KIKUSUI

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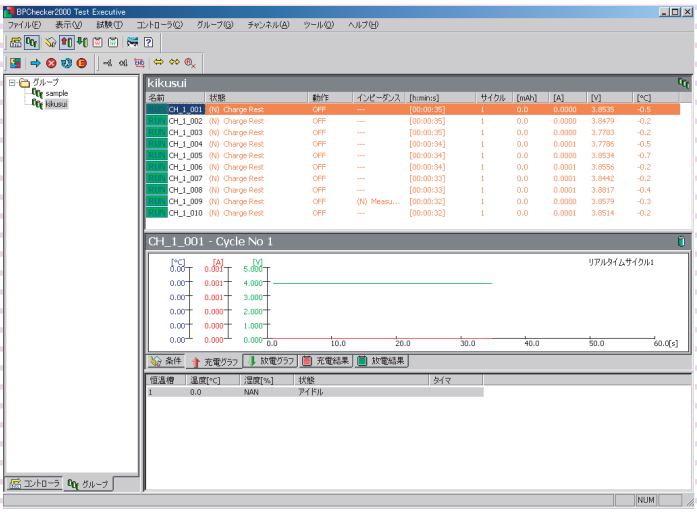
USER'S MANUAL

PFX2000 Series
Application Software
SD002

BPChecker2000
Ver.3.1



BPChecker2000 is a dedicated application software for the PFX2000 Series Charge/Discharge Battery Test System and the PFX2500 Series Charge/Discharge System Controller. BPChecker2000 enables you to set the conditions of the battery charge/discharge characteristics tests, execute the tests, and analyze the test results on a PC.

Package Contents

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

How to Read This Manual

This manual is intended for first-time users of the BPChecker2000. It describes required environment settings, installation procedure for the application software, and gives an overview of various programs.

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.

Product Version Covered

This user's manual covers BPChecker2000 version 3.1x.

The version of the BPChecker2000 can be referred to the "Information of the BPChecker2000" in the HELP menu.

Related manuals

The detailed information for the PFX2000 series and PFX2500 series, please refer to the operation manual respectively.

Help File

You can open the help file from the Help menu of BPChecker2000. The help file includes all the information in this manual except the installation procedure. It also includes some contents that are not covered in this manual. The Group Administrator can be referred to only the HELP file (it can be viewed by the F1 key).

Start Guide

PDF documents (PFX2011 tutorial.pdf for the PFX2011, PFX2021 tutorial.pdf for the PFX2021) in the "tutor" folder on the 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.

Graph Viewer Operating Procedure

A PDF document named Graph Viewer.pdf in the "tutor" folder on the CD-ROM. This document explains the operating procedures of the Graph Viewer, a test result analysis program. This PDF document uses manu screen images of the Graph Viewer so that even first-time users can easily understand the procedure.

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Safety Precautions

Before starting battery tests using this application software, please thoroughly read the PFX2000 Series or PFX2500 Series 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.

Notations used in this manual

- In the interest of brevity, the PFX2000 Series Charge/Discharge Battery System shall be hereafter reffered to as the "PFX2000 Series".
- In the interest of brevity, the PFX2500 Series Charge/Discharge System Controller shall be hereafter reffered to as the "PFX2500 Series".
- In the interest of brevity, the BPChecker2000 Application Software (SD002) shall be hereafter reffered to as the "BPChecker2000".
- In the interest of brevity, the Voltage of DUT (battery) shall be hereafter reffered to as the "Battery voltage".

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

NOTE
Indicates information that you should know.

See
Indicates reference to detailed information.

>
Indicates menu settings and setting of Test Condition Editor that you select. The menu item to the left of the > symbol is a higher level menu.

Edition of BPChecker

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

Full Edition

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

The Full Edition of the BPCheker2000 can control up to 2 units of the control unit PFX2121 by the USB port.

The number of PFX2500 Series devices that you can connect differs depending on the option boards that are installed and the controller unit's firmware version. See "Maximum Connections."

By using one control unit, you can connect 120 channels to the PFX2000 Series. When the impedance measurement unit PFX2211 is added, the PFX2000 series can perform the impedance measurement applied for all channels connected with one control unit.

If the PC is capable of USB 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 of PFX2121 via the USB port. 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.

Comparison of Edition

	Full Edition		Basic Edition
	PFX2000 series	PFX2500 series	
Number of controllable channels*1	Up to 240 channels	Up to 30 channels	Up to 2 channels
Ability to use the Impedance Measuring Unit	Possible	Not possible	Not possible
Synchronized operation with temperature chambers	Possible	Possible	Possible

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

Maximum Connections

By using one control unit, you can connect 120 channels to the PFX2000 Series.

The number of devices that you can connect to a PFX2500 Series differs depending on the option boards that are installed and the controller unit's firmware version. You cannot use the control unit's TP-BUS2.

PFX2500 Series Firmware Version*1	Option Board	Control Unit PFX2121 Firmware Version	Maximum Connections
1.xx	Cannot be installed	1.00 or later	15
2.00 or later	Not installed	1.00 or later	15
	Installed	1.xx	Cannot be connected
		2.00 or later	7*2

*1. PFX2500s whose versions are 1.xx and 2.xx cannot be connected together.
*2. If you want to record data at the highest speed (1-second interval), connect three devices or less.

Program Construction

BPChecker2000 consists of the five programs.

Hardware Config 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. The HELP can be viewed by the F1 key.

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 PC equipped with the Pentium IV or the higher specification.
- Windows2000 Professional (SP4+Update Rollup1), Windows XP (SP2 or later, x86, Windows Vista (x86, x64), Windows 7 (x86, x64), Windows 8 (x86, x64)
- Memory (RAM) : 512 MB or greater
- Hard disk : 50 MB or greater of disk space
- Display monitor : must be capable of a minimum resolution of 1024 X 768 or better (DPI setting : 96 DPI)
- CD-ROM Drive
- Mouse
- Free USB ports to connect at least the number of control units to be used
- Printer

Communications with the temperature chamber

- Temperature chambers by Espec Corp. that can be controlled using the RS485.
- RS485-to-USB converter of the Espec Corp. recommended.

The VISA library must be installed in the PC.

RS485 Protocol

Adress	1 to 6	Data bits	8 bit
Transmission mode	NOMAL	Parity bit	NONE
Bit rate	4800 bps	Delimiter	CR + LF
Stop bits	2 bit		

Contents

1

Preface

This chapter describes information you should know before using BPChecker2000.

Hardware Configuration Concept

Controllers

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

Channels

The concept of channels of BPChecker2000 is simplified greatly as compared with the actual hardware configuration. From BPChecker2000, all the channels that are connected to a single control unit appear as they are connected directly.

Channels contain position information called node numbers.

PFX2000 series

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.

PFX2500 series

The node number is set using the S1 switch on the rear panel of the system controller.

The BPChecker2000 determines the channel by combining "Instrument ID" and "Node number".

Group

Group is a concept that does not exist at the hardware level, but exists in BPChecker2000. Group is a collection of channels that share a set of test conditions. Grouping multiple channels with the same test conditions offer many benefits such as the simplification of operations and hierarchical classification of test results on graphs.

See p. 9

The assignment of temperature chamber is also done at the group level when performing tests in synchronization with the temperature chamber.

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.

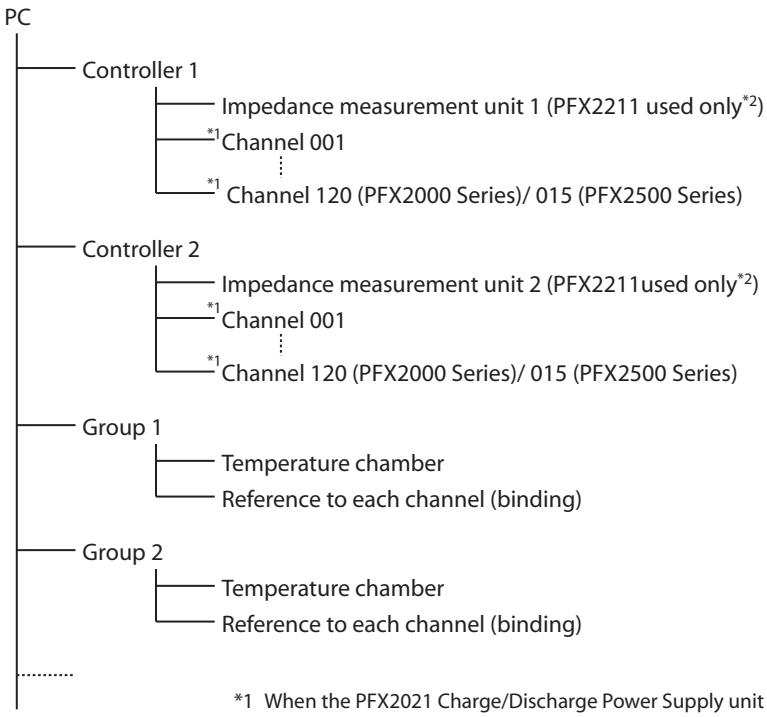
Impedance measurement unit

When using the impedance measurement unit PFX2211, the internal impedance measurement of the battery becomes possible (applied only for the PFX2000 series).

The PFX2211 is not specified explicitly on the BPChecker2000 (The impedance measurement unit can be used by the configuration setting). At the hardware level, one impedance measurement unit corresponds to one controller. 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.

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).



*1 When the PFX2021 Charge/Discharge Power Supply unit is used, only odd-numbered channels are valid.
*2 PFX2000 Series only

Executable Charge/Discharge Tests

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

The type of test is varied by the charge and discharge unit. Please refer to the operation manual of the PFX2000 series or the PFX2500 series used for details.

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.

Flow of Test Procedure

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

1 **Configure the hardware.**

Start the Hardware Config Wizard.

Set the number of control units and the use of impedance measurement units (PFX2000 series only) and temperature chambers.

Organize the channels separately for each control unit system.

For the system with the PFX2500 series, it is required to set the model information of the connected DC power supply and the electronic load.

2 **Create test conditions.**

Start the Test Condition Editor.

Create a test conditions file.

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

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

3 **Execute the test.**

Start the Test Executive.

Assign the channels that were organized using the Hardware Config 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.

4 **Analyze the test.**

Start the Graph Viewer.

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

To delete the group, use the "Group Administrator".

2

Set Up

This chapter provides instruction for the installation of the BPCheker2000 application software and the USB driver, and describes the Hardware Config Wizard that composes the hardware of the PFX2000 series/PFX2500 series.

NOTE Installation requires an administrator privilege.

Software installation and Hardware configuration

To perform the charge and discharge test using by the BPChecker2000, install entire program of the BPChecker 2000 and the USB driver first. Then, configure the hardware. It is required to install the VISA library on the PC when communicating with the temperature chamber.

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1 **Install the VISA library when communicating with the temperature chamber.**

See p. 13

2 **Install the BPChecker2000.**

3 **Connect the PFX2121.**

See p. 14

4 **Install the USB driver using the "Hardware Config Wizard".**

See p. 16

5 **Configure the hardware using the "Hardware Config Wizard".**

For recognizing the charge/discharge power supply unit (channel module) connected with the control unit, and for setting the connecting configuration of other hardware devices (such as the impedance measurement unit, the temperature chamber).

For the system with the PFX2500 series, it is required to set the model information of the connected DC power supply and the electronic load.

Installing the VISA Library

A VISA library is required to communications with the temperature chamber.

VISA (Virtual Instrument Software Architecture) is a specification for a standard software for connecting instruments that was defined by the VXIplug&play Systems Alliance.

One of the VISA libraries (driver software implemented in compliance with the VISA specifications) below is necessary.

- NI-VISAby National Instruments (Ver.3.3 or later)
- Agilent VISA by Agilent Technologies (Agilent IO Libraries Suite 15.0 or later)
- KI-VISA Ver3.1.3 or later

KI-VISA is Kikusui's original VISA library that supports VXIplug&play VISA Specifications 4.1. The KI-VISA is included in the program CD-ROM.

The newest version can be downloaded from Download service of Kikusui website (http://www.kikusui.co.jp/en/download/). KI-VISA is not required if NI-VISA or Agilent VISA is already installed.

Installing the BPChecker2000

When the BPChecker2000 is installed, the following five programs are installed in the PC.

- Hardware Config Wizard
- Group Administrator
- Test Condition Editor
- Test Executive
- Graph Viewer

1 **Insert theProgram CD-ROM into the CD-ROM drive.**

After a while, the browser will be activated. In case the browser is not activated, double click "b2k_full_xxx.exe" in the CD-ROM (*xxx is the buid number, as for the BASIC edition, double click "b2k_basic_xxx.exe") and proceed to the step 4.

2 **Select Quick Install.**

The folder installed with the setup program is displayed.

3 **Double click "b2k_full_xxx.exe" (*xxx is the buid number, as for the BASIC edition, double click "b2k_basic_xxx.exe") to activate.**

4 **Follow the description on the display, proceed to install the application software.**

When the installation of the application software is completed, the "Hardware Config Wizard" will be activated. Then, install the USB driver.

If the ***Launch BPChecker2000 Hardware Config Wizard*** is not selected and click Finish, the "Hardware Config Wizard" will not be activated.

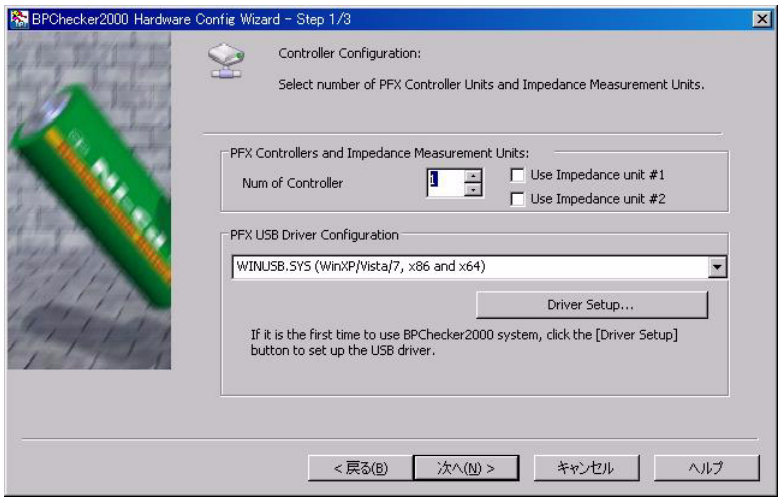
NOTE According to the system configuration, the setup program of "Microsoft Visual C++ 2008 Redistributable" or "Microsoft .NETFramework 2.0" will be automatically activated. Please follow the description of the display and install the application software.

Installing the USB driver

The USB driver can be installed by the "Hardware Config Wizard" program of the BPChecker2000. When the BPChecker2000 is installed, the USB driver file will be copied in the folder of the application. The USB driver file is also included in the program CD-ROM.

When the installation of the application software "BPChecker2000" is completed, the "Hardware Config Wizard" will be activated. In case the "Hardware Config Wizard" is not activated, double click the short-cut icon of the "Hardware Config Wizard" in the program folder or the desktop folder of the Windows.

NOTE When under operation of the "Test Executive", the "Hardware Config Wizard" can not be activated. Finish the "Test Executive".



1 **Check the rotary switch setting on the front panel.**

If you are using only a single control unit, 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.

2 **Connect the control unit to the USB port on the PC using a USB cable.**

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.

When the PC detects the control unit for the first time, the Plug&Play function starts “Found New Hardware Wizard“.

3 **Click *Cancel*.**

The USB driver can not be installed by the "Found New Hardware Wizard."

4 **Click *Driver Setup*.**

When the dialog box Run As is displayed, select the Current User. Do not select the check box of the Protect my computer and data from unauthorized program activity, then click OK.

When the dialog box User Account Control is displayed, select Allow. The "PFX2000/2500 USB Driver Wizard" is activated.

5 **Click *Next*.**

6 **Follow the description on the display, install the USB driver.**

Then, it continues to configure the hardware by the "Hardware Config Wizard".

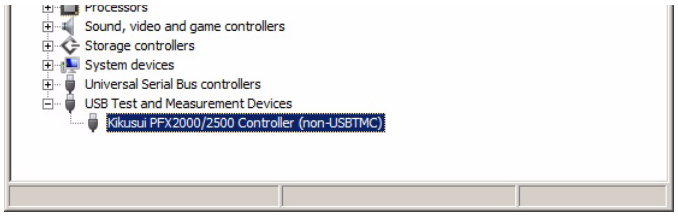
Checking whether the USB driver has been installed properly

Confirming the status of installation by "Device Manager" to verify whether the USB driver has been installed properly

1 **Select the *System* of the control panel.**

2 **Select the tab for *Hardware*, then click *Device Manager*.**

3 **Confirm whether "Kikusui PFX2000/2500 Contoller(non-USBTMC)" for Windows XP/Windows Vista/ Windows 7/ Windows 8, or "KIKUSUI PFX2121" for Windows 2000 is displayed under "USB Test and Measurement Devices".**



When the software is not installed properly, reinstall the application software.

Configuring the Hardware

The Hardware Config Wizard consists of the three steps screens.

1 **Step1/3 Controller configuration**

For setting the number of control unit, and the impedance measurement unit (when the PFX2211 is used), and to select the USB driver to be used.

2 **Step2/3 Channel configuration (Customize model ID)**

Set the channel to be used for the specified system of the controller respectively. All the channels which are currently recognized will be displayed in the list. The maximum channel for the Basid Edition can be used for 2 channels.

When using the PFX2500 series, the model ID needs to be set.

3 **Step3/3 Temperature chamber configuration**

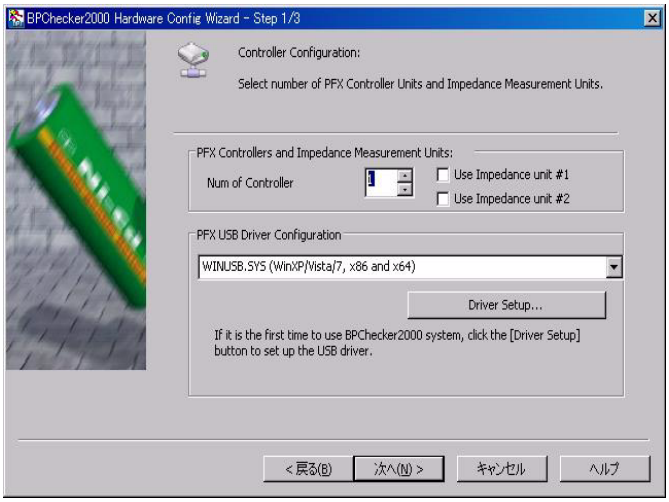
For setting the temperature chamber to be used.

If you click ***Cancel*** during the operation, the setting of the present Step may become invalid.

Step1/3 Controller configuration

To activate the "Hardware Config Wizard", double click the short-cut icon of the "Hardware Config Wizard" in the program folder or the desktop folder of the Windows.

NOTE When under operation of the "Test Executive", the "Hardware Config Wizard" can not be activated. Finish the "Test Executive".



1 **Set the number of control units.**

Select the number 1 when it is set for one system, select the number 2 when it is set for two systems (only applied for the PFX2000 series with Full Edition).

2 **When using the impedance measurement unit (only for the Full Edition), click for the check box of the assigned system.**

3 **Click *Next*.**
Displays the Step 2/3 Channel Configuration.

Step2/3 Channel configuration (Customize model ID)

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

When using the PFX2500 series, the model ID needs to be customized.

If the "!" mark is appeared in front of the header, it is required the model ID to be updated.

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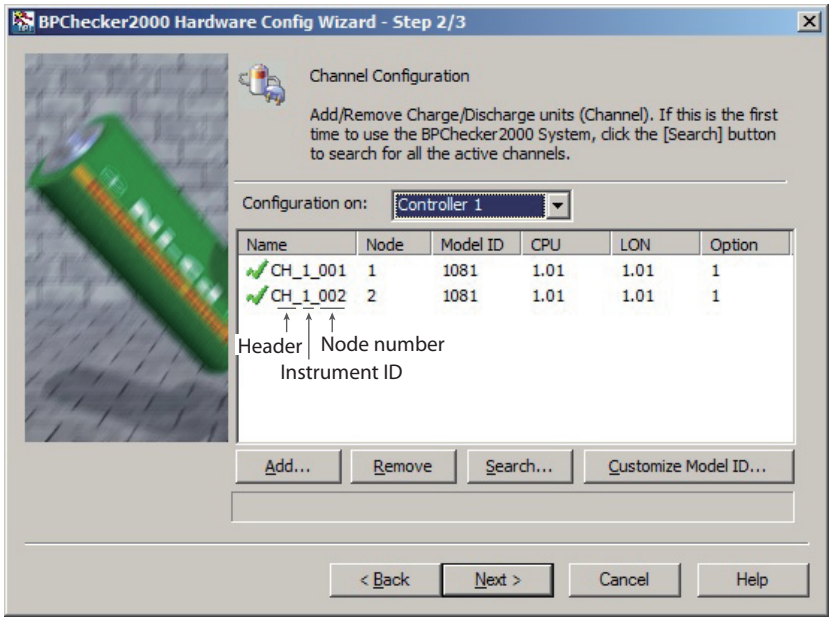

When configuring new channels

Select the system of controller configured by the ***Configuration On***, and click ***Search***. All the data including present channel configuration, group and channel assignments, and the progress status of the test will be lost, and the channel connecting to the selected controller will be displayed.

