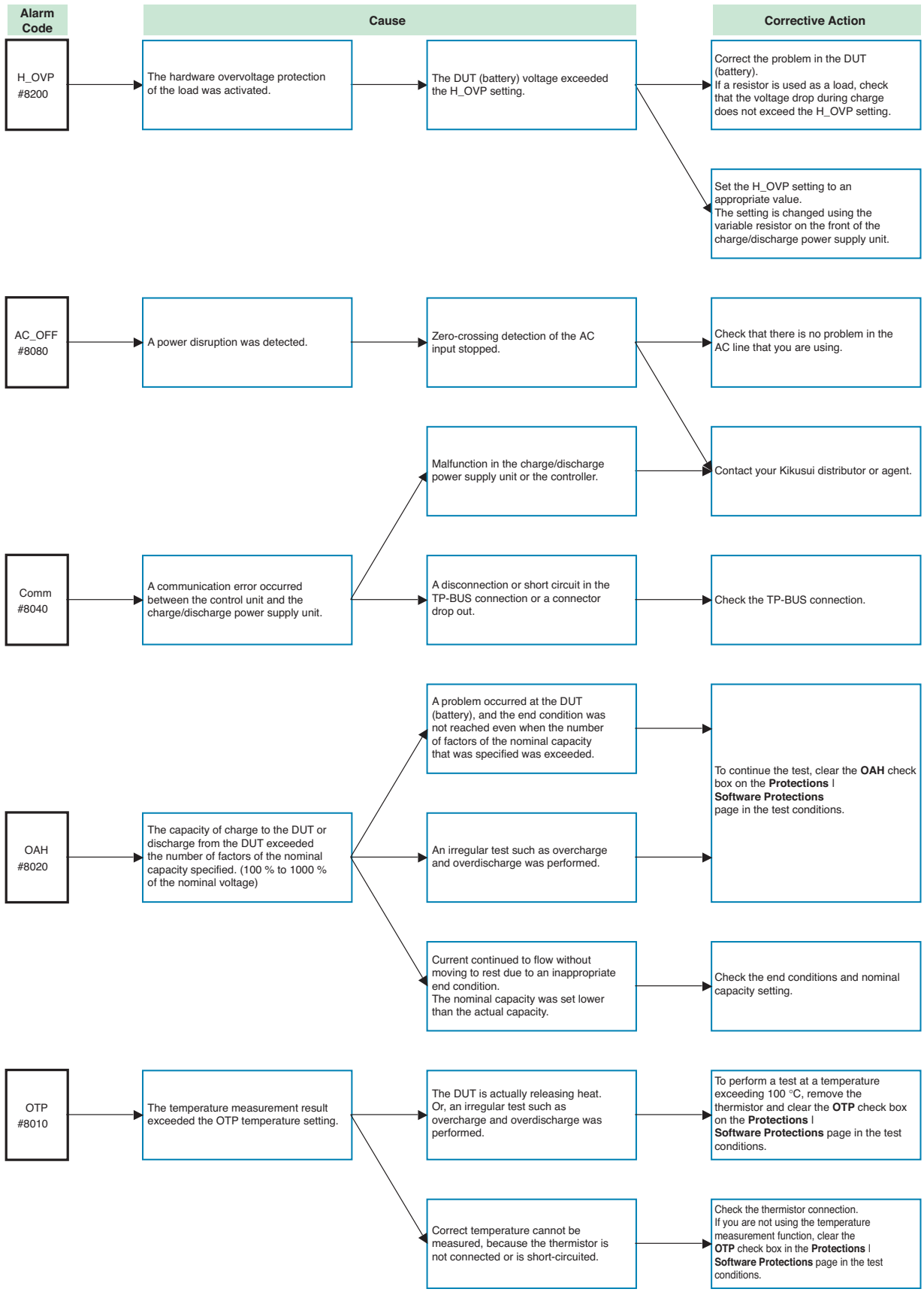

Alarm Code
Cause
Corrective Action
H_OVP #8200
The hardware overvoltage protection of the load was activated.
The DUT (battery) voltage exceeded the H_OVP setting.
Correct the problem in the DUT (battery). If a resistor is used as a load, check that the voltage drop during charge does not exceed the H_OVP setting.
Set the H_OVP setting to an appropriate value. The setting is changed using the variable resistor on the front of the charge/discharge power supply unit.
AC_OFF #8080
A power disruption was detected.
Zero-crossing detection of the AC input stopped.
Check that there is no problem in the AC line that you are using.
Comm #8040
A communication error occurred between the control unit and the charge/discharge power supply unit.
Malfunction in the charge/discharge power supply unit or the controller.
Contact your Kikusui distributor or agent.
A disconnection or short circuit in the TP-BUS connection or a connector drop out.
Check the TP-BUS connection.
OAH #8020
The capacity of charge to the DUT or discharge from the DUT exceeded the number of factors of the nominal capacity specified. (100 % to 1000 % of the nominal voltage)
A problem occurred at the DUT (battery), and the end condition was not reached even when the number of factors of the nominal capacity that was specified was exceeded.
An irregular test such as overcharge and overdischarge was performed.
To continue the test, clear the OAH check box on the Protections I Software Protections page in the test conditions.
Current continued to flow without moving to rest due to an inappropriate end condition. The nominal capacity was set lower than the actual capacity.
Check the end conditions and nominal capacity setting.
OTP #8010
The temperature measurement result exceeded the OTP temperature setting.
The DUT is actually releasing heat. Or, an irregular test such as overcharge and overdischarge was performed.
To perform a test at a temperature exceeding 100 °C, remove the thermistor and clear the OTP check box on the Protections I Software Protections page in the test conditions.
Correct temperature cannot be measured, because the thermistor is not connected or is short-circuited.
Check the thermistor connection. If you are not using the temperature measurement function, clear the OTP check box in the Protections I Software Protections page in the test conditions.