NOTE When serch 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 add or delete channels, use the ***Add*** or ***Delete***. In this case, the existing configuration information is retained.

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In case the USB driver is not installed properly, the error message (I/O error of the PFX controller) will be displayed. Confirm that the USB driver is properly installed.

When adding channels

Click ***Add***. The Add Channel dialog box appears. Enter the node number of the channel module to be added and click ***Add***.

When using PFX2500 series, the model ID needs to be customized.

When deleting channels

Select the channels you wish to delete, and click ***Delete***. You can select multiple channels at once.

Customize Model ID's (only for the PFX2500 series)

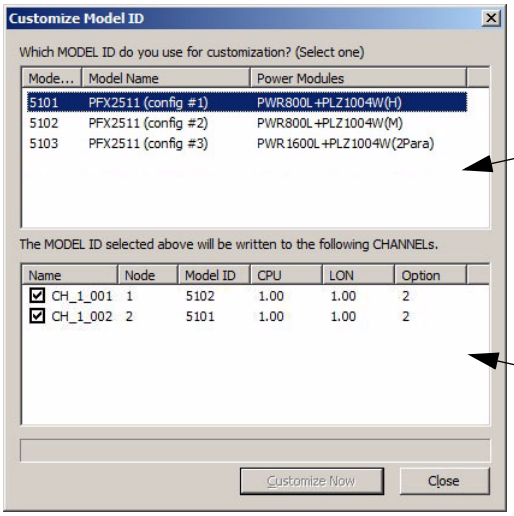
For the system with the PFX2500 series, the model ID is varied depends on configuration of the connected DC power supply and the electronic load.

The model ID for the PFX2500 series is set at "5101" as a factory default settings of which system configuration consists of the PFX2511, PWR800L, and PLZ1004W(H range). Therefore, when the BPChecker2000 is installed, it is required to customize the model ID using "Hardware Config Wizard".

Model ID	Configuration of the PFX2500 series.
5101	PFX2511, PWR800L, PLZ1004W (H range)
5102	PFX2511, PWR800L, PLZ1004W (M range)
5103	PFX2511, PWR1600L, PLZ1004W (2 units parallel)
5104	PFX2511, PWR800L, PLZ334W (H range)
5106	PFX2511, PWR1600L, PLZ1004W (H range)
5107	PFX2511, PAS10-70, PLZ1004W (H range)
5108	PFX2511, PAS20-36, PLZ1004W (H range)
5109	PFX2511, PAS20-54, PLZ1004W (H range)
5110	PFX2511, PAS40-27, PLZ1004W (H range)
5111	PFX2511, PWR800L, PLZ164W (H range)
5112	PFX2511, PAS10-35, PLZ334W (H range)

1 **Click *Customize Model ID*.**

Displays the Customize Model ID.



2 **Select the Model ID.**

3 **Select the channel for customizing the Model ID.**

You can select multiple channels at once.

4 **Click *Customize Now*.**

When the dialog box Run As is displayed, select the Current User. Do not select the check box of the Protect my computer and data from unauthorized program activity, then click OK.

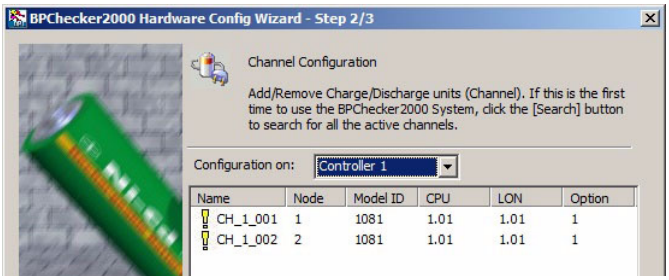
When the dialog box "User Account Control" is displayed, select Allow.

The information of the Model ID will be transmitted to the channel of the assigned PFX2500 series and it becomes to be customized. The Model ID display of the channel will be also changed.

5 **When setting the different Model ID numbers for the multiple channels, repeat the Step 2 through step 4 . When customizing the Model ID's are completed, click *Close*.**

When the mark "!" appears in front of the header;

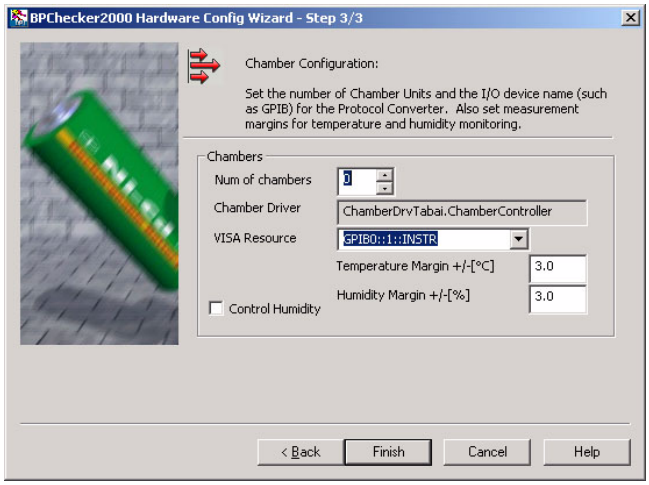
When the information for the Model ID of the BPChecker2000 becomes older due to the version upgrade, the mark "!" appears in front of the header. In such a case, customize the Model ID to be updated. Once the Model ID has been updated, the mark "!" is changed to the "Check mark".



When the setting is completed···

When the configuration of channels is completed, click ***Next***. The "Step 3/3 Chamber Configuration" will be displayed.

Step3/3 Temperature chamber configuration



In case the temperature chamber is not used;

1 **Set the number of temperature chamber at "0".**

A value of 0 means that the temperature chamber is not used.

2 **Click *Finish*.**

The configuration of hardware has been completed. The "Hardware Config Wizard" is finished.

In case the temperature chamber is used;

See p. 12

1 **Set the number of temperature chambers.**

It can be set up to 6 units. In case the temperature chamber is used, the VISA library must be installed in the PC.

2 **Set the "Chamber Driver", a driver software for the temperature chamber.**

Select the driver software for the temperature chamber. Currently, Tabai is supported.

3 **Set the "VISA Resource".**

Specify the COM number of the serial port.

Example) For serial port COM1: Select ASRL1::INSTR.

4 **When you wish to control the humidity, select for the *Control Humidity*.**

If the Control Humidity is not selected, it is limited to control for the temperature only.

5 **Set the *Temperature Margin* and the *Humidity Margin*.**

6 **Click *Finish*.**

The configuration of hardware has been completed. The "Hardware Config Wizard" is finished.

3

Creating Test Conditions

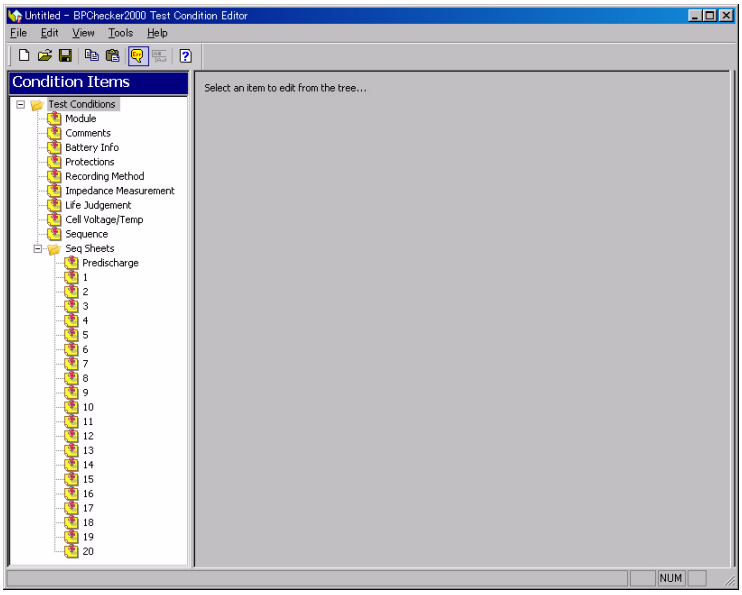
This chapter describes the Test Condition Editor and the procedure for creating test conditions.

Starting the Test Condition Editor

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

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.



Creating Test Conditions Files

Creating a new file

To create a new test conditions file, choose ***File*** > ***New***. 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 ***File*** > ***Open***.

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

Before entering the data of the test conditions

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.

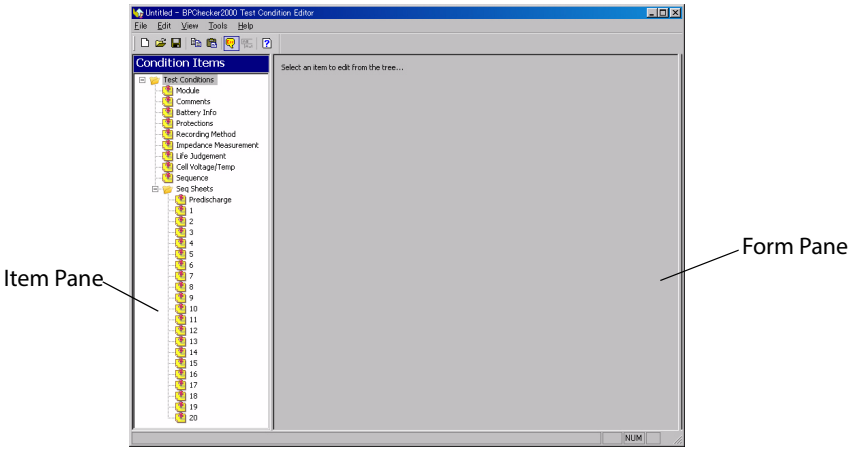
- Module
- Comment
- Battery information
- Protections
- Recording Method
- Life Judgement
- Sequence
- Sequence sheets
- Impedance Measurement (only when using the PFX2011/PFX2021)

See p. 55

Save the file when the setting of test conditions are completed.

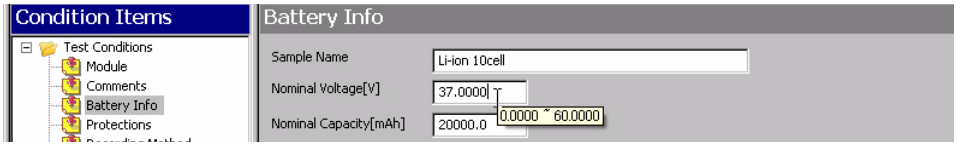
Description of the display

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.

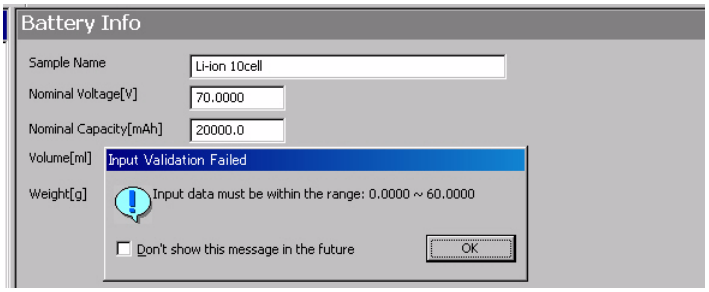


Showing the input range

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



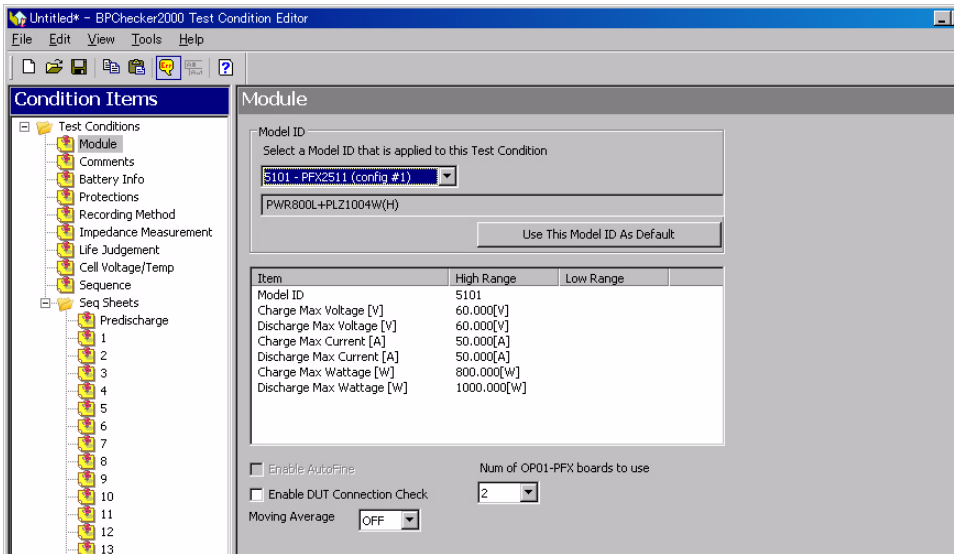
The example indicates that the nominal voltage can be entered in the range of 0.0000 V to 60.0000 V. You can enter a value outside the indicated range, but when you select an item from a different item pane, a message will appear.



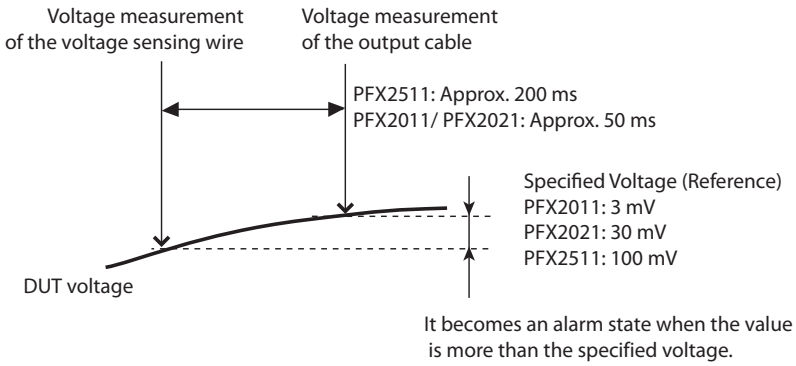
Setting the Module

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

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.

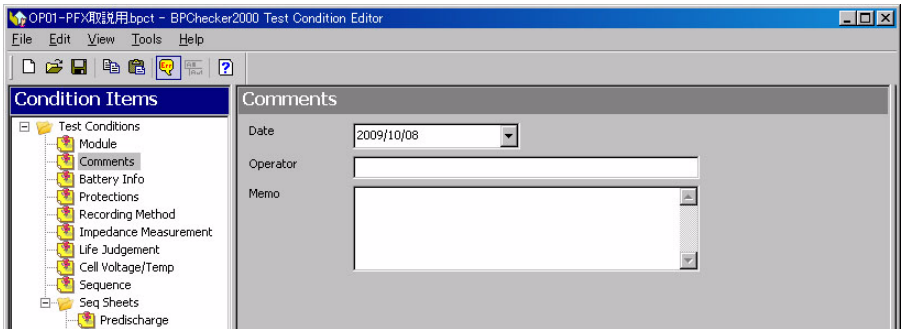


Item	Description
Model ID	Set the model (Model ID) of the power supply module you plan to use. When it is set, the suitable input range for the current and the voltage setting can be presumed. The appropriate input ranges are also used to check the range of values entered for other items that specify the actual charge/discharge conditions. Normally, the selectable models are as follows Model ID — Model 1 — PFX2011 21 — PFX2021 5101 — PFX2511 (PFX2511, PWR800L, PLZ1004W (H range)) 5102 — PFX2511 (PFX2511, PWR800L, PLZ1004W (M range)) 5103 — PFX2511 (PFX2511, PWR1600L, PLZ1004W (2 units parallel)) 5104 — PFX2511, PWR800L, PLZ334W (H range) 5106 — PFX2511, PWR1600L, PLZ1004W (H range) 5107 — PFX2511, PAS10-70, PLZ1004W (H range) 5108 — PFX2511, PAS20-36, PLZ1004W (H range) 5109 — PFX2511, PAS20-54, PLZ1004W (H range) 5110 — PFX2511, PAS40-27, PLZ1004W (H range) 5111 — PFX2511, PWR800L, PLZ164W (H range) 5112 — PFX2511, PAS10-35, PLZ334W (H range) On some special-order specifications of the BPChecker2000 systems, you may be able to select Model IDs that are not usually selectable. Select the Model ID carefully. The outline of the electrical specification of the selected charge and discharge power supply unit is displayed under the model ID. 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 PFX2021or PFX2500 series, values are shown only in the high range column, because there is only one current range. • Use This Model ID As Default When clicked, the selected Model ID becomes the default setting.

Item	Description
Enable AutoFine (PFX2000 series only)	The auto fine 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. As for the PFX2500 series, the "Auto fine" is always valid.
Enable DUT Connection Check	The connection check function of the DUT (device under test) is enabled if the checkbox is selected. The connection check function is to measure the voltage value on each of the output cable and the voltage sensing wire, and if there is any dirrerence in measured voltage value, this function determine the status as abnormal connection and an alarm occurs. The connection check function activates immediately before the charge or discharge operation is begun. The measurement of voltage between the output cable and voltage sensing wire requires time (PFX2011 and PFX2021: approx. 50 ms, PFX2511: approx. 200 ms). During this period, if the voltage of the DUT varies (the rest time is set to short time, etc.), it may cause generation of the alarm even when the connection is wired properly. In such case, please disable the connection check function.  The connection check function is not a function to verify the wiring condition completely for which might be the case of difficult judgement such as connection failure.
Moving Average	Select the moving average value. You can decrease the fluctuation of the measured value even further by performing moving average. The processing of moving average caan be performed even at the time of Pulse discharge. When the setting of the width of pulse time is long and the other than OFF is selected, the measurement result will take time to be up-dated.
Num of OP01-PFX boards to use (only for the PFX2500 Series)	When OP01-PFX option boards are installed in the PFX2500 Series, select the number of boards that are installed. If no boards are installed, select 0. If you select 1 or greater, the cell voltage test is enabled.

Enter the comment

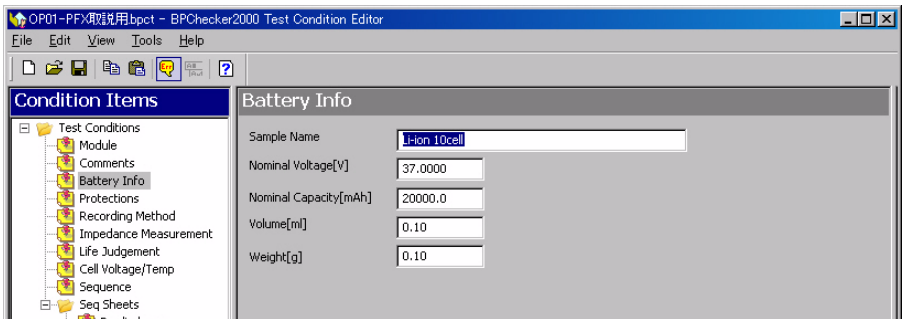
This screen is used to enter the date, the name of the operator, and notes.



Item	Description
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.

Enter the battery information

This screen is used to enter information concerning the battery.



See p. 58

Item	Description
Sample Name	Enter the name of the DUT (battery). You can enter up to 63 characters.
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.
Weght	Enter the weight of the DUT.

Setting the 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.

In case of the incorrect setting, it may generate the trouble such as a damage to the DUT caused by not activating the protection function under the abnormal operation (when it requires to activate the protection function), or aborting the test even detected no abnormality.

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

This screen is used to set the software protection. The "HARDWARE PROTECTION" function can be set in the "Test Executive" program.

Each item is enabled only when the checkbox is selected.

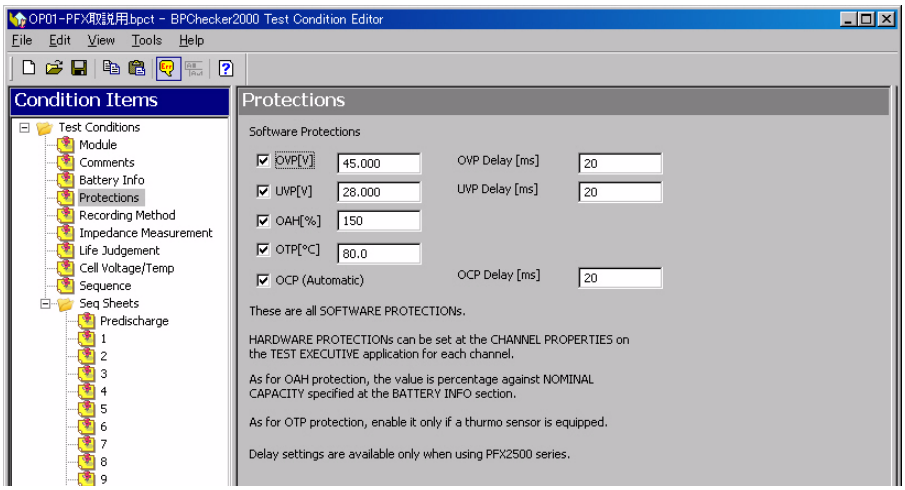
See p. 24

For the protection function "Conn (activates the alarm by the unconnected DUT)" can be set in the "Setting the Module".

The "Shock_Det. (activates the alarm detecting by the hard vibration, only for the PFX2500 series)" can be set by the dip switch of the PFX2500 series.

See p. 31

You can set the cells' OVP, OCP, OTP, and unbalance protection functions in the "Cell Voltage/Temp settings" under Test Conditions.



See p. 58

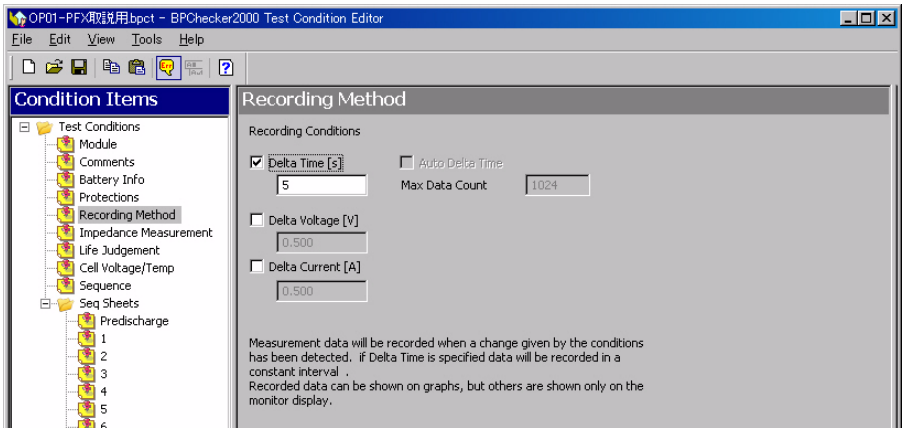
Item	Description
OVP	Set the software OVP (overvoltage protection). If battery voltage exceeds the OVP value during testing, an alarm occurs and the test is aborted. The accurate overvoltage detection is possible because of the detection accuracy is the same as the voltage measurement accuracy. The detecting speed is 150 ms (max). In normal cases, set a voltage relatively close to the cutoff voltage or CV voltage for charging. • OVP delay (PFX2500 series only) Set the activation delay time for the protection function. (the period of time to start activation of the protection function)

Item	Description
UVP	Set the software UVP (undervoltage protection). If battery voltage falls below the UVP value during testing, an alarm occurs and the test is aborted. The accurateundervoltage detection is possible because of the detection accuracy is the same as the voltage measurement accuracy. The detecting speed is 150 ms (max). In normal cases, set a voltage relatively close to the cutoff voltage for discharging. • UVP delay (PFX2500 series only) Set the activation delay time for the protection function. (the period of time to start activation of the protection function)
OAH	Set the software OAH (overcharge capacity protection). 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 Battery Info. Set an appropriate value when performing overcharge or overdischarge tests.
OTP	Set the software OTP (overtemperature protection). 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. If the temperature measurement is not required (including the case for not connecting the thermistor), invalid the OTP protection function.
OCP (Automatic)	Set either valid or invalid of the Software OCP (Over Current Protection) function. The OCP value is set at +100 mA (+10 mA when set in the Low Range) of the constant current setting value for the PFX2000 series, and +1 A of the constant current setting value for the PFX2500 series. When the charge current exceeds the OCP value during the test (detected by the AC converter), the alarm will be activated and abort the test. • OCP delay (Valid only for the PFX2500 series) It sets the activation delay time for the protection function. (the time to start activation of the protection function)

Setting the 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. Charge/discharge data will not be recorded, if all items are not selected.

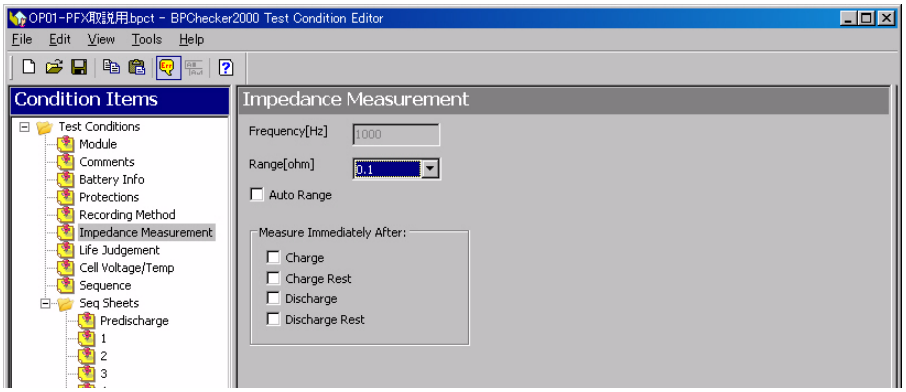


See p. 58

Item	Description
Delta Time	Set the time interval for recording the data. If a short time is specified, the amount of data that is recorded increases. If the test period is long (several hours or more), the number of data points becomes greater than 1 000 points. Use caution when setting the time. When the period of testing time is long, it is convenient to use the "Auto Delta Time" which limits the total volume of the data. While the "Auto Delta Time" is selected, the Delta Time can not be set.
Auto Delta Time	Set the maximum number of data for recording. 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." If Delta Time is selected, Auto Delta Time cannot be selected.
Delta Voltage	Data is recorded when the voltage changes by an amount greater than the specified value.
Delta Current	Data is recorded when the current changes by an amount greater than the specified value.

Setting the Impedance Measurement (when PFX2211 is used)

When the impedance measurement unit PFX2211 is used, set the condition for the impedance measurement.



See p. 58

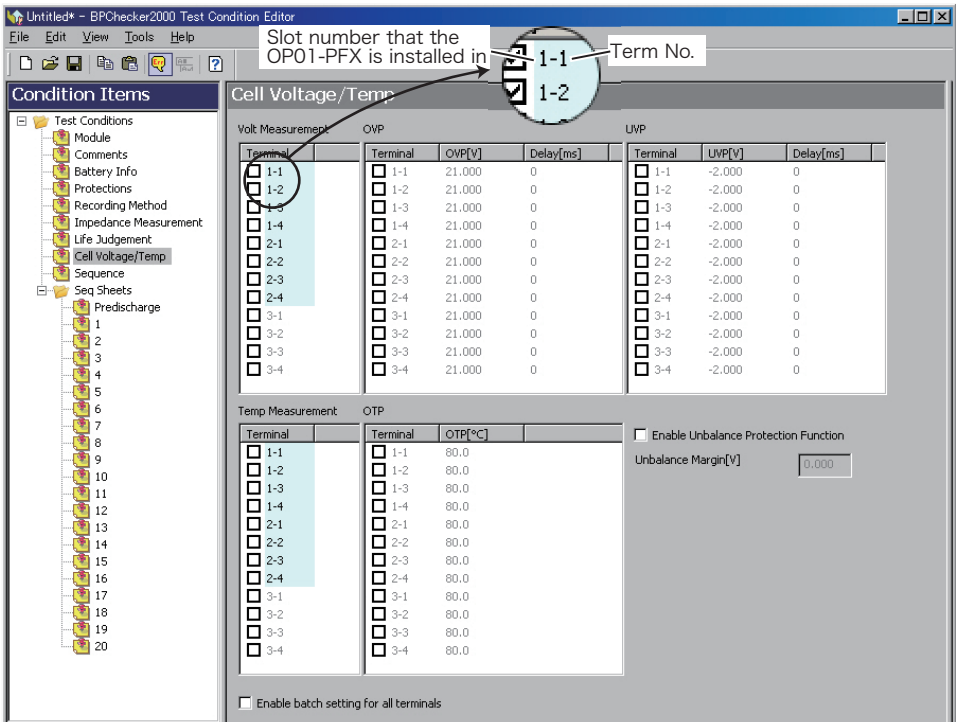
Item		Description
Frequency		Set the measurement frequency. The frequency is fixed to 1000 Hz in the current version of the software.
Range		Select the measurement range.
Auto Range		The auto range function is enabled if the checkbox is selected. Once the Auto range function becomes valid, whenever it is required, the range will be switched automatically from the position of the selected range.
Measure Immediately After		Specify the point in the test execution cycle when impedance measurement is to be carried out. It is possible to select multiple measurement points. It measures the selected items.
	Charge	Measures immediately after charge is complete.
	Charge Rest	Measures immediately after charge rest is complete.
	Discharge	Measures immediately after discharge is complete.
	Ddischarge Rest	Measures immediately after discharge rest is complete.

Setting the Cell Voltage/Temp (Only on the PFX2500 Series)

This screen is used to configure the voltage and temperature measurement of the cells and their protection functions.

See p. 24

When you have installed OP01-PFX boards into the PFX2500 Series and selected 1 or greater for Num of OP01-PFX boards to use in the "Module settings" under Test Conditions, this screen is enabled.



See p. 58

Item		Description
Volt Measurement		Select the terminal numbers of the cells that you want to measure the voltage of.
OVP		Set the software OVP.
	Terminal	When the voltage of one of the selected terminals exceeds the OVP value, an alarm occurs, and the test is aborted.
	OVP	Set the OVP value.
	Delay	Set the amount of time (the delay) before the protection function begins operating.
UVP		Set the software UVP.
	Terminal	When the voltage of one of the selected terminals falls below the UVP value, an alarm occurs, and the test is aborted.
	UVP	Set the UVP value.
	Delay	Set the amount of time (the delay) before the protection function begins operating.
Temp Measurement		Select the terminal numbers of the cells that you want to measure the temperature of.
OTP		Set the software OTP.
	Terminal	When the temperature of one of the selected terminals exceeds the OTP value, an alarm occurs, and the test is aborted.
	OTP	Set the OTP value.

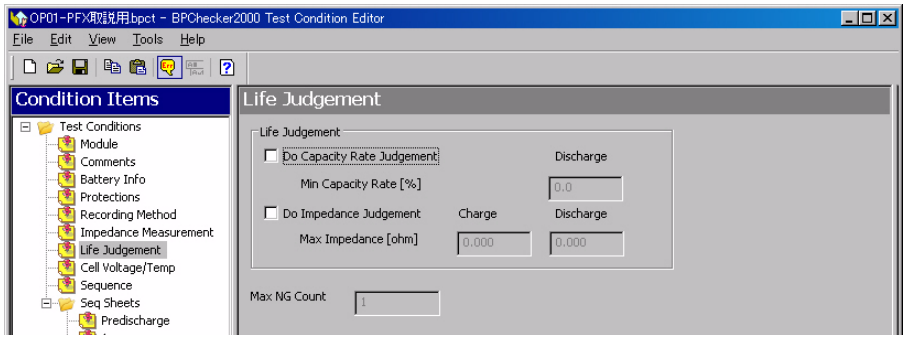
Item		Description
Enable Unbalance Protection Function		If you select this check box, an alarm occurs when the unbalance voltage exceeds the unbalance margin. The multiple cells that you have specified for voltage measurement (the OVP and UVP terminals that you have selected) are compared, and the difference between the maximum and minimum cell voltages is the unbalance voltage. The unbalance voltage is detected approximately 1 second after the cell voltage measurement completes. If the charge / discharge voltage fluctuates greatly (the internal voltage of the DUT is high), this function may not operate correctly. If the measured voltages are different or sensing cables are not connected to both ends of the cells, this function will not operate correctly. For information on how to connect the cells to the PFX2500 Series, see the PFX2500 Series operation manual.
	Unbalance Margin	Set the unbalance margin.
Enable batch setting for all terminals		If you select this check box, you can set one terminal, and those settings will be applied to all other terminals.

Setting the Life Judgement

Battery capacity degrades or its impedance increases as batteries are repeatedly charged and discharged. This screen is used to set the life judgement items.

The life judgement function determines the performance degradation of the battery by comparing the actual capacity against the nominal capacity. When the PFX2211 is used, it can also judge the performance failure of the battery by referring 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.



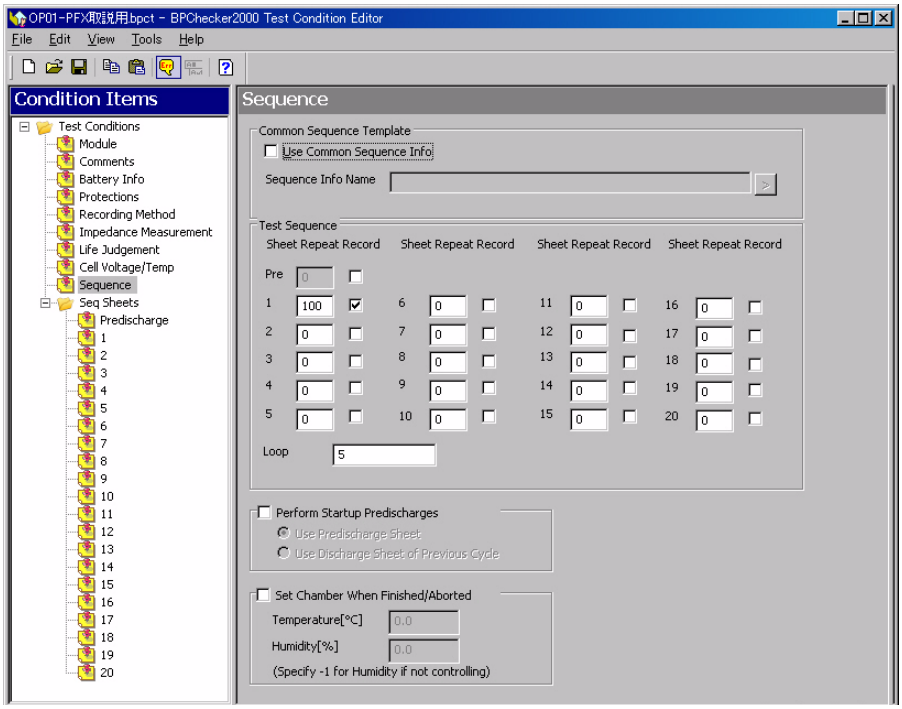
See p. 59

Item		Description
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 "Battery Info" which is taken to be 100%.
Do Impedance Judgement (when the PFX2211 is used)		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	The maximum impedance can be specified independently for charge and discharge. The maximum impedance is evaluated on all measurements that were specified in "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.

Setting the Sequence

Sequence defines how to execute the charge/discharge contents that are specified in sequence sheets #1 to #20. The "Test Executive" performs the charge and discharge test complied with the description of the setting sequence.

"Repeat" specifies the number of times a sequence sheet is repeated; "Loop" specifies the number of times the set of sequence sheets (all 20 types) are repeated. The test is performed in order from sequence sheet #1.



Item		Description
Common Sequence Template See p. 56		The "Common Sequence Template" is a function that is necessary only when controlling temperature chambers. The BPChecker2000 can manage separately for the setting of the sequence related function and the temperature chamber related function (including for the repeated sequence function). The setting of the temperature chamber related function can be shared between the multiple test condition files. Use Common Sequence Info Select it when the "Common Sequence Template" is used. Set the file name of the "Common Sequence Template" for the sequence information.
Test Sequence		The test is executed according to the sequence specified here. 20 types (#1 to #20) of test sheets of charge and discharge can be specified. You can repeat any of these sheets and loop the entire sequence. 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. Record (data file) remains only if the checkbox is selected. 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 #20.
Perform Startup Predischarges		When it is selected, it starts to perform the 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. When performing the Startup Predischarge, specify the description of the Predischarge. • Use Predischarge Sheet For the Startup Predischarge, use the Predischarge sequence sheet (Sequence sheet #0). • 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. For the setting of "Startup Predischarges", when the "Do Predischarge when the sheet is first used" is selected for the Charge sheet of each sequence sheet, the setting on the sequence sheet takes priority (the sequence #0 is used)
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.
	Temperature	Set the temperature at the time when the test is finished or when the test is aborted.
	Humidity	Set the humidity at the time when the test is finished or when the test is 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.

Relationship between the predischarge settings and discharge sheets that are executed

The following describes how the predischarge performs by the setting of the predischarge, the case is an example for the sequence setting of that the sheet #1 and #2 are only used. There are twelve patterns in the predischarge setup pattern that you can set by using two sequence sheets.

As for the sequence setting, the "Repeat" is set for 2 (Sequence sheet #1), for 1 (Sequence sheet #2), for 0 (Sequence sheet #3 to #20), and the "Loop" is set for 2.

Predischarge setup pattern	1	2	3	4	5	6	7	8	9	10	11	12
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			✔	✔			✔	✔			✔	✔

■ Case 1: The case when the specified sequence finished normally.

Test start												
Predischarge	-	#0	-	#0	#0	#0	#0	#0	#0	#0	#0	#0
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											

For patterns 6 and 8, there is a conflict in the predischarge settings is started between the sequence sheet setting and the sheet #1 setting. In this case, the setting of sheet has priority, and predischarge is never executed twice. For patterns 9 to 12, ***Use Discharge Sheet of Previous Cycle*** is selected. This case specifies immediately after starting the test, so there is no previous cycle. The result is the same as when ***Use Predischarge Sheet*** is selected.

■ Case 2: The case when the test is aborted at cycle 3 of the specified sequence and then restarted.

Test start												
Predischarge	-	#0	-	#0	#0	#0	#0	#0	#0	#0	#0	#0
Cycle 1	Sequence sheet #1											
Cycle 2	Sequence sheet #1											
Predischarge	-	-	#0	#0	-	-	#0	#0	-	-	#0	#0
Cycle 3	Sequence sheet #2 Abort											
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											

Since a test is restarted from the aborted cycle. 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. The case 2 is specified that restarts from the "Cycle 3", and the sheet #2 is used for the first time. 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.

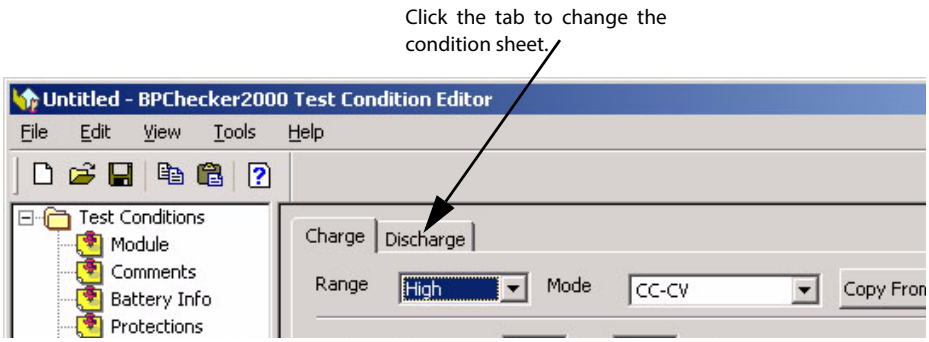
Use Predischarge Sheet is selected in patterns 5 and 6. Thus, predischarge is executed when the test is restarted.

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.

About Sequence Sheet

There are 21 sequence sheets including the predischarge sheet and sheets #1 to #20. Since each sheet from #1 to #20 consists of a charge condition sheet and a discharge condition sheet, the total number of sheets is 41.

For the test condition of charge and discharge, click the view tab to change the condition sheet.