Fig. A-3

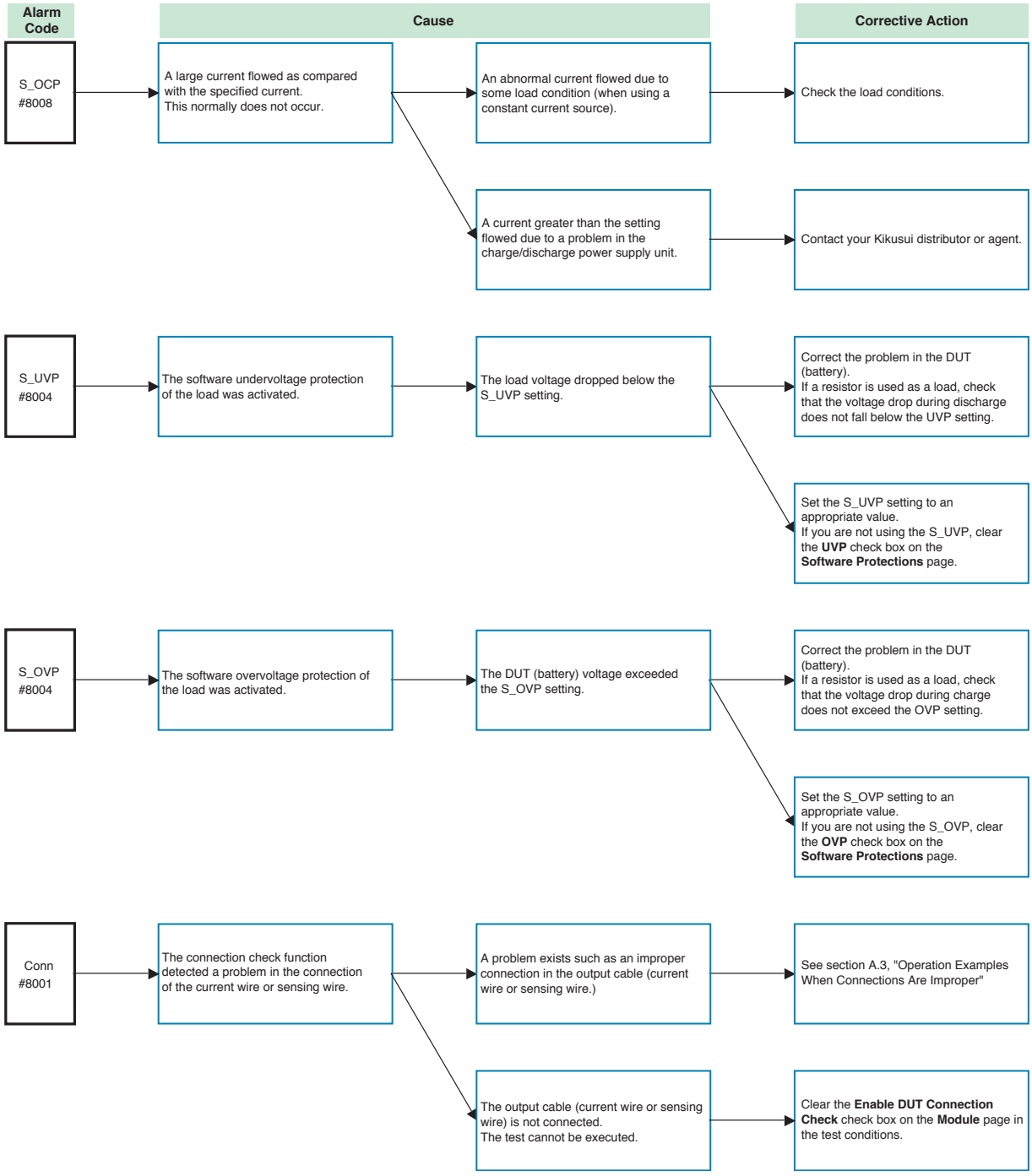

Alarm Code
Cause
Corrective Action
S_OCP #8008
A large current flowed as compared with the specified current. This normally does not occur.
An abnormal current flowed due to some load condition (when using a constant current source).
Check the load conditions.
A current greater than the setting flowed due to a problem in the charge/discharge power supply unit.
Contact your Kikusui distributor or agent.
S_UVP #8004
The software undervoltage protection of the load was activated.
The load voltage dropped below the S_UVP setting.
Correct the problem in the DUT (battery). If a resistor is used as a load, check that the voltage drop during discharge does not fall below the UVP setting.
Set the S_UVP setting to an appropriate value. If you are not using the S_UVP, clear the UVP check box on the Software Protections page.
S_OVP #8004
The software overvoltage protection of the load was activated.
The DUT (battery) voltage exceeded the S_OVP setting.
Correct the problem in the DUT (battery). If a resistor is used as a load, check that the voltage drop during charge does not exceed the OVP setting.
Set the S_OVP setting to an appropriate value. If you are not using the S_OVP, clear the OVP check box on the Software Protections page.
Conn #8001
The connection check function detected a problem in the connection of the current wire or sensing wire.
A problem exists such as an improper connection in the output cable (current wire or sensing wire.)
See section A.3, "Operation Examples When Connections Are Improper"
The output cable (current wire or sensing wire) is not connected. The test cannot be executed.
Clear the Enable DUT Connection Check check box on the Module page in the test conditions.