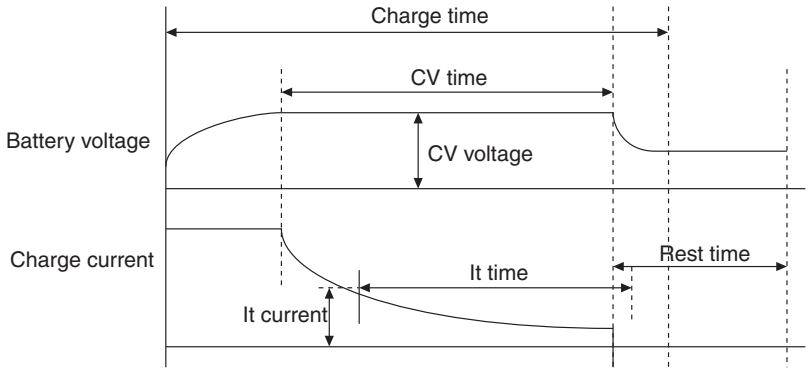


Fo the charge or discharge condition, the setting descriptions are varied by the operation mode. Each operation mode for the charge test, predischarge test, and discharge test are described in the following section.

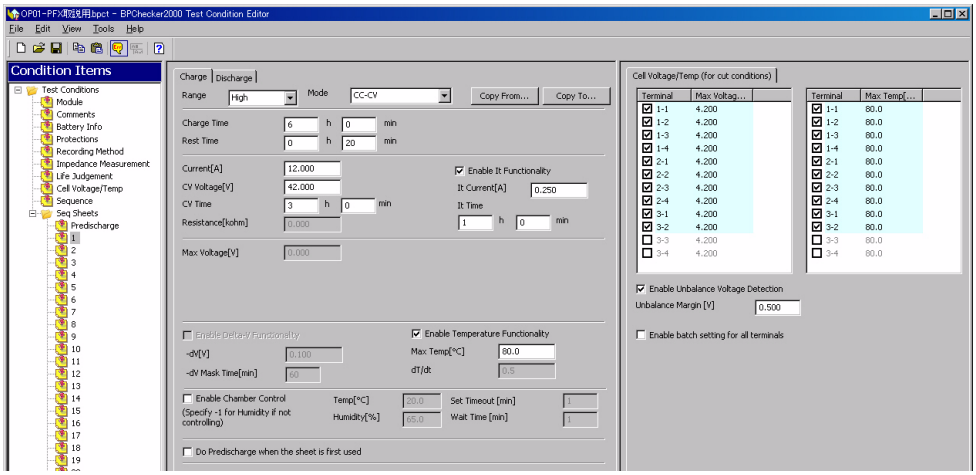
When you click ***Copy from*** or ***Copy to***, the descriptions of other sequence sheet can be copied or pasted.

Seq Sheet - CC-CV Charge mode

The following figure is shown as an example of the Constant Current and the Constant Voltage (CC-CV) charge 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.)



Select 1 or greater for "Num of OP01-PFX boards to use" under Module to display the Cell Voltage/Temp Setup screen.



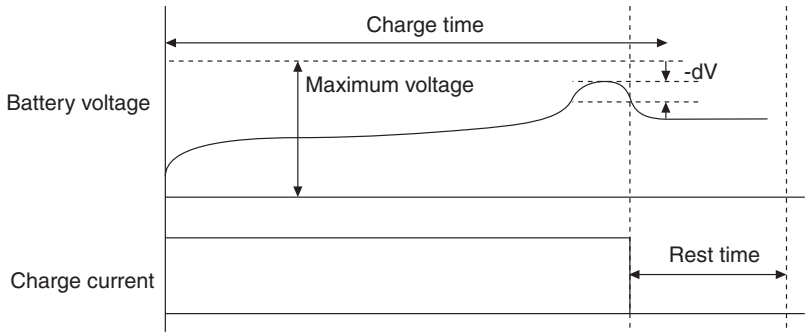
■ Setting descriptions

See p. 43、 p. 60

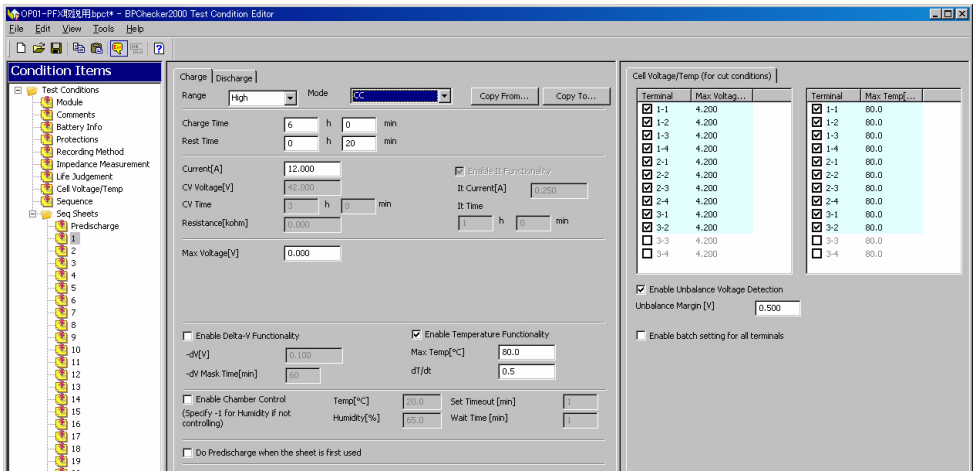
- Range
- Mode
- Charge Time
- Rest Time
- Current
- CV Voltage
- CV Time
- Enable IT Functionality
- Enable Chamber Control
- Do Predischarge when the sheet is first used
- Cell Voltage/Temp (for cut conditions)

Seq Sheet - CC Charge mode

The following figure is shown as an example of the Constant Current (CC) charge operation. The figure illustrates the transition of constant current charge -> -dV detection -> charge termination -> charge rest.



Select 1 or greater for "Num of OP01-PFX boards to use" under Module to display the Cell Voltage/ Temp Setup screen.



■ Setting descriptions

See p. 43、 p. 59

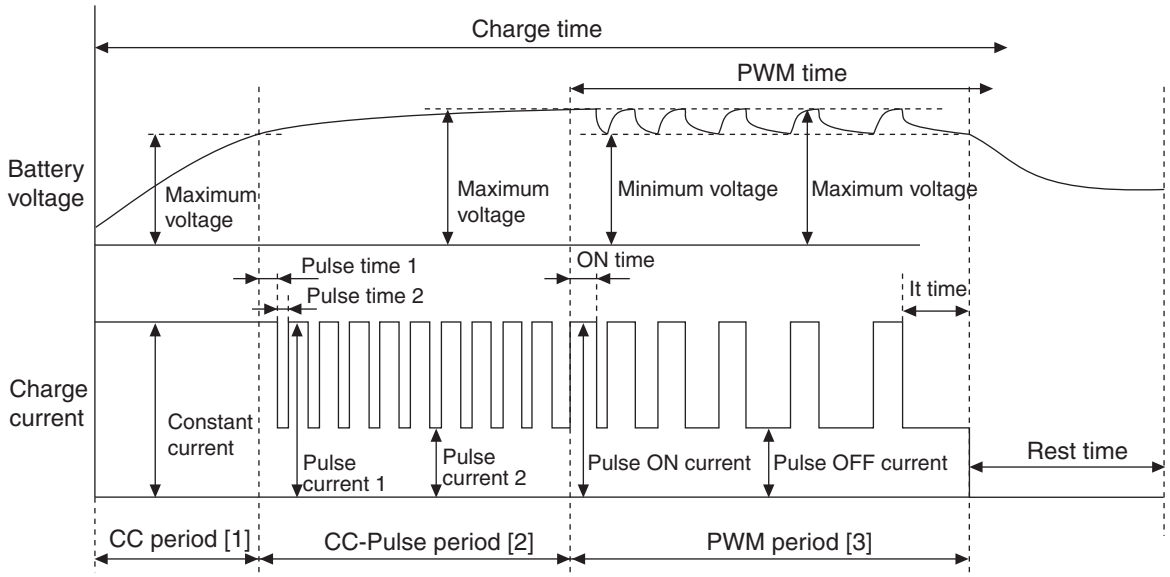
- Range
- Mode
- Charge Time
- Rest Time
- Current
- Max Voltage
- Enable Delta-V Functionality
- Enable Temperature Functionality
- Enable Chamber Control
- Do Predischarge when the sheet is first used
- Cell Voltage/Temp (for cut conditions)

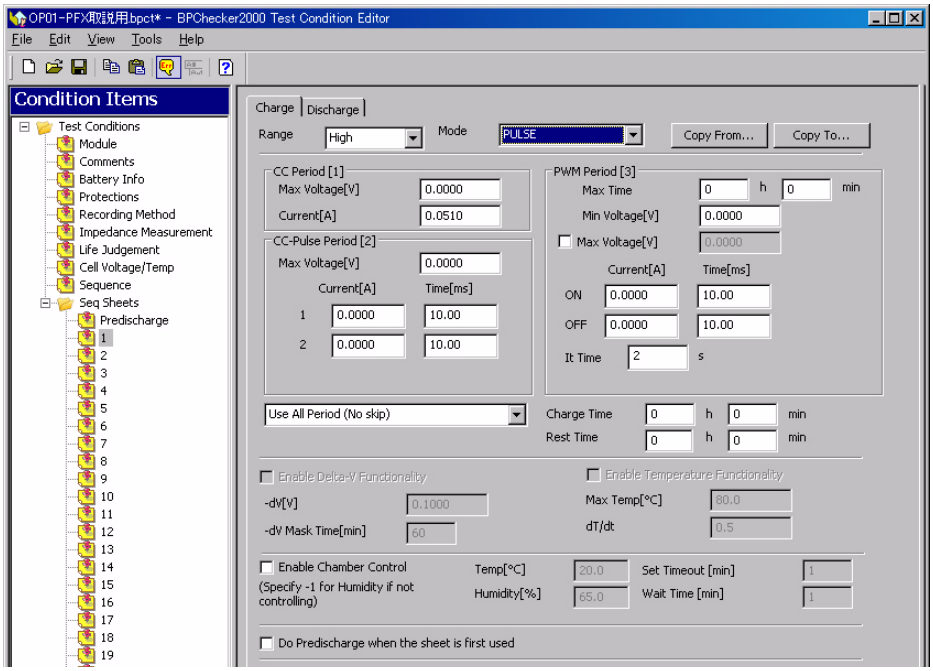
Seq Sheet - Pulse Charge mode (PFX2000 series only)

The following figure is shown as an example 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).

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)





See p. 43、p. 60

■ Setting descriptions

Range

Mode

CC Period [1]

CC-Pulse Period [2]

PWM Period [3]

Charge Time

Rest Time

Enable Chamber Control

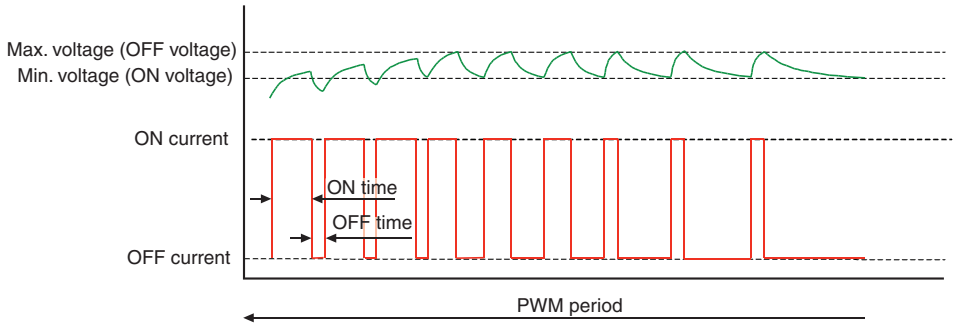
Do Predischarge when the sheet is first used

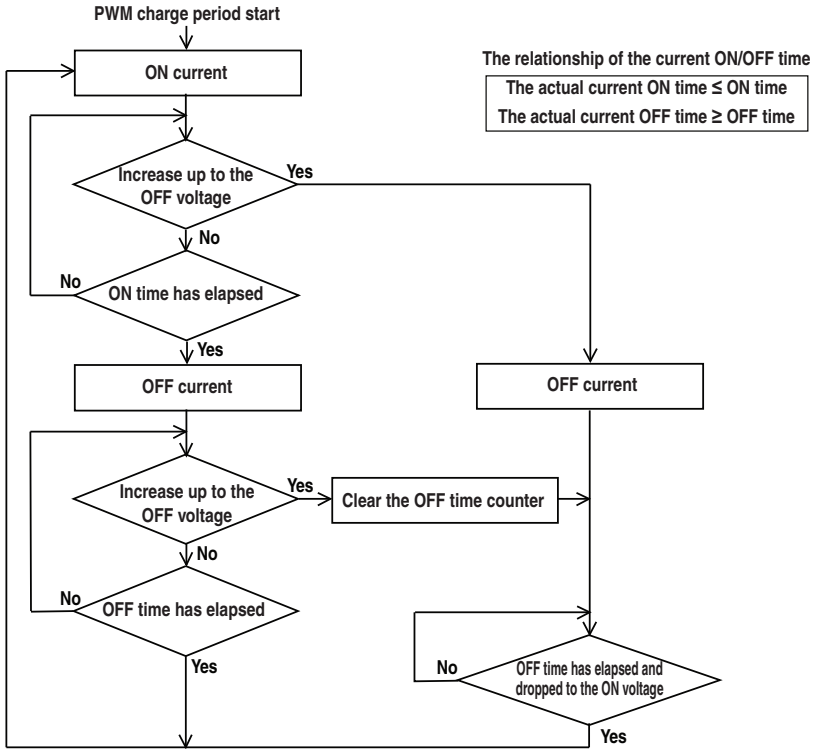
Current control during the PWM period

Current control during the PWM period varies depending on the ***Max Voltage*** (OFF voltage) setting.

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

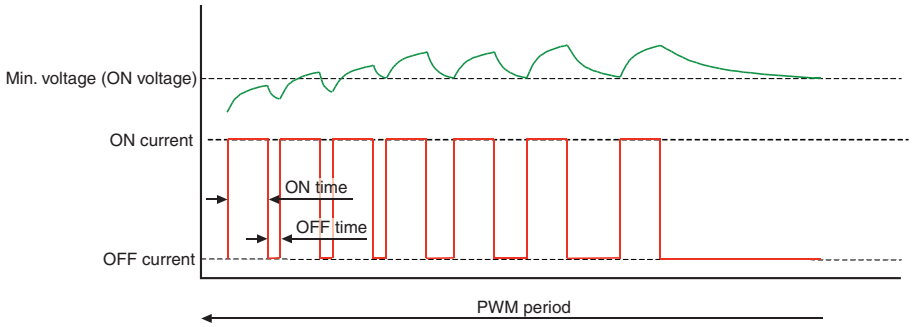
When the battery voltage increases to the OFF voltage or when the ON time elapses during the ON current period, the operation moves to OFF current. During the OFF current period, the operation moves to ON current when the battery voltage drops to the ON voltage and the OFF time has elapsed. Because voltage detection requires at least 0.5 ms, the minimum ON current time is 0.5 ms.

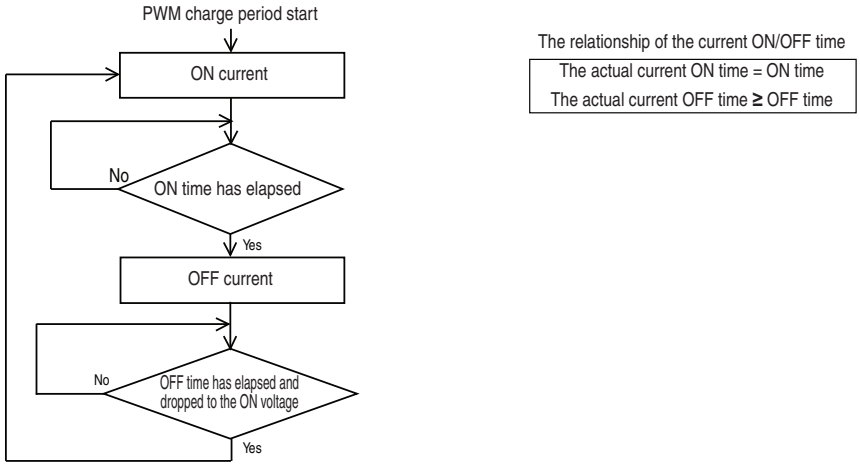




When the Max Voltage (OFF voltage) check box is not selected

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.





The Setting Description for the Charge Conditions

Item		Description
Range		You can select the range if you selected the PFX2011 Charge/Discharge Power Supply Unit for Model ID in "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. Other modes may be included depending on the Test Condition Editor version. Dimmed items are not selectable.
Charge Time		Set 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. In the Pulse charge mode, 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, charge is skipped.
Rest Time		Set 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		Set the charge current. The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.
CV Voltage		Set the voltage value at which the battery voltage moves to constant voltage (CV) operation.
CV Time		CV time is one of the factors that terminate charging. Set the time from shifting to the constant voltage (CV) operation due to the increase of the battery voltage until the charge is finished.
Enable It Functionality		Selecting this checkbox enables you to set It Current and It Time.
	It Current	Set the It current value. 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. The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.
	It Time	It time is one of the factors that terminate charging. Set the time from detecting the It current until the charge is finished.
Max Voltage		Set the maximum voltage. 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	Set the -dV. 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	Set the -dV mask time. The -dV detection is disabled during the -dV mask time.
CC Period [1]		Set the CC preiod [1].
	Max Voltage	Set the maximum voltage. When the battery voltage reaches maximum voltage during CC charging, the operation moves to the CC-Pulse period.
	Current	Set 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]		Set the CC preiod [2].
	Max Voltage	Set the maximum voltage. CC-Pulse. When the battery voltage reaches maximum voltage during CC-Pulse charging, the operation moves to the PWM period.
	Current (1, 2)	Set 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 (1, 2)	Set the pulse time width (1 and 2) during the CC-Pulse period.

Item		Description
PWM Period [3]		Set the CC preiod [3].
	Max Time	Set the maximum time for the PWM period. When this time elapses, the operation moves to charge rest.
	Min Voltage	Set the minimum voltage. When the battery voltages drops to minimum voltage during pulse OFF current, the operation moves to pulse ON current.
	Max Voltage	Set the maximum voltage. 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.
	Current (ON, OFF)	Set 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 (ON, 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*** check box.
	It Time	Set the It time. 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.
Enable Temperature Functionality		Selecting this checkbox enables you to set Max Temp and dT/dt.
	Max Temp	Set the maximum temperature. Maximum temperature is one of the factors that terminate charging. Charging ends when the battery temperature exceeds the specified value during charging.
	dT/dt	Set the 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.
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, Humidity, Setting Timeout, and Wait Time.
	Temperature	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	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	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.
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.
Cell Voltage/Temp (for cut conditions)		Select this check box to set the cell voltages and temperatures.
	Terminal	Select the terminals to set the maximum voltage or maximum temperature that will be used as an end condition. Max Voltage When the maximum voltage is reached, charging is stopped. Max Temp When the maximum temperature is reached, charging is stopped.

Item		Description
	Enable Unbalance Voltage Detection	Select this check box to set the unbalance margin. The multiple cells that you have specified for voltage measurement (the terminals that you have set maximum voltages for) are compared, and the difference between the maximum and minimum cell voltages is the unbalance voltage. Charging is stopped when the unbalance voltage exceeds the unbalance margin. The unbalance voltage is detected approximately 1 second after the cell voltage measurement completes. If the charge / discharge voltage fluctuates greatly (the internal voltage of the DUT is high), this function may not operate correctly. If the measured voltages are different or sensing cables are not connected to both ends of the cells, this function will not operate correctly. For information on how to connect the cells to the PFX2500 Series, see the PFX2500 Series operation manual.
	Enable batch setting for all terminals	If you select this check box, you can set one terminal, and those settings will be applied to all other terminals.

Seq Sheet - Predischarge

Set the predischarge to execute for the case when starting the test, or when the sequence sheet is used for the first time.

■ Setting descriptions

See p. 53、 p. 61

Range

Mode

Discharge Time

Rest Time

Capacity Voltage

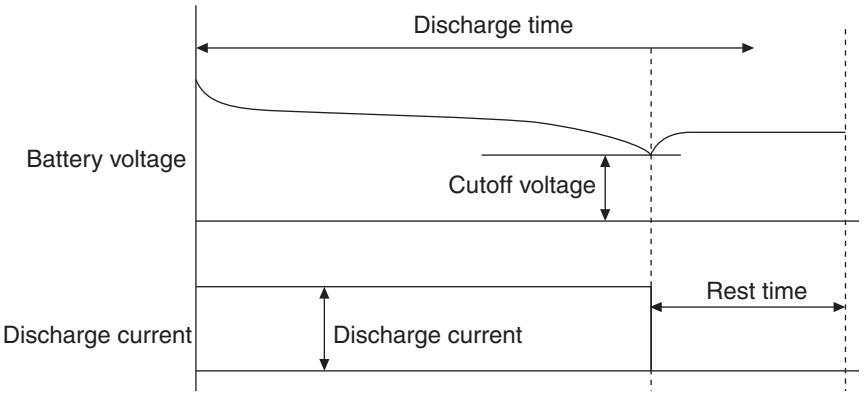
Cutoff Voltage

Enable Chamber Control

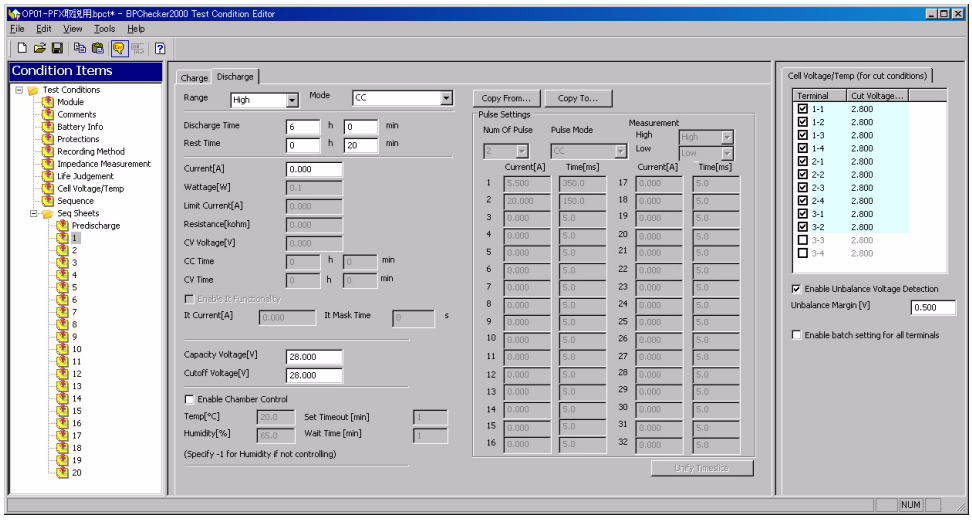
Cell Voltage/Temp (for cut conditions)

Seq Sheet - CC Discharge mode

The following figure is shown as an example of the Constant Current (CC) discharge operation. The figure illustrates the transition of constant current discharge -> voltage drop to the cutoff voltage -> discharge termination -> discharge rest.



Select 1 or greater for "Num of OP01-PFX boards to use" under Module to display the Cell Voltage/Temp Setup screen.



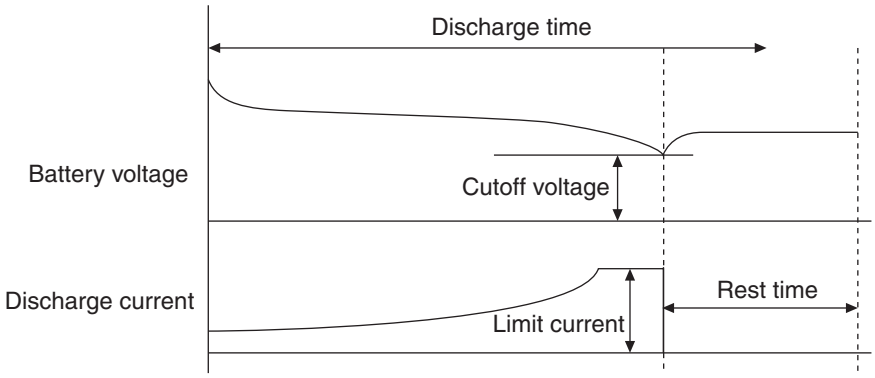
■ Setting descriptions

See p. 53、 p. 61

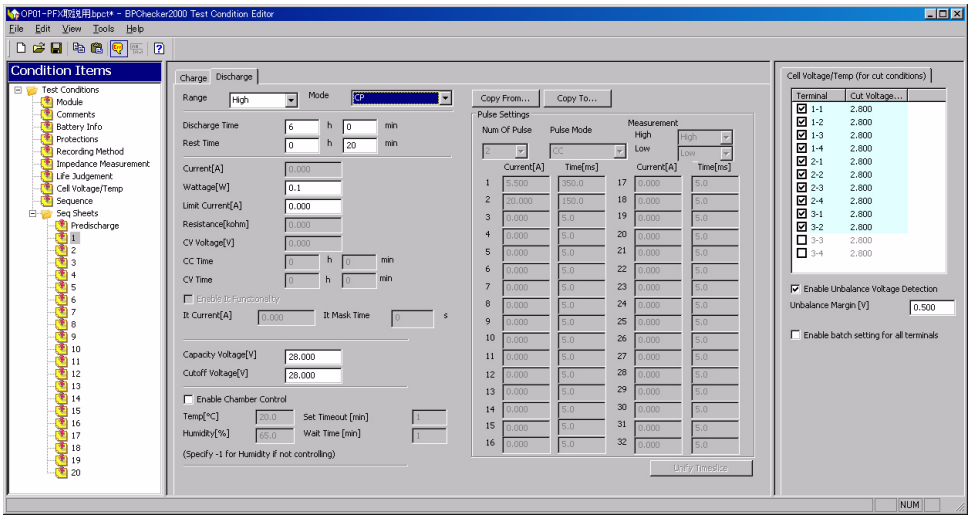
- Range
- Mode
- Discharge Time
- Rest Time
- Current
- Capacity Voltage
- Cutoff Voltage
- Enable Chamber Control
- Cell Voltage/Temp (for cut conditions)

Seq Sheet - CP Discharge mode

The following figure is shown as an example of the Constant Power (CP) discharge operation. The figure illustrates the transition of constant power discharge -> voltage drop to the cutoff voltage -> discharge termination -> discharge rest.



Select 1 or greater for "Num of OP01-PFX boards to use" under Module to display the Cell Voltage/ Temp Setup screen.



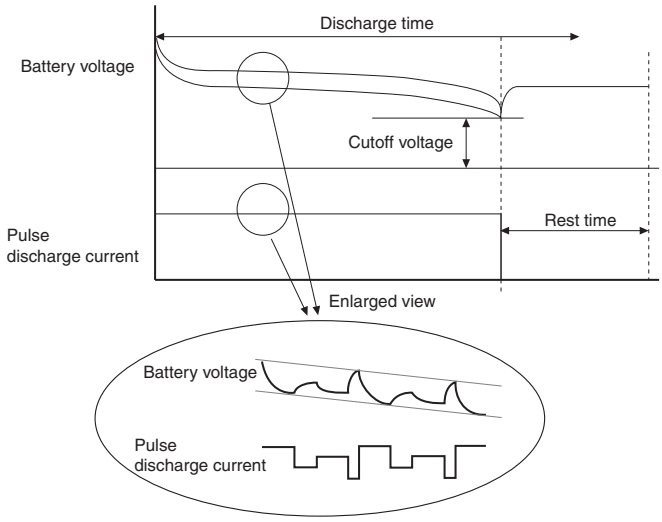
■ Setting descriptions

See p. 53、 p. 61

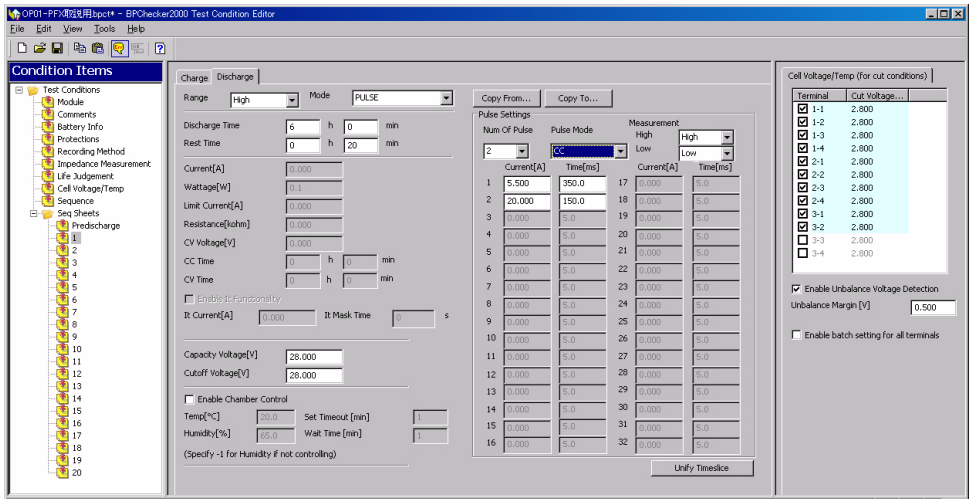
- Range
- Mode
- Discharge Time
- Rest Time
- Wattage
- Limit Current
- Capacith Voltage
- Cutoff Voltage
- Enable Chamber Control
- Cell Voltage/Temp (for cut conditions)

Seq Sheet - CC-Pulse Discharge mode

The following figure is shown as an example of the Constant Current and the Pulse (CC-Pulse) discharge operation. The figure illustrates the transition of pulse discharge -> voltage drop to the cutoff voltage -> pulse discharge termination -> discharge rest.



Select 1 or greater for "Num of OP01-PFX boards to use" under Module to display the Cell Voltage/Temp Setup screen.



■ Setting descriptions

参照 p. 53、 p. 62

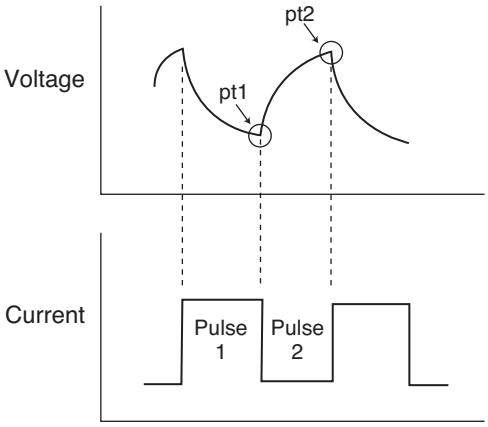
- Range
- Mode
- Discharge Time
- Rest Time
- Pulse Setting
- Capacity Voltage
- Cutoff Voltage
- Enable Chamber Control
- Cell Voltage/Temp (for cut conditions)

Pulse setting example of the PFX2021

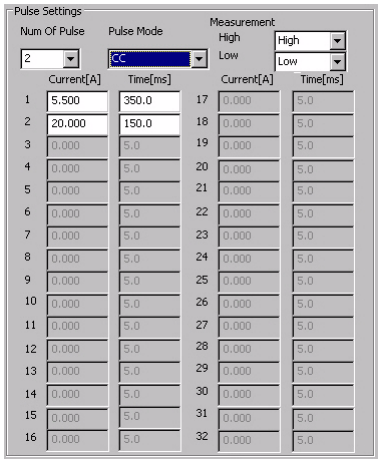
This example is for the case when detecting the discharge cutoff voltage on the high end using two pulses.

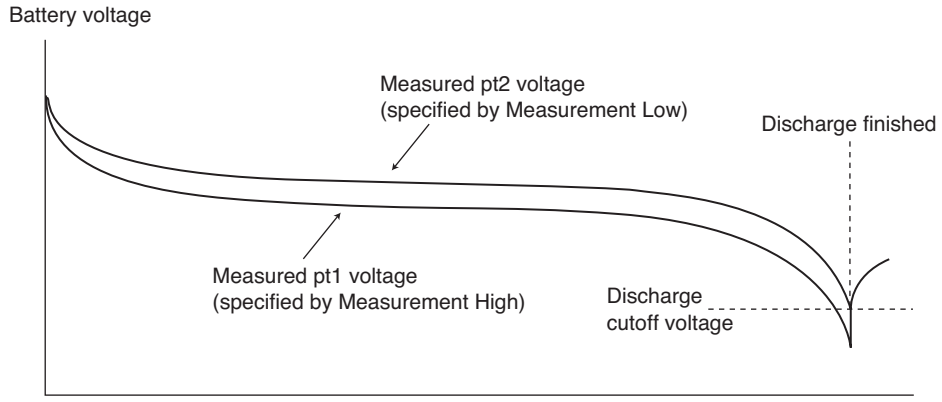
Pulse Settings

- 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

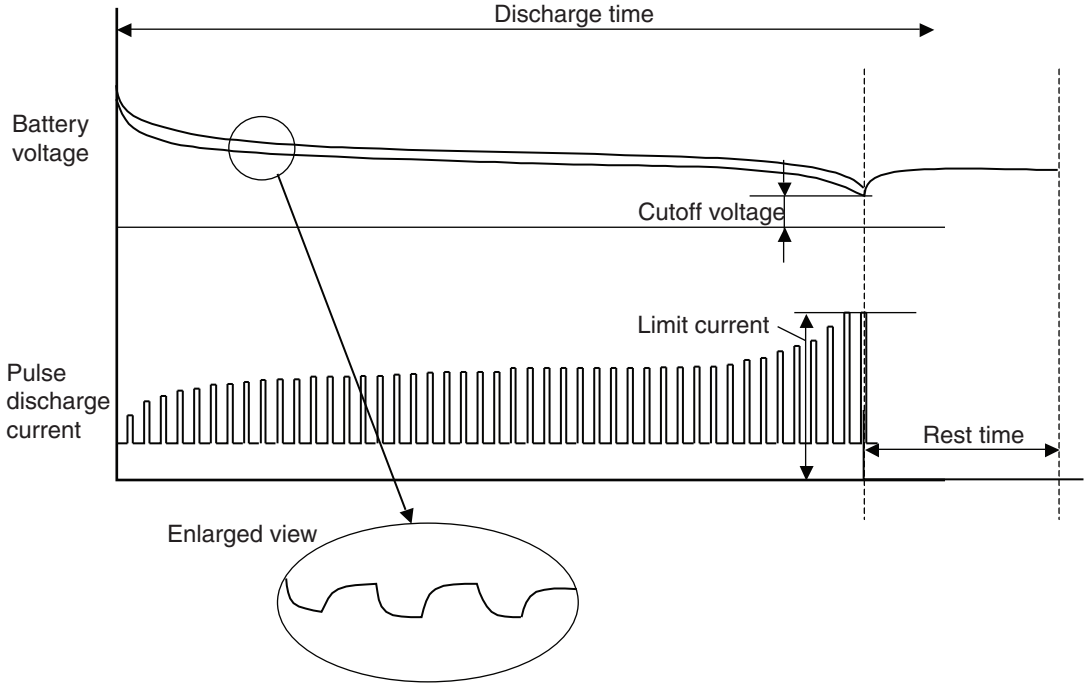
If you set Measurement High to "High," the voltage of Pt2 is retrieved. The data is the same as the measured voltage of Measurement Low, and the graphs overlap.

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 Operation Manual.

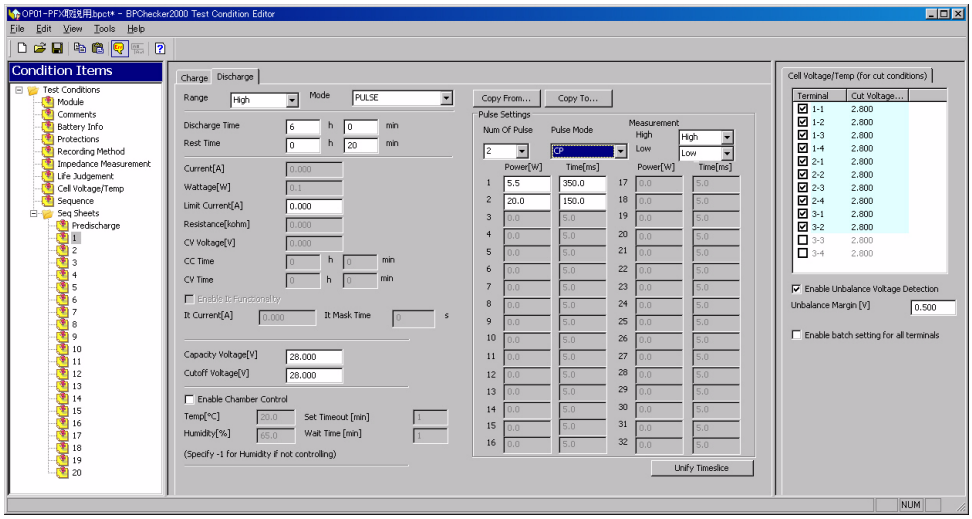
Seq Sheet - CP-Pulse Discharge mode (except the PFX2011)

You can select the CP-Pulse discharge if you selected the PFX2021 or PFX2500 series for "Module > Model ID."

The following figure is shown as an example of the Constant Power and the Pulse (CP-Pulse) operation. The figure illustrates the transition of constant power pulse discharge -> voltage drop to the cutoff voltage -> pulse discharge termination -> discharge rest.



Select 1 or greater for "Num of OP01-PFX boards to use" under Module to display the Cell Voltage/Temp Setup screen.



■ Setting descriptions

See p. 53、 p. 62

Range

Mode

DIscharge Time

Rest Time

Pulse Setting

Limit Current

Capacity Voltage

Cutoff Voltage

Enable Chamber Control

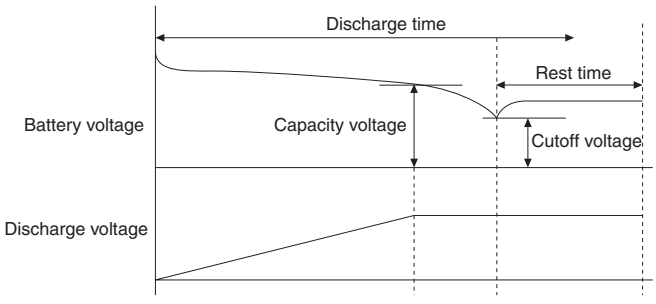
Cell Voltage/Temp (for cut conditions)

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.

The Setting Descriptions for the Discharge Conditions

Item		Description
Range		You can select the range if you selected the PFX2011 Charge/Discharge Power Supply Unit for Model ID in "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 Pulse. To select CC-Pulse or CP-Pulse, select Pulse and then select CC or CP for Pulse Mode of Pulse Setting. Other modes may be included depending on the Test Condition Editor version. However, they are for special-order features. Dimmed items are not selectable.
Discharge Time		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		Set the time after discharging has ended (state in which nothing is performed after discharging). If the entry is 0:00, rest is skipped.
Current		Set the discharge current. The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.
Wattage		Set the discharge wattage value. The input range varies depending on the range setting on the PFX2011 Charge/Discharge Power Supply Unit.
Limit Current		Set the limit current. 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.
Pulse Settings		Set the Pulse.
	Num Of Pulse	Set the number of pulses per cycle. In the CC-Pulse discharge mode, you can set up to 8 values on the PFX2011 and 20 values on the PFX2021 and PFX2500 series.
	Pulse Mode	To select CC-Pulse mode, select CC. To select CP-Pulse mode, select CP.
	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 and PFX2500 series. • High Select the voltage measurement point from High (Highest voltage point in the cycle) and pt1 to ptn (n: number of pulses, Point immediately before the switching of each current value). • Low Select the voltage measurement point from Low (Lowest voltage point in the cycle) and pt1 to ptn (n: number of pulses, Point immediately before the switching of each current value).
	Current	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.
	Power	Set each power value of pulse discharge. You can set a power value for each pulse value.
	Time	Set each time width of pulse discharge. You can set a time width for each pulse value.
Capacity Voltage		This function stops the integration of the discharge capacity when the battery voltage, which declines as discharge progresses, falls below the capacity voltage setting.



Item		Description
Cutoff Voltage		Set the Cutoff Voltage. 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 and PFX2500 series. (On the PFX2021, if Measurement Low is set to a value other than "Low," the cutoff voltage is not detected until the ptn voltage is measured.)
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, Humidity, Setting Timeout, and Wait Time.
	Temperature	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	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	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.
Cell Voltage/Temp (for cut conditions)		Select this check box to set the cell voltages.
	Terminal	Select this check box to set the cutoff voltages. When the cutoff voltages are reached, discharging is stopped.
	Enable Unbalance Voltage Detection	Select this check box to set the unbalance margin. The multiple cells that you have specified for measurement (the terminals that you have set cutoff voltages for) are compared (for pulse discharge, the measurements are taken at the Measurement Low point), and the difference between the maximum and minimum cell voltages is the unbalance voltage. Discharging is stopped when the unbalance voltage exceeds the unbalance margin. For pulse discharge, the measured values vary more than normal. Take this into account when you configure the settings. The unbalance voltage is detected approximately 1 second after the cell voltage measurement completes. If the charge / discharge voltage fluctuates greatly (the internal voltage of the DUT is high), this function may not operate correctly. If the measured voltages are different or sensing cables are not connected to both ends of the cells, this function will not operate correctly. For information on how to connect the cells to the PFX2500 Series, see the PFX2500 Series operation manual.
	Enable batch setting for all terminals	If you select this check box, you can set one terminal, and those settings will be applied to all other terminals.