Fig. A-4

A.3 Operation Examples When Connections Are Improper

A.3.1 If the Connection between the Frame and Impedance Measurement Unit Is Not Correct

Operation examples are given below when the connection between the unit frame and the impedance measurement unit is not correct. If you connect a frame with a different number, unintended impedance measurement is made on the DUT. It is especially difficult to detect an incorrect connection when performing numerous test on DUT with matching characteristics. Use extra caution when configuring the test system.

Table A-6 Incorrect Connection through the DUT Connector (UTP Cable)

No.	Cause	Description
1	A LAN cable was inserted into the DUT connector.	There is no electrical danger, because the circuit is isolated through a transformer on the LAN side. However, because power is supplied on the outside (pins 7 and 8), the protection circuit inside the device is tripped if a short circuit occurs.
2	A CONT connector modular cable was inserted into the DUT connector.	There is no danger, but normal measurement is not possible.
3	Different frame numbers were connected in the connection of the DUT connector. The CONT connector was connected correctly.	Impedance is measured on unintended DUTs (channels). Because the scanner in the frame does not function, measurement is made with the load open (infinity).
4	Different frame numbers were connected in the connection of the DUT connector. Likewise, different numbers were connected on the CONT connector.	Impedance is measured on an unintended DUT (channel). The scanner in the frame functions. However, measurement is made with the load open (infinity) when the corresponding DUT (channel) is charging or discharging. When the corresponding DUT is resting or stopped, the impedance of the DUT is measured.

Table A-7 Incorrect Connection through the CONT Connector (Modular Cable)

No.	Cause	Description
1	A telephone line was inserted into the CONT connector.	This act is dangerous, because high voltage is supplied to the telephone wire at all times. This may damage the internal protection circuit.
2	Different frame numbers were connected in the connection of the CONT connector. The DUT connector was connected correctly.	Impedance is measured on an unintended DUT (channel). Because the scanner in the frame does not function, measurement is made with the load open (infinity).
3	Different frame numbers were connected in the connection of the CONT connector. Likewise, different numbers were connected on the DUT connector.	Impedance is measured on an unintended DUT (channel). The scanner in the frame functions. However, measurement is made with the load open (infinity) when the corresponding DUT (channel) is charging or discharging. When the corresponding DUT is resting or stopped, the impedance of the DUT is measured.

A.3.2 When the Test Is Executed with Improperly Connected Output Cables

Operation examples are given below when tests are executed with improperly connected output cables. Extremely dangerous conditions may result depending on the cutoff condition settings such as OVP, UVP, and time. Use extreme caution when making connections to the DUT.

Hardware OVP and UVP functions are very effective when the DUT is connected improperly. Be sure to set these functions when configuring the system.

Symbols used in the table

- ▲: Possibility of overcharge
- ▼: Possibility of overdischarge
- ◆: Other dangers
- ◇: No danger to the DUT

Table A-8 When the connection check function is enabled (abnormalities can be detected using the connection function)

No.	Test Mode	Current Wire	Sensing Wire	Battery Voltage	H_OVP Setting	H_UVP Setting	Cutoff Voltage	If the Test Is Continued Ignoring the Connection Check Function	Danger Level	Stop or Cutoff Condition
1	Charge	Reverse	Correct	----	----	----	----	CV or maximum voltage is never reached, because the DUT is actually discharged. As a result, the voltage drops even though the DUT is charged.	▼	UVP Charge time -ΔV
2	Dis-charge	Reverse	Correct	----	----	----	----	Cutoff voltage is never reached, because the DUT is actually charged. As a result, the voltage increases even though the DUT is discharged.	▲	OVP Discharge time
3	Charge	Correct	Reverse	1.2 V or greater	----	----	----	Test execution not possible due to UVP.	◇	Warning
4	Charge	Correct	Reverse	----	----	0.0 V or greater	----	Test execution not possible due to UVP.	◇	Warning
5	Charge	Correct	Reverse	0.0 V to 1.2 V	----	Negative battery voltage or greater	----	Test execution not possible, because the detected voltage (reverse polarity of the battery voltage) fall below the UVP setting	◇	Warning
6	Charge	Correct	Reverse	0.0 V to 1.2 V	----	Negative battery voltage or less	----	After the test (charge) is started, CV or maximum voltage is never reached, because the voltage drops even though the DUT is charged.	▲	UVP Charge time -ΔV
7	Charge	Correct	Reverse	0.0 V to 1.2 V	----	Min	----			
8	Dis-charge	Correct	Reverse	1.2 V or greater	----	----	----	Test execution not possible due to UVP.	◇	Warning
9	Dis-charge	Correct	Reverse	----	----	0.0 V or greater	----	Test execution not possible due to UVP.	◇	Warning
10	Dis-charge	Correct	Reverse	0.0 V to 1.2 V	----	Negative battery voltage or greater	----	Test execution not possible, because the detected voltage (reverse polarity of the battery voltage) fall below the UVP setting.	◇	Warning
11	Dis-charge	Correct	Reverse	0.0 V to 1.2 V	----	----	0.0 V or greater	Discharge ends immediately, because the detected voltage is below the cutoff voltage.	◇	Cutoff voltage
12	Dis-charge	Correct	Reverse	0.0 V to 1.2 V	----	----	0.0 V or greater	Discharge ends immediately, because the detected voltage is below the cutoff voltage.	◇	Cutoff voltage