NOTE The PFX2021 does not detect the cutoff voltage until it measures the ptn voltage that has been set by the cutoff voltage's Measurement Low. If you have set the Pulse Settings so that it takes a long time for all pulses to be generated and the cutoff voltage's Measurement Low to a setting other than "Low," discharging may continue even if the voltage falls below the cutoff voltage.
If you set Measurement Low to "Low," the cutoff voltage is always detected.

Saving the test conditions file

When the setting of test condition is completed, save it to the file.

To save the opened test conditions file, select ***File > Save*** or ***File > Save as***. The extension of the test condition file is ".BPCT".

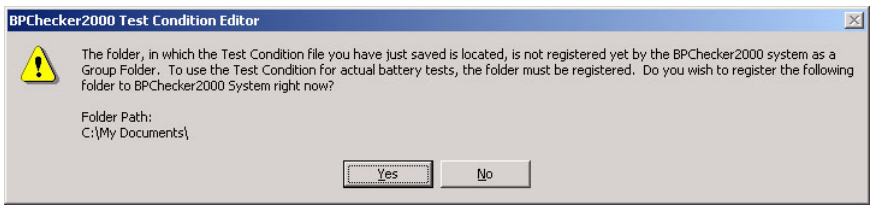
Save the test condition file to the group folder which is recognized by the BPChecker2000.

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.

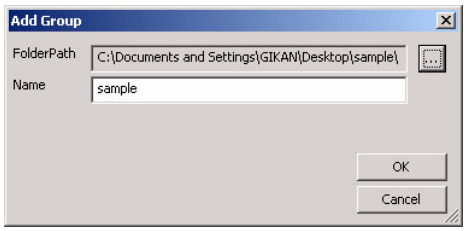
NOTE When the saved folder is not registered as the group folder, the test can not be executed because the folder can not be recognized as the group from the "Test Executive".

Message that appears when saving a file (Create the group folder).

When the folder saved for the test condition file is not recognized as the group folder of the BPChecker2000, the message appears when saving a file.



When the folder is not recognized as the group folder, the test can not be executed, in this case, click ***YES***, then following dialog "Add Group" displays.



Unless there is a special reason not to do so, recommended that the same name be used for the group name and folder name.

When creating the group folder is completed, the icon of the selected folder changes to as  , and it becomes registered and controlled as a group of the BPChecker2000 system.

It can be recognized by the "Test Executive" program. The "Desktop.INI" is a file to manage the icon of the folder. Do not delete this file. Do not delete this file.

■ Deleting a group

The group can be deleted by the "Group Administrator". Refer to the Help file of the "Group Administrator".

Common Sequence Templete

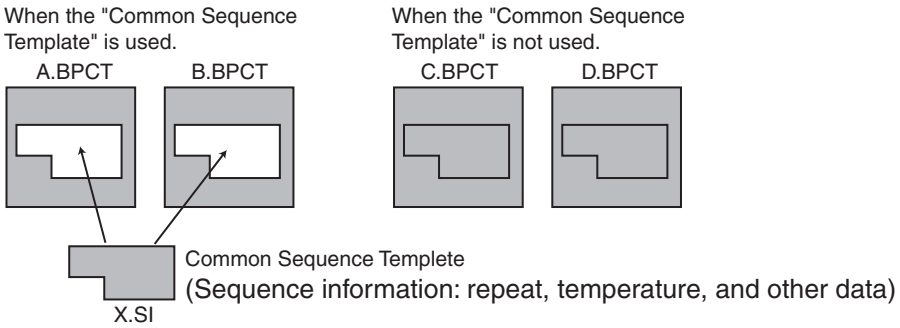
When performing tests in synchronization with the temperature chamber, it is required that all the channels of synchronized operation must be bound to the same group.

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. The setup conditions of a temperature chamber becomes concern due to the mixture of the different test conditions within the group. The setup conditions of a temperature chamber is set 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. Such discrepancy is not allowed in temperature chamber synchronization.

The BPChecker2000 can save the file as separate file (Common Sequence Template file) for repeating the sequence and the description of the temperature chamber settings. If you use a Common Sequence Template file, inconsistencies in the sequence information and temperature chamber setting information can be avoided.

The "Common Sequence Template" can be shared by multiple test condition files. It is useful when testing at the same time for the different test conditions in the group using the same temperature chamber, or when testing at the same time for combining the different power supply module (such as combination of the PFX2011 and PFX2021) in the group using the same temperature chamber.

If all the synchronized channels are to use the same test conditions, there is no need to use the common sequence template file.



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

- ***Test Conditions*** > ***Sequence***

  Test Sequence

  Perform Startup Predischarges

  Set Chamber When Finished/Aborted

- ***Test Conditions*** > ***Seq Sheet*** > ***Charge/Discharge***

  Enable Chamber Control

  Do Predischarge when the sheet is first used

Creating a Common Sequence Template

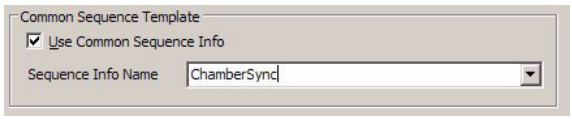
1 **Set the test conditions you want to save in the Common Sequence Template.**

See p. 35

2 **In *Test Conditions* > *Sequence*, select the *Use Common Sequence Info*.**

3 **Enter the sequence information name (file name, using 1 to 63 characters).**

Characters that are improper for file names (<>.,/+- etc.) cannot be used.



4 **To save the file, choose *File* > *Save* / *Save As*.**

The Common Sequence Template file (.SI extension) is created in the same folder as the test conditions file (.BPCT extension).

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.

See p. 24

2 **When performing the test in synchronization with temperature chamber by the different power supply module, it is necessary to change the *Model ID* in *Test Conditions* > *Module*.**

See p. 35

3 **In *Test Conditions* > *Sequence*, select the *Use Common Sequence Info*.**

4 **Enter the common template file name to be used.**

Click the ▼ at the right of the combo box, select 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.

5 **Choose *File* > *Save* / *Save As* to save the file.**

The settings are saved (.BPCT extension). The common template file is overwritten (.SI extension).

NOTE 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.

Range of Test Condition Settings

Battery Info

Item	PFX2011[1]	PFX2021[21]	PFX2511[5101 to 5112]
Nominal Voltage [V]	0.0000 to 5.0000	0.000 to 20.000	0.000 to 60.000
Nominal Capacity	0.1 mAh to 110000.0 mAh	←	0.0000 Ah to 2000.0000 Ah
Volume [ml]	0.01 to 99999.99	←	←
Weight [g]	0.01 to 99999.99	←	←

Protections

Item	PFX2011[1]	PFX2021[21]	PFX2511[5101 to 5112]
Software OVP [V]	0.0000 to 5.1000	0.000 to 21.000	0.000 to 63.000
Software UVP [V]	-2.1000 to 5.0000	-2.100 to 19.000	-6.000 to 57.000
OAH [%]	100 to 1000	←	←
OTP [°C]	-40.0 to 100.0	←	←
OVP delay [ms]	---	---	0 to 5000
UVP delay [ms]	---	---	0 to 5000
OCP delay [ms]	---	---	0 to 5000

Cell end conditions (only on a PFX2500 Series in which an OP01-PFX is installed)

Item	OP01-PFX
Software OVP [V]	0.000 to 21.000
Software UVP [V]	-2.000 to 19.000
OTP [°C]	-100.0 to 400.0
OVP delay [ms]	0 to 5000
UVP delay [ms]	0 to 5000
Unbalance margin [V]	0.010 to 5.000

Recording Method

Item	PFX2011[1]	PFX2021[21]	PFX2511[5101 to 5112]
Delta Time [s]	1 to 50000	←	←
Auto Delta Time Max Data Count	1000 to 5000	←	←
Delta Voltage [V]	0.0001 to 0.9999	0.001 to 0.999	←
Delta Current [A]	0.0001 to 0.9999	0.001 to 0.999	←

Impedance Measurement

Item	PFX2011[1]	PFX2021[21]	PFX2511[5101 to 5112]
Frequency [Hz]	1000	←	-
Range [Ω]	0.1 / 1 / 10 / Auto	←	-

Life Judgement

Item		PFX2011[1]	PFX2021[21]	PFX2511[5101 ～ 5112]
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)

■ Charge (CC mode)

The values inside parentheses are setting range for the low range.

Item		PFX2011[1]	PFX2021 [21]	PFX2511 [5101 to 5106]	PFX2511 [5107]	PFX2511 [5108]	PFX2511 [5109]	PFX2511 [5110]	PFX2511 [5111]	PFX2511 [5112]
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	0.000 to 50.000	←	0.000 to 36.000	0.000 to 50.000	0.000 to 27.000	0.000 to 50.000	0.000 to 35.000
Cutoff conditions	Max Voltage [V]	0.0000 to 5.0000	0.000 to 20.000	0.000 to 60.000	0.000 to 10.000	0.000 to 20.000	←	0.000 to 40.000	0.000 to 60.000	0.000 to 10.000
	-dV [V]	0.0010 to 1.0000	0.001 to 1.000	0.010 to 10.000	←	←	←	←	←	←
	-dV Mask Time [min]	1 to 60	←	←	←	←	←	←	←	←
	Max Temp [°C]	-40.0 to 100.0	←	←	←	←	←	←	←	←
	dT/dt [°C/min]	0.5 to 10.0	←	←	←	←	←	←	←	←

Cell end conditions (only on a PFX2500 Series in which an OP01-PFX is installed)

Item	OP01-PFX
Max. voltage [V]	0.000 to 20.000
Max. Temp [°C]	-100.0 to 400.0
Unbalance margin [V]	0.010 to 5.000

■ Charge (CC-CV mode)

The values inside parentheses are setting range for the low range.

Item		PFX2011[1]	PFX2021 [21]	PFX2511 [5101 to 5106]	PFX2511 [5107]	PFX2511 [5108]	PFX2511 [5109]	PFX2511 [5110]	PFX2511 [5111]	PFX2511 [5112]
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	0.000 to 50.000	←	0.000 to 36.000	0.000 to 50.000	0.000 to 27.000	0.000 to 50.000	0.000 to 35.000
	CV Voltage [V]	0.0000 to 5.0000	0.000 to 20.000	0.000 to 60.000	0.000 to 10.000	0.000 to 20.000	←	0.000 to 40.000	0.000 to 60.000	0.000 to 10.000
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	0.000 to 50.000	←	0.000 to 36.000	0.000 to 50.000	0.000 to 27.000	0.000 to 50.000	0.000 to 35.000
	It Time [h:min]	9999h 59min	←	←	←	←	←	←	←	←
	Max Temp [°C]	-40.0 to 100.0	←	←	←	←	←	←	←	←

Cell end conditions (only on a PFX2500 Series in which an OP01-PFX is installed)

Item	OP01-PFX
Max. voltage [V]	0.000 to 20.000
Max. Temp [°C]	-100.0 to 400.0
Unbalance margin [V]	0.010 to 5.000

■ Charge (Pulse mode)

The values inside parentheses are setting range for the low range.

Item		PFX2011[1]	PFX2021[21]	PFX2511[5101 to 5112]
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	←	---

Seq Sheets (Disharge)

■ Discharge (CC mode)

The values inside parentheses are setting range for the low range.

Item		PFX2011[1]	PFX2021[21]	PFX2511 [5101]	PFX2511 [5102]	PFX2511 [5103 to 5110]	PX2511 [5111]	PFX2511 [5102]
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	0.000 to 50.000	0.000 to 20.000	0.000 to 50.000	0.000 to 33.000	0.000 to 50.000
Cutoff condition	Cutoff Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000	0.000 to 60.000	←	←	←	←
Measurement	Capacity Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000	0.000 to 60.000	←	←	←	←

Cell end conditions (only on a PFX2500 Series in which an OP01-PFX is installed)

Item	OP01-PFX
Max. voltage [V]	0.000 to 20.000
Unbalance margin [V]	0.010 to 5.000

■ Discharge (CP mode)

The values inside parentheses are setting range for the low range.

Item		PFX2011[1]	PFX2021 [21]	PFX2511 [5101]	PFX2511 [5102]	PFX2511 [5103]	PFX2511 [5104]	PFX2511 [5106 to 5110]	PFX2511 [5111]	PFX2511 [5112]
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	0.1 to 1000.0	←	0.1 to 2000.0	0.1 to 330.0	0.1 to 1000.0	0.1 to 165.0	0.1 to 330.0
	Limit Current [A]	0.0000 to 5.0000 (0.00000 to 0.50000)	0.000 to 10.000	0.000 to 50.000	0.000 to 20.000	0.000 to 50.000	←	←	0.000 to 33.000	0.000 to 50.000
Cutoff condition	Cutoff Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000	0.000 to 60.000	←	←	←	←	←	←
Measurement	Capacity Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000	0.000 to 60.000	←	←	←	←	←	←

Cell end conditions (only on a PFX2500 Series in which an OP01-PFX is installed)

Item	OP01-PFX
Max. voltage [V]	0.000 to 20.000
Unbalance margin [V]	0.010 to 5.000

■ Discharge (CC-Plse mode, CP-Pulse mode)

The values inside parentheses are setting range for the low range.

Item		PFX2011[1]	PFX2021 [21]	PFX2511 [5101]	PFX2511 [5102]	PFX2511 [5103]	PFX2511 [5104]	PFX2511 [5106 to 5110]	PFX2511 [5111]	PFX2511 [5112]
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	0.000 to 50.000	0.000 to 20.000	0.000 to 50.000	←	←	0.000 to 33.000	0.000 to 50.000
	Power [W]	---	0.02 to 200.00	0.1 to 1000.0	←	0.1 to 2000.0	0.1 to 330.0	0.1 to 1000.0	0.1 to 165.0	0.1 to 330.0
	Time [ms]	0.50 to 65000.00	←	5.0 to 65000.0	←	←	←	←	←	←
Cutoff condition	Cutoff Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000	0.000 to 60.000	←	←	←	←	←	←
Measure ment	Capacity Voltage [V]	-0.5000 to 5.0000	-2.000 to 20.000	0.000 to 60.000	←	←	←	←	←	←
	Number of pulse voltage points	2	←	←	←	←	←	←	←	←

Cell end conditions (only on a PFX2500 Series in which an OP01-PFX is installed)

Item	OP01-PFX
Max. voltage [V]	0.000 to 20.000
Unbalance margin [V]	0.010 to 5.000

Temperature chamber

Item	PFX2011[1]	PFX2021[21]	PFX2511[5101 to 5103]
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	←	←

4

Test Execution

This chaper describes that the confirmation needs to be taken prior to the actual test is performed, the required setting conditions, and an instruction for starting the actual test.

Starting the 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.

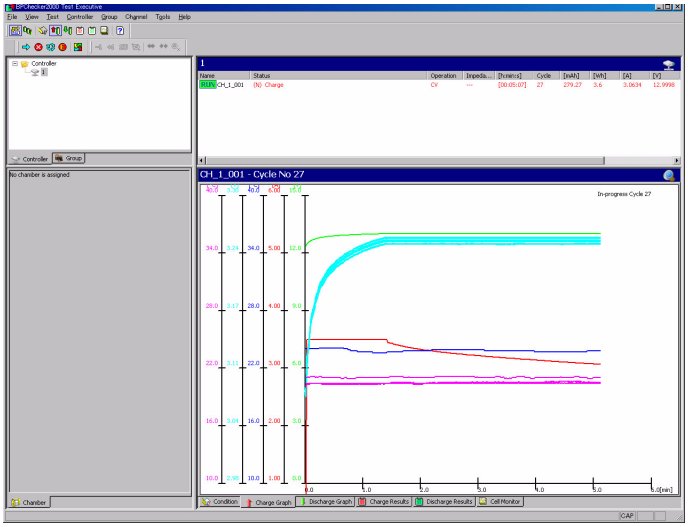
Before starting the "Test Executive", configure the hardware by the "Hardware Config Wizard".

■ When synchronizing with the temperature chamber ···

Turn on all RS485-to-USB converters, 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 Config Wizard to be the upper limit.

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.



The "Test Executive" will startup with the condition of the last operation setting (connecting each hardware, group configuration, test progress of each channel, assigning test conditions, etc.).

When starting up the "Test Executive" for the first time, the default value of the operation will be the setting value set by the "Hardware Config Wizard, Group Administrator, Test Condition Editor".

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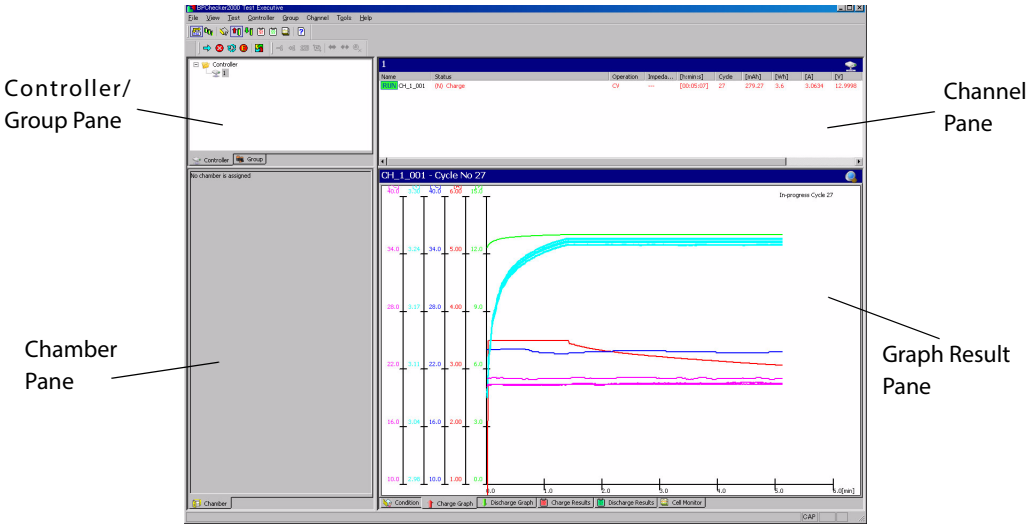
While starting up, the Test Executive program connects to the control units (1 or 2) that were configured by the Hardware Config Wizard via the USB and initializes the channels. If the the hardware configuration specified conditions and the actual hardware configuration differ when the Test Executive is started, any errors may occur.

If the Test Executive detects the entire hardware configuration, the names of the detected control units and channels appear on the Test Executive screen.

The Test Executive consists of four panes. The selected item is highlighted on the display.



Item	Description
Controller/Group Pane	Select Controller or Group. To switch the view mode, click the tab at the bottom section of the Controller/Group Pane. • Controller view mode Organizes information according to the system of control unit connections • group view mode Organizes information according to test execution groups
Channel Pane	This pane displays all the channels that belong to the controller or group that is selected in the Controller/Group Pane and their execution status.
Graph Result Pane	This pane displays the following information for the channel that is selected in the Channel Pane. Conditions (the test conditions that are being used) Charge graph (realtime graph) Discharge graph (realtime graph) Charge result Discharge result Cell monitor Channels that are not being tested are not displayed. Click the tabs at the bottom of the pane to switch the displayed contents.
Chamber Pane	Shows the temperature chamber operation.

Creating Groups

Even when performing the "Test Executive", you can select ***Group*** > ***Launch GroupAdministrator*** and enable to create a new group or delete existing registered group.

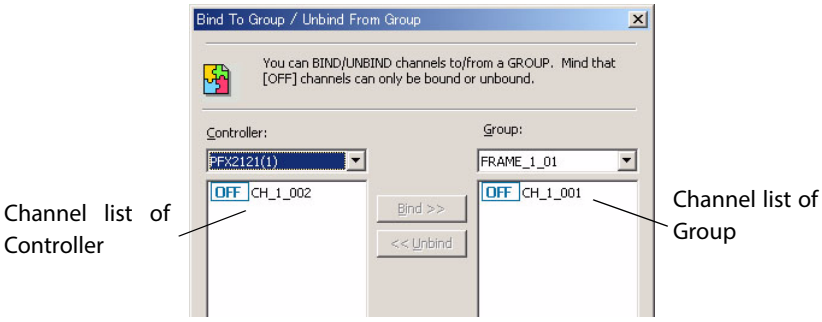
The changes to the group binding are not immediately applied on the Test Executive screen. You can refresh the screen by choosing ***View*** > ***Refresh***.

Binding Channels to Groups

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. Channels on which you wish to execute tests must be bound to some group.

Simply creating groups does not bind the channels to the groups. You must first bind the channels to a certain group.

To bind channels to a group, choose ***Test*** > **Bind/Unbind Channels**. A Bind To Group/ Unbind From Group dialog box appear.



- Channel list of Controller

  Displays all the channels controlled by the corresponding controller that are not bound to any group.

- Channel list of Group

  Channels that are bound to the corresponding group are displayed. Only those channels that can be unbound 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.

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).

Binding Channels

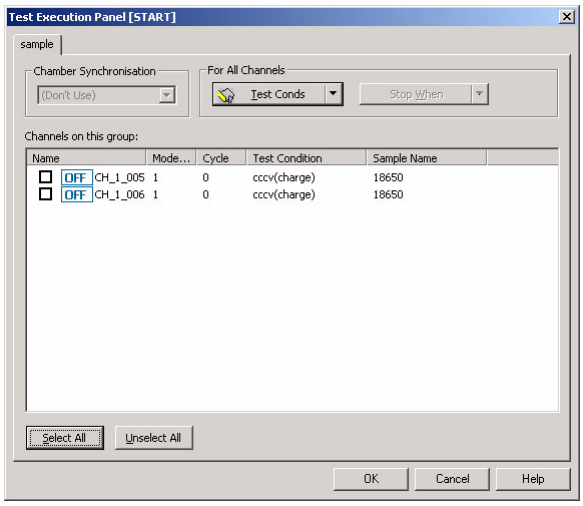
1. **Select the controller with specified channel which you wish to bind.**
2. **Select the group which you wish to bind.**
3. **Select one or more channels you wish to bind and click *Bind*>>.**
   The channel moves from the list of controller to the list of group.

Unbinding Channels

1. **Select the group which you wish to unbind.**
2. **Select one or more channels you wish to unbind and click <<*Unbind*.**
   The channel moves from the list of group to the list of controller.

Assigning Test Conditions

You must assign test conditions before starting the tests. Choose ***Test*** > ***Start*** to display the Test Execution Panel [START].



There are two methods for assigning test conditions.

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

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

When performing tests in synchronization with the temperature chambers

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When the temperature chamber is available to be used, the temperature chamber number for Chamber Synchronization can be selected.

If you are performing tests in synchronization with the temperature chambers, you must specify the number (1 to 6) of the temperature chamber you wish to assign to this group from the ***Chamber Synchronization*** box.

If you are not performing tests in synchronization with the temperature chamber, select ***Don't Use*** in the ***Chamber Synchronization*** box.

The temperature chamber number is corresponded to the sub address of the temperature chamber controlled by the protocol converter.

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.

Assign the same test conditions to all the channels in the group.

Assignment is not made on channels that are already executing the test. If the cycle number display is 1 or more, the assignment is not made.

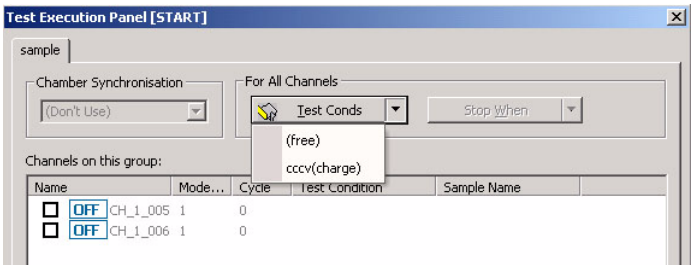
1 **Click *Test Conds*.**

Open a dialog box used to select the test conditions that have been created before.

2 **Select a single test conditions file.**

The selected test conditions are assigned to all the channels in the group.

Channels that are assigned test conditions become plugged status (connected status) and enter the monitor loop. At this point the icon display changes to IDLE.



Assign/Change different test conditions for each channel.

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.

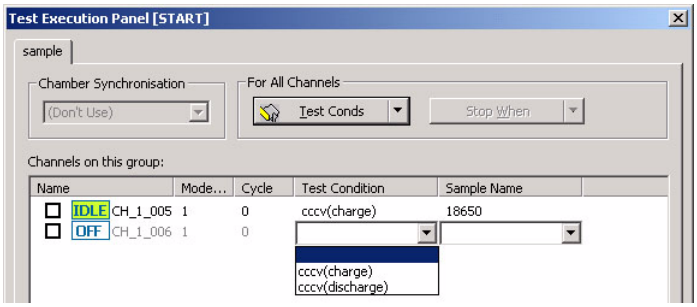
1 **Click the channel which you assign the test condition.**

The channel will be highlighted on the display. A menu button is added to the Test Condition item of that channel.

2 **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.

Channels that are assigned test conditions become plugged status (connected status) and enter the monitor loop. At this point the icon display changes to IDLE.



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Check the status display in the Channel Pane. Test conditions cannot be assigned to channels that have #0002 (#0102) or #0003 (#0103) shown.

Changing the sample name for each channel.

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

1 **Click the channel which you wish to change the sample (DUT) name.**

The channel will be highlighted on the display. The Sample Name item turns into a combo box.

2 **Enter the name in the box.**

The entered name is displayed in a list, and you can select it from that point.

Executing Tests

See p. 67

Before executing the test, assign the setting condition.

The display of the line corresponding to channels that are indicated with the IDLE icon change from grayed to normal (black), and the checkbox becomes selectable. In rare cases, some channels remain grayed 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.

The cell monitor for a PFX2500 Series in which an OP01-PFX is installed is displayed on the Graph Result Pane.

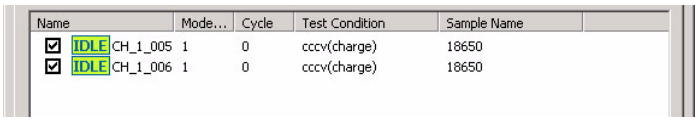
Once the test is executed, the following file will be created.

- The file for creating the C/D graph

  The file with the recorded data of charge/discharge characteristics of each cycle for creating the C/D graph by the Graph Viewer.

- The file for creating the Life graph

  The file with the recorded data of the changes in the capacity of each channel for creating the Life graph by the Graph Viewer.



1 select the channels (select the checkboxes) on which you wish to start the test.

Click Select All to select all channels.

Click Unselect All to cancel selecting all channels.

The dimmed channel can not select or cancel.

When performing the synchronized operation with the temperature chamber, the execution channel can not be selected individually. When one of the channel is selected, all the executable channels in the group will be selected.

2 Click *OK* to start the test.

Creates the file for creating the C/D graph and the file for creating the Life graph.

If there is a file in the created folder of the test data, the dialog "Proceed Test (And Data Backup)" is displayed.

See p. 104

See p. 72

Stopping Tests

In order to stop the test, specify the timing of when the stop process to be applied. Choose ***Test*** > ***Stop***. Test Execution Panel [STOP] appears.

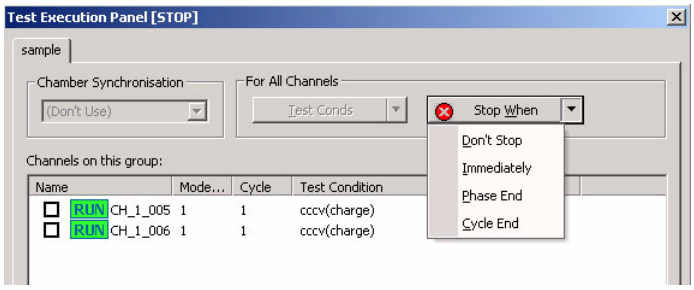
There are 4 types of timing for stopping the test.

Item	Description
Don't Stop (default)	It does not stop the test. It is valid for the case when the specified channel for the completed phase, or the completed cycle is not desired to be stopped.
Immediately	The test is immediately stopped regardless of the progress status of the test.
Phase End	It stops when the phase (Charge phase or Discharge phase) under progress is finished.
Cycle End	It stops when the cycle (one of the pattern in the test condition) under progress is finished.

There are 2 ways to specify when to stop.

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

Specify the same timing to all the channels



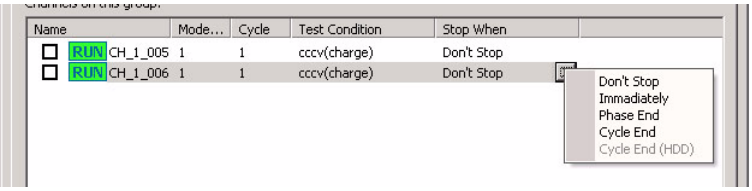
1 **Select when to stop for all channels.**

2 **Select the checkboxes of channels you wish to stop (or channels you wish to enable scheduled stop).**

3 **Click *OK*.**

This will carry out the stop process.

Specify the timing individually on each channel.



1 **Click the channel to specify the stop period.**

The channel will be highlighted on the display, and appears the drop down menu under the Stop When.

2 **Click the drop down menu and select the stop period from the menu item.**

3 **When you assign the other channels, repeat step 1 to step 2 . Once the channels are assigned, click *OK*.**

This will carry out the stop process.

Emergency Stop Function

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

Resuming Tests

To resume 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 ***Test*** > ***Start*** to display the Test Execution Panel [START].

To restart the test from the beginning, recycle the channel.

See p. 76

Confirmation before resuming the test

Confirm the cycle numbers indicated on the channel pane. For the channel of which test is in progress (indicated by a RUN icon), it shows the number of the cycle that is currently being executed; for the channel not in progress, it 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 from 2.

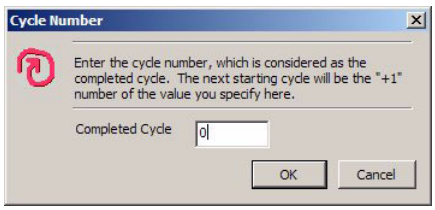
If the cycle number is 0, it indicates that there are no completed cycles. Channels that are indicated as 0 are handled exactly the same as a new execution. The assigned test conditions can be changed.

See p. 79

When it is other than 0, the assigned test conditions cannot be changed, because there are cycles that have been completed already. The description of the test condition can be changed.

Changing the cycle number

Completed cycle numbers can be changed by choosing ***Channel*** > ***Increment Cycle Number +1***, ***Decrement Cycle Number -1***, or ***Enter Cycle Number*** or toolbar.



Resuming Tests

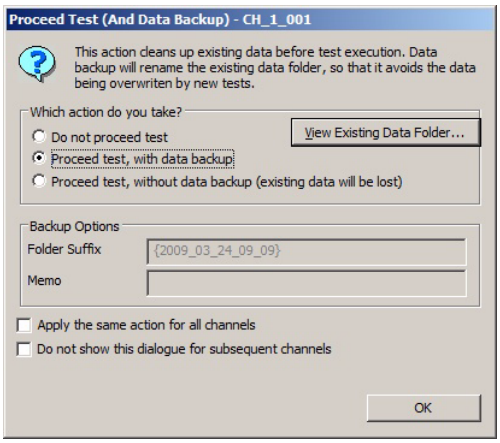
To resume testing, select the specified channel to execute, then click ***OK***.

When you click ***OK***, the dialog "Proceed Test (And Data Backup)" is displayed. Select the action to execute.

■ The "Proceed Test (And Data Backup)" dialog

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. If the test data generation folder is deleted, the folder is created.

If any files exist in the generation folder, the Proceed Test (And Data Backup) dialog box appears. The dialog appears for all channels that are checked.



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

Item	Descriptions
Which action do you take?	Select the action to execute.
Do not proceed test	Nothing is executed. This is the same as clicking ***Cancel*** on the Test Execution Panel ***START***.
Proceed test, with data backup (defaut)	Renames the data folder, and all of the test data in the data folder are backed up.
Proceed test, without data backup (existing data will be lost)	The data folder is not backed up. The file of the interrupted cycle for the C/D graph will be overwritten by the new creating file.
View Existing Data Folder	If you click, Windows Explorer starts displaying the corresponding data folder.
Backup Options	It is enabled when ***Proceed test, with data backup*** is selected.
Folder Suffix	Set the additional name when the data folder will be renamed. By default, set to the date/time.
Memo	The memo can be entered for this backup action. A text file containing the memo is created in the folder that is backed up.
Apply the same action for all channels	If you select, the same action selected previously will be set on the next warning dialog.
Do not show this dialogue for subsequent channels	It is enabled when ***Apply the same action for all channels*** is selected. The same condition setting is applied to the channel which is confirmed by the test executed for this time.

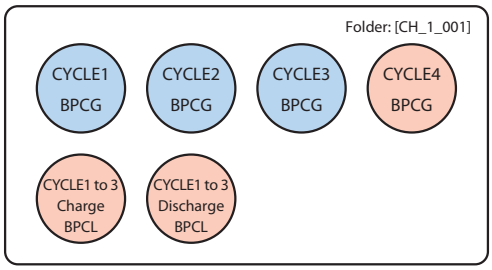
■ The difference between selecting "Proceed test, with data backup" and "Proceed test, without data backup".

The following describes for the test case up to "cycle 6" with when the test was interrupted and resumed during the "cycle 4".

If you wish to backup the data, the data folder will be created individually for before and after resuming the test, accordingly the file of the Life graph will be separated. Select "Proceed test, with data backup" when you wish to save the interrupted data for the C/D graph. (sample shows the BPCG file of the "cycle 4")

In case any memo is entered, the text file of the memo will be created in the backup folder.

The folder for the test when it is interrupted during the "cycle 4".

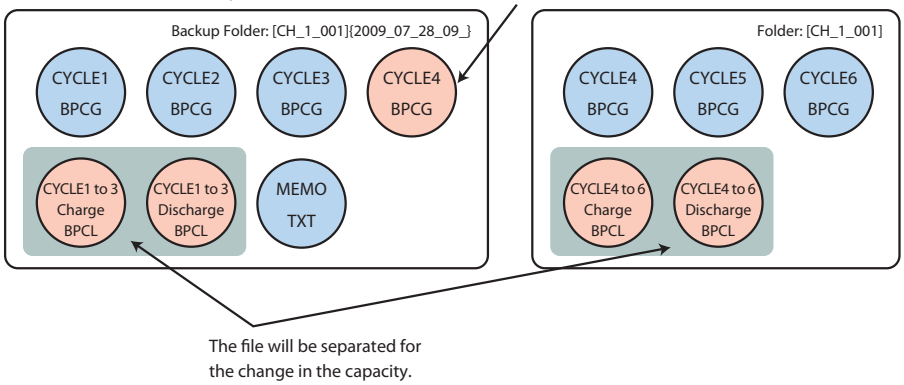


BPCG: The file for creating the C/D graph

BPCL: The file for creating the Life graph

The folder for the test when it is backuped and resumed from the "cycle 4".

The file for the halfway of the "cycle 4" will be saved.



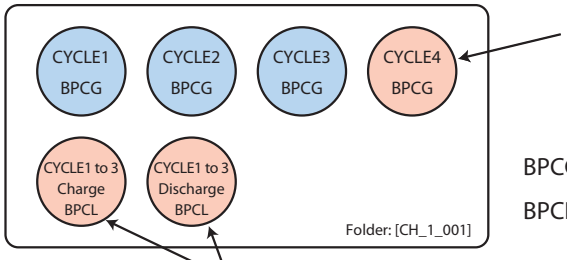
The file will be separated for the change in the capacity.

See p. 72

If you do not wish to backup the data, the file for the C/D graph which is interrupted during the test will be overwritten by the new creating data. Also when decreasing the number of completed cycle, it will be overwritten.

The data after resuming the test will be added to the file for the existing Life graph. Select "Proceed test, without data backup" if you wish to test the cycle continously.

The folder for the test when it is interrupted during the "cycle 4".



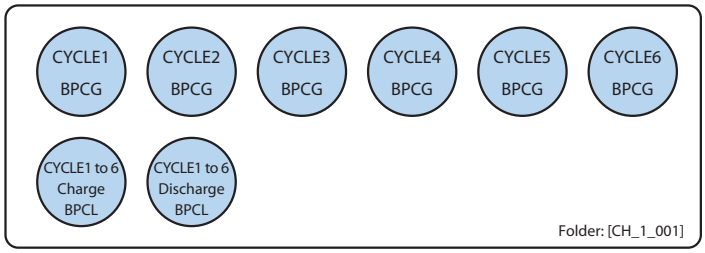
The file for the halfway of the "cycle 4" will be overwritten.

BPCG: The file for creating the C/D graph

BPCL: The file for creating the Life graph

The data after resuming the test will be added to the next of this data.

The folder for the test when it is backuped and resumed from the "cycle 4".



Terminating Tests

When all test cycles scheduled by the test condition are completed, the test will be terminated.

When all test cycles have been completed, the channel is indicated as END and is removed from the monitor loop.

When you wish to forcibly terminate the tests (handle the tests as terminated), finish the operation of the test.

To terminate the test, the channels that you wish to terminate must be stopped.

See p. 70

1. **Confirm that the channel which you wish to terminate has been stopped.**
   When the test is not stopped, apply the stop process.
2. **Select the channel which you wish to terminate from the channel list pane.**
3. **Choose *Channel* > *Toggle End Mark*.**
   This operation can also be used to remove the END marks from the channels that already have END marks.

Recycle the Channel

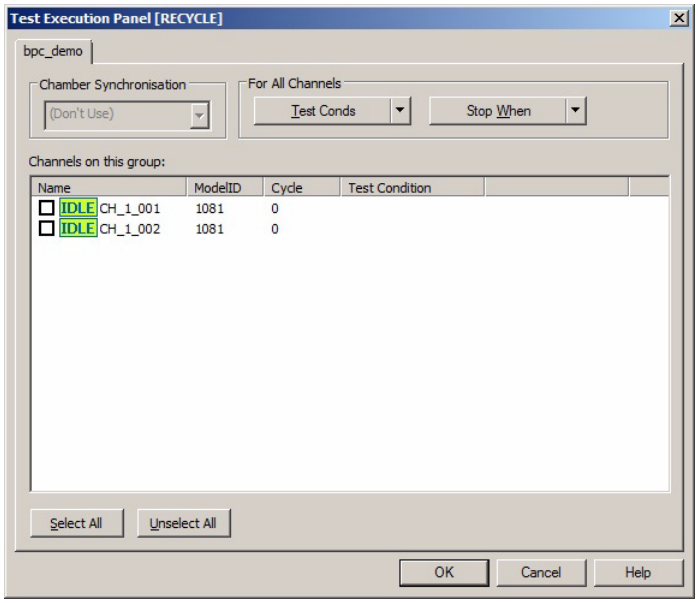
When a test is started or re-executed, the Test Executive always checks to see if there are files present in the test data generation folder. This is to prevent overwriting existing test data inadvertently. If any files exist in the generation folder, the Channel Recycle (And Data Backup) dialog box appears.

When you wish to dispose existing test data and recycle the empty channel to test, back up the channel data then recycle it. It is effective for when you wish to restart the test from the beginning immediately after connecting with the DUT (Battery), and confirming the operating condition, or when you wish to test connecting with the other DUT (Battery) to the empty channel of which the test has been already terminated.

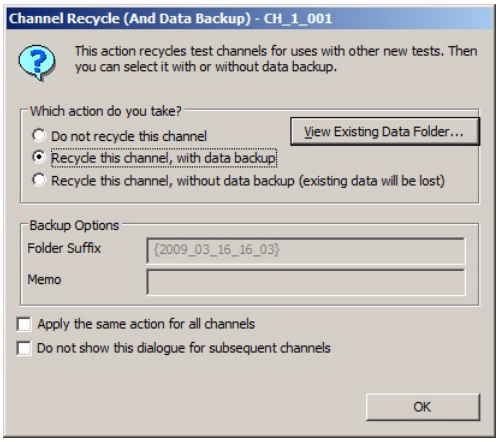
The data analysis for the backup data can be performed by the "Graph Viewer".

All the recycled channel becomes to the reset status (Completed test cycle 0, No assignment of the test condition). The new test can be performed with keeping the channel name and the group configuration.

When you wish to dispose the test data and recycle, select ***Test*** > ***Recycle*** to display the "Test Execution Pane [RECYCLE] ".