13	Dis-charge	Correct	Reverse	0.0 V to 1.2 V	----	Negative bat-tery voltage or less	Negative bat-tery voltage or less	Cutoff voltage is never reached, because the voltage increases even though the DUT is discharged.	▼	Discharge time
14	Dis-charge	Correct	Reverse	0.0 V to 1.2 V	----	Min.	Negative bat-tery voltage or less	Cutoff voltage is never reached, because the voltage increases even though the DUT is discharged.	▼	Discharge time
15	Charge	*1	Correct	----		----	----	CV or maximum voltage is never reached, because no current flows through the DUT.	◇	Charge time
16	Dis-charge	*1	Correct	----		----	----	Cutoff voltage is never reached, because no current flows through the DUT.	◇	Discharge time
17	Charge	Correct	*1	----	0.0 V or less	----	----	The voltage of the DUT cannot be mea-sured (0 V is displayed), because the sensing line is shorted. Test execution not possible due to OVP.	◇	Warning
18	Charge	Correct	*1	----	----	0.0 V or greater	----	The voltage of the DUT cannot be mea-sured (0 V is displayed), because the sensing line is shorted. Test execution not possible due to UVP.	◇	Warning
19	Charge	Correct	*1	----	0.0 V or greater	0.0 V or less	----	Continues to charge until the charge time elapses or until OAH is activated.	▲	Charge time OAH
20	Dis-charge	Correct	*1	----	0.0 V or less	----	----	The voltage of the DUT cannot be mea-sured (0 V is displayed), because the sensing wire is shorted. Test execution not possible due to OVP.	◇	Warning
21	Dis-charge	Correct	*1	----	----	0.0 V or greater	----	The voltage of the DUT cannot be mea-sured (0 V is displayed), because the sensing wire is shorted. Test execution not possible due to UVP.	◇	Warning
22	Dis-charge	Correct	*1	----	0.0 V or greater	0.0 V or less	0.0 V or less	Continues to discharge until the discharge time elapses or until OAH is activated.	▼	Discharge time OAH
23	Dis-charge	Correct	*1	----	----	----	0.0 V or greater	Discharge ends immediately, because the detected voltage is below the cutoff voltage.	◇	Cutoff voltage
24	Charge	Open	Correct	----	----	----	----	Stops with an alarm on the CD/B. Extremely dangerous if the current wire is in contact with a metal part around it.	◇ ◆	CD/B (CD board malfunction)
25	Dis-charge	Open	Correct	----	----	----	----	Stops with an alarm on the CD/B. Extremely dangerous if the power line is in contact with a metal part around it.	◇ ◆	CD/B (CD board malfunction)
26	Charge	Correct	Open	----	Max.	Min.	Measured voltage or less	The battery voltage cannot be measured, and an abnormal value is returned. Charge ends immediately or after the It time elapses.	◇	Max. voltage It time
27	Charge	Correct	Open	----	Max.	Min.	Measured voltage or greater	CV or maximum voltage is never reached, because the battery voltage cannot be measured.	▲	Charge time
28	Dis-charge	Correct	Open	----	Max.	Min.	Measured voltage or greater	Discharge ends immediately, because the detected voltage is below the cutoff voltage.	◇	Cutoff voltage
29	Dis-charge	Correct	Open	----	Max.	Min.	Measured voltage or less	Cutoff voltage is never reached, because the battery voltage cannot be measured.	▼	Discharge time
30	Charge	Open	Open	----	----	----	----	Stops immediately with an alarm.	◇	Warning CD/B
31	Dis-charge	Open	Open	----	----	----	----	Stops immediately with an alarm.	◇	Warning CD/B

*1 The wire is shorted at the - (or +) terminal of the DUT.

Table A-9 When the connection check function is disabled (abnormalities cannot be detected using the connection function)

No.	Test Mode	Current Wire	Sensing Wire	Battery Voltage	H_OVP Setting	H_UVP Setting	Cutoff Voltage	If the Test Is Continued Ignoring the Connection Check Function	Danger Level	Stop or Cutoff Condition
1	Charge	Reverse	Reverse	1.2 V or greater	---	---	---	Test execution not possible due to UVP.	◇	Warning
2	Charge	Reverse	Reverse	---	---	0.0 V or greater	---	Test execution not possible due to UVP.	◇	Warning
3	Charge	Reverse	Reverse	0.0 V to 1.2 V	---	Negative battery voltage or greater	---	Test execution not possible, because the detected voltage (reverse polarity of the battery voltage) fall below the UVP setting.	◇	Warning
4	Charge	Reverse	Reverse	---	---	Negative battery voltage or less	---	The battery is actually discharged, and the maximum voltage is never reached. There is a danger of overdischarge.	▼	Charge time OAH
5	Charge	Reverse	Reverse	---	---	Min.	---	The battery is actually discharged, and the maximum voltage is never reached. There is a danger of overdischarge.	▼	Charge time OAH
6	Discharge	Reverse	Reverse	1.2 V or greater	---	---	---	Test execution not possible due to UVP.	◇	Warning
7	Discharge	Reverse	Reverse	---	---	0.0 V or greater	---	Test execution not possible due to UVP.	◇	Warning
8	Discharge	Reverse	Reverse	0.0 V to 1.2 V	---	Negative battery voltage or greater	---	Test execution not possible, because the detected voltage (reverse polarity of the battery voltage) fall below the UVP setting.	◇	Warning
9	Discharge	Reverse	Reverse	---	---	---	0.0 V or greater	Discharge ends immediately, because the detected voltage is below the cutoff voltage.	◇	Cutoff voltage
10	Discharge	Reverse	Reverse	---	---	Negative battery voltage or less	Negative battery voltage or less	The battery is actually charged and the detected voltage increases. There is a danger of overcharge.	▲	Discharge time Cutoff voltage OAH
11	Discharge	Reverse	Reverse	---	---	Min.	Negative battery voltage or less	The battery is actually charged, and the cutoff voltage is never reached. There is a danger of overcharge.	▲	Discharge time Cutoff voltage OAH
12	Charge	The current wire and sensing wire are connected properly, but the end is open (no DUT).		---	---	---	---	Stops immediately with an alarm.	◇	OVP UVP CD/B
13	Discharge	The current wire and sensing wire are connected properly, but the end is open (no DUT).		---	---	---	---	Stops immediately with an alarm.	◇	OVP UVP CD/B
14	Charge	Connected in parallel with other channels.		---	---	---	---	A combined current flows while the PFX is operating in constant current (CC) mode. Operation is not guaranteed after moving to constant voltage (CV) mode.	▲	Charge time It time
15	Discharge	Connected in parallel with other channels.		---	---	---	---	A combined current flows through the battery. Abnormality cannot be detected. There is a danger of overdischarge.	▼	Discharge time Cutoff voltage

A.4 Folders and Files

This section describes the folders and files that are created by the BPChecker2000.

Fig. A-5 shows the folders and files that are created when the test is executed under the following conditions.

Control Unit	Using 1 system (Instrument ID: 1)
Charge/discharge power supply unit	2 channels (Node numbers: 001 and 002)
Group folder	bpc2000(cccv) Location: Desktop
Test conditions	cccv 3 cycles of execution

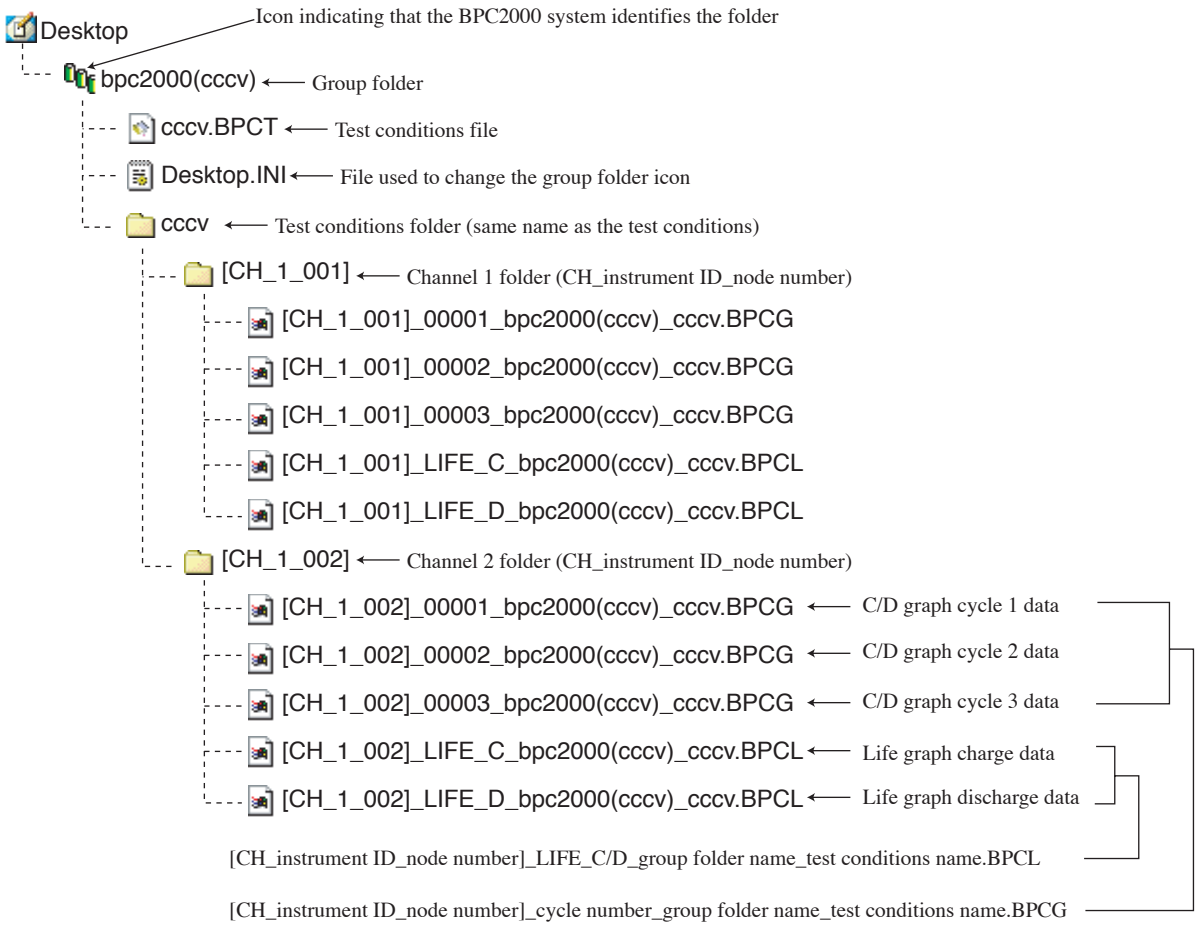


Fig. A-5

After the test is finished, let's assume that Backup the folder is selected for both channels 1 and 2 in the data backup dialog box and that the test data contents are deleted.

We assume that the folder suffix and memo boxes of the data backup dialog box are entered as follows.

Folder suffix	{30 October 2002, 17'07}
Memo box (both CH1 and CH2)	backup data

The channel folder is renamed as shown in Fig. A-6, and a file named BACKUP.TXT is created in the channel folder. This file contains the text "backup data" that was entered in the memo box.

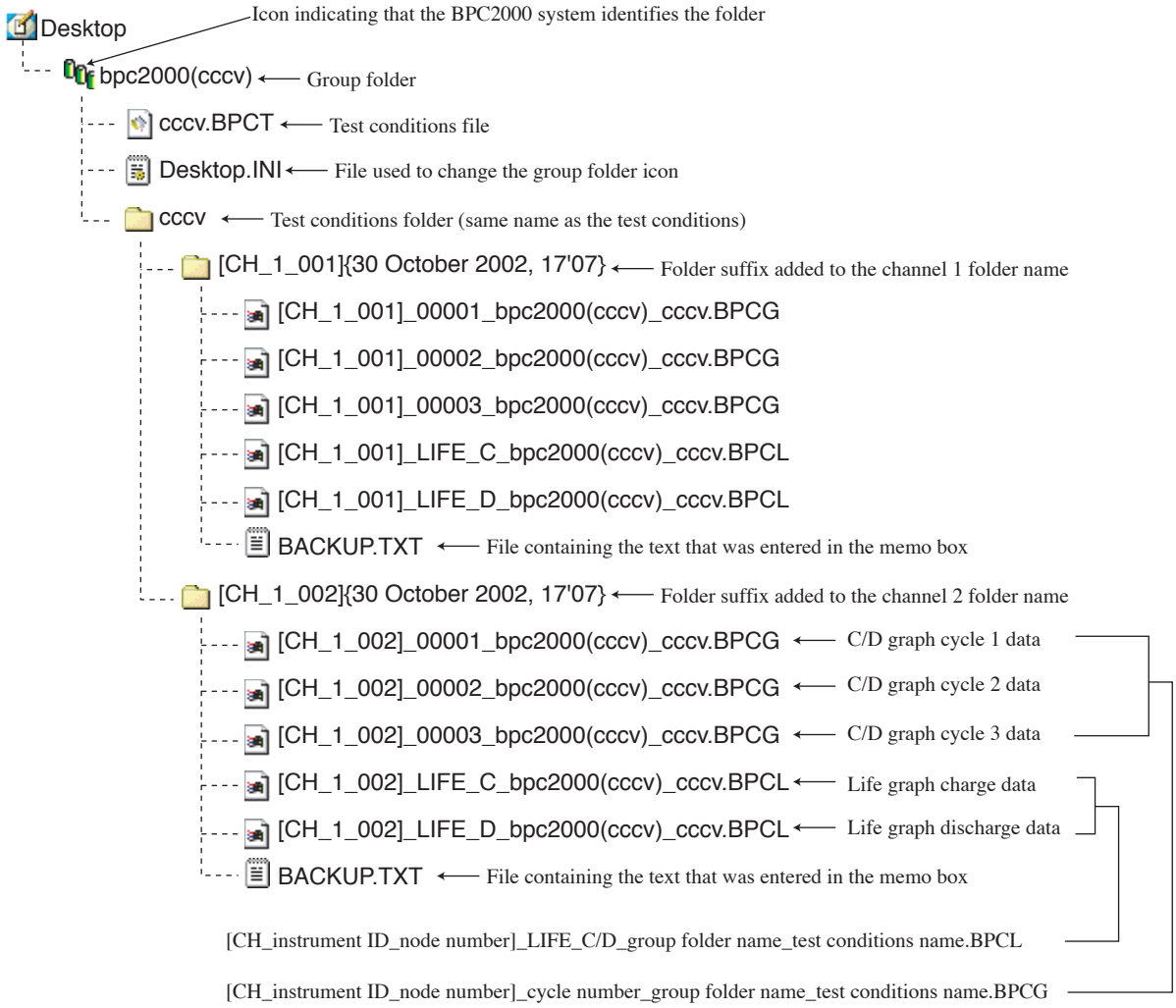


Fig. A-6

Other files that are created

- Sequence information file (.SI extension)

If the **Use Common Sequence Info** checkbox is selected on the sequence page of the Test Conditions Editor, a sequence information file with .SI extension is created in the group folder.

- Test data file in text format (.TXT or .CSV extension, etc.)

If **Generate Text Files** is selected in the **Options** menu of the Test Executive, files with the same name as the files with .BPCG and .BPCL extensions in each channel folder are created in the same folders with different extensions (TXT, CSV, etc.).

- Graph files (.BPCO extension)

If you save graphs on the Graph Viewer, graph files with .BPCO extension are created.

- Graph data file in text format (.TXT extension)

If you save graphs to text files on the Graph Viewer, graph data files with .TXT extension are created.

A.5 Range of Test Condition Settings

Below are lists of setting ranges of test condition items specified using the Test Condition Editor.

Battery Info

Item	PFX2011	PFX2021
Nominal Voltage [V]	0.0000 to 5.0000	0.000 to 20.000
Nominal Capacity [mAh]	0.1 to 110000.0	
Volume [ml]	0.01 to 99999.99	
Weight [g]	0.01 to 99999.99	

Protections

Item	PFX2011	PFX2021
Software OVP [V]	0.0000 to 5.1000	0.000 to 21.000
Software UVP [V]	-2.1000 to 5.0000	-2.100 to 19.000
OAH [%]	100 to 1000	
OTP [°C]	-40.0 to100.0	

Recording Method

Item	PFX2011	PFX2021
Delta Time [s]	1 to 50000	
Auto Delta Time Max Data Count	1000 to 5000	
Delta Voltage [V]	0.0001 to 0.9999	0.000 to 1.000
Delta Current [A]	0.0001 to 0.9999	0.000 to 1.000

Impedance Measurement

Item	PFX2011	PFX2021
Frequency [Hz]	1000	
Range [Ω]	0.1 / 1 / 10 / Auto	

Life Judgement

Item		PFX2011	PFX2021
Min Capacity Ratio [%]	Discharge	0.0 to 100.0	
Max Impedance [mΩ]	Charge	0 to 20000000	
	Discharge	0 to 20000000	
Max NG Count		1 to 100	

Seq Sheets

Charge

Mode	Item		PFX2011	PFX2021
CC	Charge Time [h:min]		9999h 59min	
	Rest Time [h:min]		9999h 59min	
	Setting	Current [A]	0.0000 to 5.0000 (0.00000 to 0.50000)	0.000 to 10.000
	Cutoff conditions	Max Voltage [V]	0.0000 to 5.0000	0.000 to 20.000
		-dV [V]	0.0010 to 1.0000	0.001 to 1.000
		-dV Mask Time [min]	1 to 60	
		Max Temp [°C]	-40.0 to 100.0	
		dT/dt [°C/min]	0.5 to 10.0	
CC-CV	Charge Time [h:min]		9999h 59min	
	Rest Time [h:min]		9999h 59min	
	Setting	Current [A]	0.0000 to 5.0000 (0.00000 to 0.50000)	0.000 to 10.000
		CV Voltage [V]	0.0000 to 5.0000	0.000 to 20.000
	Cutoff conditions	CV Time [h:min]	9999h 59min	
		It Current [A]	0.0000 to 5.0000 (0.00000 to 0.50000)	0.000 to 10.000
		It Time [h:min]	9999h 59min	
		Max Temp [°C]	-40.0 to 100.0	
Pulse	Charge Time [h:min]		9999h 59min	
	Rest Time [h:min]		9999h 59min	
	CC Period	Max Voltage [V]	0.0000 to 5.0000	0.000 to 20.000
		Current [A]	0.0000 to 5.0000 (0.00000 to 0.50000)	0.000 to 10.000
	CC-Pulse Period	Max Voltage [V]	0.0000 to 5.0000	0.000 to 20.000
		Current [A]	0.0000 to 5.0000 (0.00000 to 0.50000)	0.000 to 10.000
		Time [ms]	0.50 to 65000.00	
	PWM Period	Max Time [h:min]	9999h 59min	
		Min Voltage [V]	0.0000 to 5.0000	0.000 to 20.000
		Max Voltage [V]	0.0000 to 5.0000	0.000 to 20.000
		Current [A]	0.0000 to 5.0000 (0.00000 to 0.50000)	0.000 to 10.000
		Time [ms]	0.50 to 65000.00	
		It Time [s]	2 to 6000	

* The values inside parentheses are setting range for the low range.

Discharge

Mode	Item		PFX2011	PFX2021
CC	Discharge Time [h:min]		9999h 59min	
	Rest Time [h:min]		9999h 59min	
	Setting	Current [A]	0.0000 to 5.0000 (0.00000 to 0.50000)	0.000 to 10.000
	Cutoff condition	Cutoff Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000
	Measurement	Capacity Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000
CP	Discharge Time [h:min]		9999h 59min	
	Rest Time [h:min]		9999h 59min	
	Setting	Wattage [W]	0.01 to 25.00 (0.001 to 2.500)	0.02 to 200.00
		Limit Current [A]	0.0000 to 5.0000 (0.00000 to 0.50000)	0.000 to 10.000
	Cutoff condition	Cutoff Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000
	Measurement	Capacity Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000
CC/CP Pulse	Discharge Time [h:min]		9999h 59min	
	Rest Time [h:min]		9999h 59min	
	Setting	Num Of Pulse	8	20
		Current [A]	0.0000 to 5.0000 (0.00000 to 0.50000)	0.000 to 10.000
		Power [W]	–	0.02 to 200.00
		Time [ms]	0.50 to 65000.00	
	Cutoff condition	Cutoff Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000
	Measurement	Capacity Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000
		Number of pulse voltage points	2	

* The values inside parentheses are setting range for the low range.

Temperature chamber

Item	PFX2011	PFX2021
Temperature [°C]	-273.0 to 200.0	
Humidity [%]	0.0 to 100.0 or -1	
Setting Timeout [min]	1 to 1000	
Wait Time [min]	1 to 1000	

A.6 A List of Menus

Test Condition Editor

File		
	New	Creates a new test condition file. This is the same condition as when the Test Condition Editor is started.
	Open	Loads an existing test conditions file.
	Save	Saves the test conditions file.
	Save As	Saves the test conditions file to a new name.
	Exit	Exits the Test Conditions Editor.
Edit		
	Copy	Copies the selected range to the clipboard.
	Paste	Pastes the contents of the clipboard.
	Copy Sheet From	Copies the contents of another sequence sheet to the current sheet.
	Copy Sheet To	Copies the contents of the current sheet to another sheet.
Tools		
	Run Test Executive	Starts the Test Executive.
	Options	Opens the Options dialog box.
Help		
	BPChecker2000 TEST CONDITION EDITOR Help Index	Shows the help file.
	About BPChecker2000	Displays version information of the product.

Test Executive

File			
	Exit		Exits the Test Executive.
View			
	Controller		Switches the Controller/Group Pane to Controller View Mode.
	Group		Switches the Controller/Group Pane to Group View Mode.
	Channel	Test Condition	Switches the Graph Result Pane to test conditions display.
		Charge Graph	Switches the Graph Result Pane to charge graph display.
		Discharge Graph	Switches the Graph Result Pane to discharge graph display.
		Charge Result	Switches the Graph Result Pane to charge result display.
		Discharge Result	Switches the Graph Result Pane to discharge result display.
	Toolbar	Standard	Shows or hides the standard toolbar.
		Execution	Shows or hides the execution toolbar.
		Channel	Shows or hides the channel toolbar.
	Refresh		Refreshes the screen.

Test		
	Bind/Unbind Channels	Binds or unbinds channels from groups.
	Start	Assigns test conditions and starts the tests.
	Stop	Stops the tests.
	Empty	Clears existing test data.
	Reset Alarm	Resets alarms.
	Emergency Stop	Stops the charge/discharge operation on all channels immediately.
Controller		
	Properties	Shows controller properties.
Group		
	Launch Group Administrator	Starts the Group Administrator.
	Properties	Shows group properties.
Channel		
	Recognise	Makes controller recognize channels.
	Plug	Moves the identified channels to monitor loop so that tests can be executed.
	Unplug	Removes channels from the monitor loop.
	Reset Alarm	Resets alarms.
	Edit Test Conditions	Starts the Test Condition Editor and opens the assigned test conditions file.
	View Folder	Displays the folder containing the test data files of the channel.
	Enter Cycle Number	Sets the cycle number of the channel whose cycle has been completed.
	Increment Cycle Number +1	Increments the cycle number of the channel whose cycle has been completed.
	Decrement Cycle Number -1	Decrements the cycle number of the channel whose cycle has been completed.
	Toggle End Mark	Terminates the test of the channel in the stopped status. Or, removes the end mark from the channel that has already finished the test.
	Properties	Shows channel properties, sets hardware protection functions, and sets the axes of the realtime graph.
Tools		
	Launch Test Condition Editor	Starts the Test Conditions Editor.
	Options	Sets the graph properties on the Graph List Pane, sets the items shown on the Channel List Pane, sets how warnings are displayed, and sets the behavior when an alarm occurs when performing tests in synchronization with temperature chambers.
	Hardware Configuration	Starts the Hardware Configuration Wizard in read-only mode.
Help		
	BPChecker2000 TEST EXECUTIVE Help Index	Shows the help file.
	About BPChecker2000	Displays version information of the product.

Graph Viewer

File			
	Select Project		Select the project.
	New	C/D Graph	Opens charge/discharge characteristics graphs.
		Life Graph	Opens cycle life characteristics graphs.
	Open		Opens graphs that have been save previously.
	Close		Closes the graph.
	Save		Saves the graph.
	Save As		Saves the graph to another name.
	Save Text		Saves the graph to a text file (tab-separated).
	Show Graph		Opens a new charge/discharge characteristics graph or cycle life characteristics graph.
	Print		Prints the graph.
	Print Preview		Shows a print preview of the graph.
	Printer Setup		Sets the printer type.
	Colour Printing		Turns ON/OFF color printing.
	Exit		Exits the Graph Viewer.
Edit			
	Copy Graph		Copies the graph to the clipboard.
	Copy Data		Copies condition, result, and analysis data to the clipboard.
View			
	Graph	Charge* 1	Displays charge data on charge/discharge characteristics graph.
		Discharge* 1	Displays discharge data on charge/discharge characteristics graph.
		Charge/Discharge* 1	Displays charge data and discharge data on charge/discharge characteristics graph.
		Capacity* 2	Displays capacity data on cycle life characteristics graph.
		Impedance* 2	Displays impedance data on cycle life characteristics graph.
		Capacity/Impedance* 2	Displays capacity data and impedance data on cycle life characteristics graph.
	X Axis	Time* 1	Displays the X axis of the charge/discharge characteristics graph as time.
		Capacity* 1	Displays the X axis of the charge/discharge characteristics graph as capacity.
		Watthour* 2	Displays the X axis of the charge/discharge characteristics graph as watthour.
		Linear* 2	Displays the X axis of the cycle life characteristics graph on a linear scale.
		Log*2	Displays the X axis of the cycle life characteristics graph on a logarithmic scale.
	Y Axis	Voltage* 1	Displays the Y axis of the charge/discharge characteristics graph as voltage.
		Current* 1	Displays the Y axis of the charge/discharge characteristics graph as current.
		Capacity* 1	Displays the Y axis of the charge/discharge characteristics graph as capacity.
		Temperature* 1	Displays the Y axis of the charge/discharge characteristics graph as temperature.
		Capacity Value* 2	Displays the Y axis of the cycle life characteristics graph as capacity value.
		Capacity Ratio* 2	Displays the Y axis of the cycle life characteristics graph as capacity ratio.

View (continued)			
	Scale		Sets the X axis and Y axis scale.
	C/D Pane		Switches the tree window display to C/D Pane.
	Life Pane		Switches the tree window display to Life Pane.
	Toolbar	Standard	Shows or hides the standard toolbar.
		C/D Graph	Shows or hides the C/D graph toolbar.
		Life Graph	Shows or hides the Life graph toolbar.
	Refresh		Refreshes the tree window.
Data			
	Select Graphs		Adds or deletes graphs to the current displayed graph.
	Set Analysis Conditions		Sets the data used as a reference for computing analysis data and the drawing style of the capacity calculation voltage.
	Capacity Ratio Reference Cycle* 2		Sets the reference cycle for the capacity ratio on cycle life characteristics graphs.
	Set Comments		Sets comments. The comment appears on the graph screen and in print.
	Set Print Header		Sets the print header.
Options			
	Drawing Style		Sets the drawing style of the graphs.
	Drawing Unit		Sets the unit on the C/D graph.
	Save Window Position		Starts the program using the window size that was used that last time you exited the program.
Window			
	Cascade		Displays multiple windows cascaded.
	Tile		Displays multiple windows side by side.
	Arrange Icons		Arranges the minimized windows.
	Windows		Sets the document window display mode.
Help			
	BPChecker2000 GRAPH VIEWER Help Index		Shows the help file.
	About BPChecker2000		Displays version information of the product.

*1When charge/discharge characteristics graph is displayed

*2 When cycle life characteristics graph is displayed

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