Select the channel of which you wish to recycle (Possible to select multiple channels). The dimmed channel can not be selected. Click ***OK*** to display the dialog "Channel Recycle (And Data Backup)" of the selected channel.



See p. 104

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

Item	Description
Which action do you take?	Select the action to execute.
Do not recycle this channel	The channel is not recycled. This is the same as clicking ***Cancel*** on the Test Execution Panel (Recycle).
Recycle this channel, with data backup (default)	Renames the existing data folder and backup entire data in the data folder. The channel will be recycled and it can be used for the new test.
Recycle this channel, without data backup (existing data will be lost)	It does not back up the data. The channel will be recycled and it can be used for the new test. The existing test data will be overwritten by the data which is newly created.
View Existing Data Folder	If you click, Windows Explorer starts displaying the corresponding data folder.
Backup Options	It is enabled when ***Recycle this channel, with data backup*** is selected.
Folder Suffix	Set the additional name applied when the data folder will be renamed. By default, set to the date/time.
Memo	The memo can be entered for this backup action. A text file containing the memo is created in the folder that is backed up.
Apply the same action for all channels	If you select, the same action selected previously will be set on the next warning dialog.
Do not show this dialogue for subsequent channels	It is enabled when ***Apply the same action for all channels*** is selected. The same condition setting is applied to the channel which is confirmed by the channel recycle for this time.

Resetting Alarms

If an alarm occurs during the test, the test on the corresponding channel is automatically stopped at the charge/discharge power unit side. The test results of the phase currently in execution (either charge result data or discharge result data) are retrieved and saved to a file.

See p. 72, p. 90

The icon of the channel on which an alarm occurred changes to ALM. You must remove the cause of the alarm on such channels and execute the test again.

■ Using the Test Execution Panel [RESET ALARM]

It is useful when releasing the alarm for multiple channels.

Choose ***Test*** > ***Reset Alarm***. Test Execution Panel [RESET ALARM] appears.

Click the ***Select All*** to collectively select all the channels or select the channels individually, and then click ***OK***.

■ 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.

You to reset alarms without opening the Test Execution Panel [RESET ALARM].

Changing the Test Conditions during the Test

The "Test Executive" can not reassign the different test condition file to the channel under the test in progress, however, it is possible to change the setting of the test condition applied to the further cycle to be executed.

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.

  The test condition can be modified only for the test condition file which is currently used. 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. If you change the repeat settings of a sequence, you can change the information. 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.

1 **Select the channel which you wish to change the description of the test conditions.**

2 **Choose *Channel* > *Edit Test Conditions*.**

The Test Condition Editor starts with the test conditions assigned to that channel loaded.

3 **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.

■ 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.

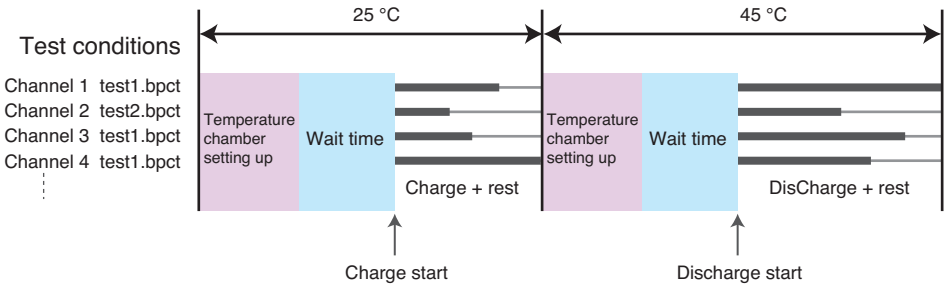
The changes you make using the Test Condition Editor while the test is in progress apply to the original file. The Test Executive is not affected while the test is in progress, because it does not refer to the original file. It creates a copy from to the original file at the start of the next cycle or 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. Because the original test conditions that are assigned to multiple channels are read simultaneously, changing the test conditions affect all relevant channels.

Synchronized Testing with a Temperature Chamber

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

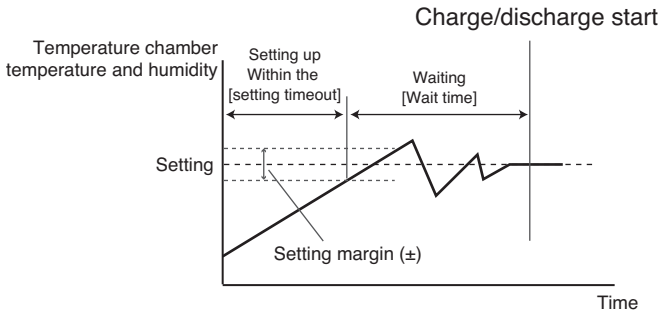
The charge/discharge test progresses while the channels in the same group controls the temperature chambers according to the specified temperature and humidity settings. The starting of the charge/discharge is always synchronized within the same group.

- 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.

- 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*** of Test Condition Editor. 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.

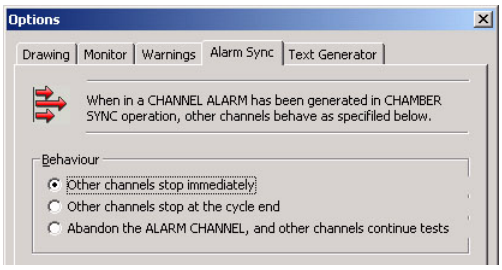
Set the temperature and humidity margins in the temperature chamber configuration of the Hardware Config Wizard.

You can set the temperature and humidity of the temperature chamber at Test Condition Editor when the test is completed. Set the room temperature to prevent unnecessary damage to the DUT.

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.

On the ***Tools*** menu, click ***Options***, and then click the ***Alarm Sync*** tab to display the Options dialog box.



Item		Description
Behaviour		Select the operating description at the alarm occurrence.
	Other channels stop immediately (default)	When the alarm is occurred, 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.
	Other channels stop at the cycle end	Even the alarm is occurred, 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.
	Abandon the ALARM CHANNEL, and other channels continues tests	Even the alarm is occurred, normal channels continue the test without stopping. The data after the alarm occurrence is not retrieved on the channel on which the alarm occurred.

When the setting is completed, click ***OK***.

Continue the test

■ When the *Other channels stop immediately* is selected.

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.

■ When the *Other channels stop at the cycle end* is selected.

The channel on which the alarm occurred could not complete the test cycle and is 1 cycle behind other channels. Adjust the cycle and correspond the number of cycle at all channels.

1. **Wait for the normal channels to automatically stop.**
2. **Reset the alarm on the corresponding channel.**
3. **Right-click on the Channel Pane and then choose *Increment Cycle Number +1*.**
   The increment of the number of cycle will be one for the channel of which the alarm is occurred.
4. **Resuming the test.**
   The test restarts from the next cycle number after the cycle on which the alarm occurred. The channel on which the alarm occurred will have one cycle of data missing.

under test using the impedance measurement unit PFX2211 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 Config Wizard. The "Hardware Config Wizard" can not be executed while executing the "Test Executive". If you choose ***Controller*** > ***Property*** 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. All the channels belonging to the same controller share the same impedance measurement unit. 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.

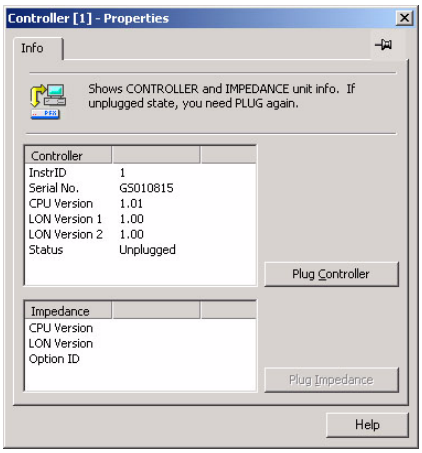
The measured impedance values cannot be monitored in realtime (while the test is in progress) on the Test Executive. The values are displayed on the ChargeResults or DischargeResults page on the Graph Result Pane after the completion of the charge or discharge phase. You can also view the values by analyzing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

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.

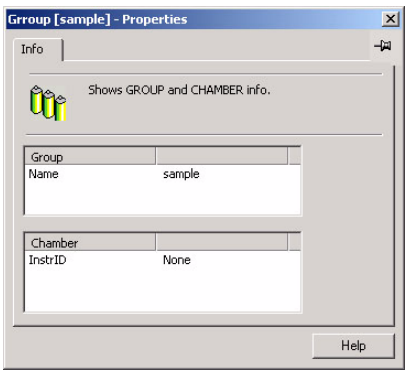
Controller properties display

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



Group properties display

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



Channel properties display

Click the channel in the channel pane for which you desire to check the properties, then right-click to display the channel properties. The channel properties display consists of the three property sheets, click the tab to change the sheet.

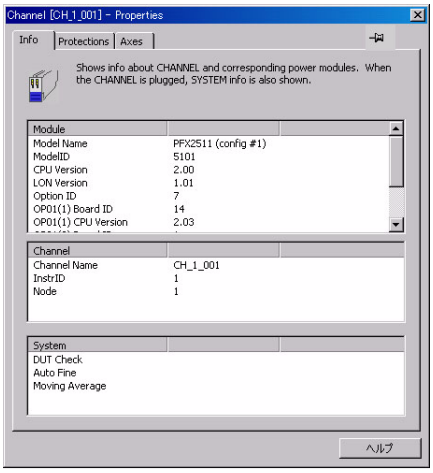
■ Info

Displays the details of the charge/discharge module.

The Module section displays the model name, CPU version, LON version, and status of option.

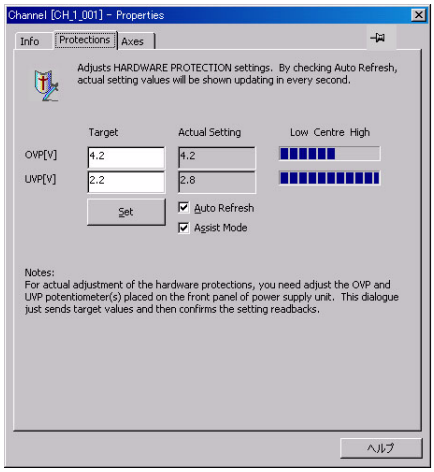
The Channel section displays the name assigned to the channel and the position of the connection (instrument ID and node number.)

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). These items are displayed only on channels that are displaying the IDLE or RUN icon. For all other cases, blank is displayed.



■ Protections (for the PFX2011)

To set the hardware over voltage protection (H OVP) and under voltage protection (H UVP) functions, turn the H OVP and H UVP variable resistors on front panel of Charge/Discharge Power Supply Unit for adjustments. A comparator is used at the detection section and the circuit is independent from the internal microcomputer control. The detection speed is at 100 µs (maximum).



1 **Select the *Auto Refresh*.**

2 **When the display is located apart from the display, select the *Assist Mode*.**
The "POWER/STANDBY" LED blinks in orange.

3 **Enter the desired value of the voltage in *Target* to set for the OVP and the UVP.**

Set a OVP that is higher than S_OVP to prevent erroneous operation due to noise and by taking the detection accuracy (±100 mV) into consideration. Set a UVP that is lower than S_UVP.

4 **Click *Set*.**

5 **While viewing the bar graph or the value of *Actual Setting*, adjust the variable resistor of the PFX2011.**

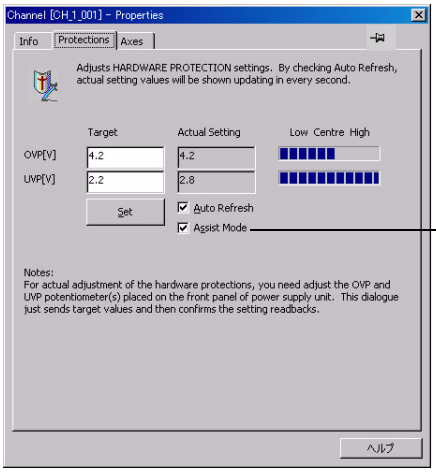
Status	LED display	
POWER/STANDBY	Blinks in orange	Indicates that the LED is in assist mode.
CHG/DISCH/REST	Lights in green	The H OVP setting is within the appropriate range.
CC/CV/CP	Lights in green	The H_UVP setting is within the appropriate range.
ALARM/WARNING	Same function as in the normal mode.	

Item	Description
Target	Enter the voltage values you wish to assign for H OVP and H UVP. If you click ***Set***, the setting value will be transmitted to the PFX2011 and the value of "Target" becomes valid. 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 PFX2011 (when in Assist Mode).
Actual Setting	Displays the actual H OVP and H UVP voltage values assigned to the charge/discharge power supply unit.
Bar graph	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	The LEDs on the PFX2011 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 ***Assist Mode*** is selected, the front panel LED of the PFX2011 becomes the Assist Mode display. Assist mode is disabled when you close the properties sheet, open a properties sheet of another channel, or execute the test on the channel in assist mode.

■ Protections page (for the PFX2021 and the PFX2500 series)

Set the hardware over voltage protection (H OVP) and under voltage protection (H UVP) functions

When you enter the desired voltages for H OVP and H UVP in the ***Target***, the internal variable resistors are automatically adjusted. A comparator is used at the detection section and the circuit is independent from the internal microcomputer control. The detecting speed is 100 μs(max) for the PFX2021, and 10 ms(TYP value) for the PFX2500 series.



1 **Enter the desired value of the voltage in *Target* to set for the OVP and the UVP.**

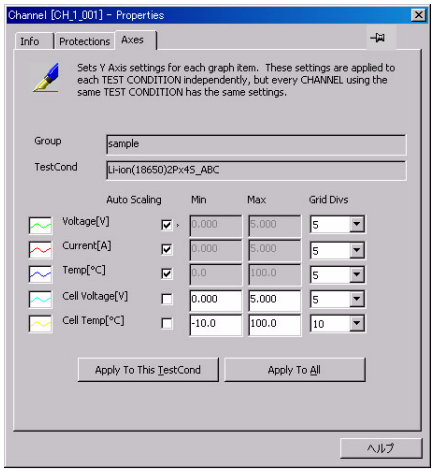
Set a OVP that is higher than S_OVP to prevent erroneous operation due to noise and by taking the detection accuracy (PFX2021: ±100 mV, PFX2500 series: ±300 mV) into consideration. Set a UVP that is lower than S_UVP.

2 **Click *Set*.**

Item	Description
Target	Enter the desired voltages for H OVP and H UVP and click the Set button. The value is transmitted to the PFX2021 or the PFX2500 series.
Auto Refresh	If you select the check box, the ***Actual Setting*** display is refreshed at approximately 0.5 s intervals.
Assist Mode	If you select the check box, the panel LED display of PFX211 will change to Assist Mode. The Assist Mode is not used for the PFX2021/PFX2500 series since it employs the automatic adjustment.

Axes

Set the axes of the realtime graph display (charge graph and discharge graph on the Graph Result Pane).

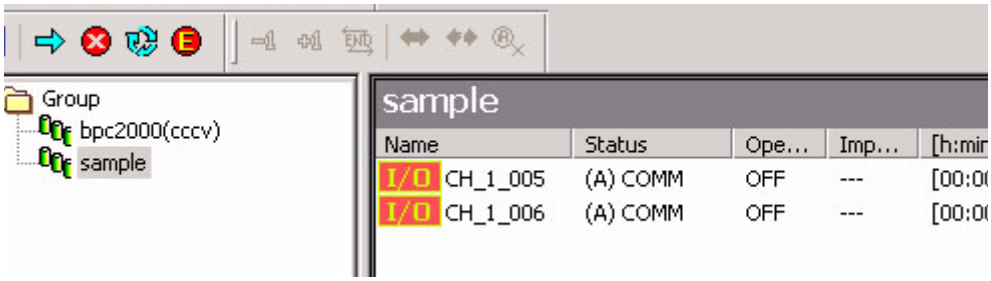


Recovery after Power Failures

Describes the behavior of the charge/discharge test system when a power failure occurs while using the system. The followings are described for each section of the system, the Host PC, the Control Unit, and other Charge/Discharge Units.

When a Power Failure Occurs on the Charge/Discharge Unit

If a power failure occurs on the charge/discharge unit while the host PC is running normally, the behavior of the Test Executive varies depending on the operation status of the charge/discharge unit. The operation status of the charge/discharge unit is indicated on the Channel Pane using icons.



If a power failure occurs on a charge/discharge unit displaying a RUN icon

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. (This is the same if the power failure recovers within 10 s.)

See p. 78

1 After the power failure recovers (or after turning on the power), reset the alarm.

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.

2 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 is selected in the test conditions, the test starts with predischarge.

If a power failure occurs on a charge/discharge unit displaying an IDLE icon

The icon corresponding to the channel changes to an I/O icon.

See p. 78

After the power failure recovers (or after turning on the power), reset the alarm. 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.

If a power failure occurs on a charge/discharge unit displaying an END icon

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. You can execute the test as in the normal case.

If a power failure occurs on a charge/discharge unit displaying an OFF icon

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.

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. You can execute the test as in the normal case.

If you execute the test while the charge/discharge unit is not available (power is not supplied), an error occurs.

When a Power Failure Occurs on the Host PC

If a charge/discharge unit executing a test (RUN icon indication) exists when the power failure occurs

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.

1 **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.

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.

2 **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 unit that is not executing a test exists when the power failure occurs

All units recover to the status that they were in when the power failure occurred.

When a Power Failure Occurs on Both the Charge/Discharge Unit and PC

Immediately after the power to the hardware recovers, all charge/discharge power supply units enter the STANDBY status.

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.

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.

When a Power Failure Occurs on the Control Unit (USB Connection Dropped)

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.

Display the properties of the controller that produced the communication error and reconnect. You do not have to reset alarms on channels individually.

After the alarm is reset, the status of the corresponding channel changes to an IDLE icon.

Alarms and Warnings

The charge/discharge 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.

- Those in which the user specifies values according to the DUT and activate using the specified values as references.

  In order to set properly, it is required to have correct understanding and the application of use for each alarm and warning functions.

  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.

- Those that activate using fixed values that are assigned within the system as references

  Knowing the operating condition of the alarm functions is useful to prevent the alarm occurrence.

Protection Functions That Require the User to Set Appropriate Values (Alarms)

Type	Description	
S_OVP	When the DUT voltage is greater than or equal to the specified voltage, an alarm occurs and the output is turned OFF. The PFX2500 series equips the delay function. Since accurate detection is possible, you usually set the voltage relatively close to the cutoff voltage or CV voltage for charging.	See p. 27
H_OVP	When the DUT voltage is greater than or equal to the specified voltage, an alarm occurs and the output is turned OFF. 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.	See PFX2011:p. 84 PFX2021 or PFX2500 series: p. 85
S_UVP	When the DUT voltage is less than or equal to the specified voltage, an alarm occurs and the output is turned OFF. The PFX2500 series equips the delay function. Since accurate detection is possible, you usually set the voltage relatively close to the cutoff voltage for discharging.	See p. 27
H_UVP	When the DUT voltage is less than or equal to the specified voltage, an alarm occurs and the output is turned OFF. 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.	See PFX2011:p. 84 PFX2021 or PFX2500 series: p. 85
S_OCP	If the charge/discharge current exceeds the constant current preset value (PFX2000 series: 100 mA, PFX2500 series: 1 A), an alarm occurs and the output is turned OFF. The PFX2500 series equips the delay function.	See p. 27
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.	See p. 27
OTP	When the DUT temperature exceeds the specified temperature, an alarm occurs and the output is turned OFF.	See p. 27
Shock_Detect (PFX2500 series only)	When the shake or the shock is detected in the standby state with the vibration sensor is on, or if the PFX2500 series is not installed on the level surface, the alarm becomes to be activated and the output is turned off. The vibration sensor is set to OFF position at the factory shipment.	See See the operation manual of the PFX2500 series.
Conn	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. The difference in the electric potential is not measured during the test.	See p. 24

Protection Functions with Fixed Values (Alarms)

Type	Description	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.	If OHP trips continuously even when no abnormal conditions exist in the ambient temperature, dust filter, and so on, disable it.
H_OCP (PFX2500 series only)	When the charge/discharge current exceeds the rated value (when it is detected by the comparator circuit), it becomes the alarm to be activated and the output is turned off.	The comparator circuit operates at 55 A (Typical value *1), with the shut-down speed of 100 ms (Typical value *1).
Comm	When the communication between the control unit and the PFX series is not working properly, an alarm occurs.	The test continues until the phase currently in progress (charge or discharge) ends.
AC_OFF	If the input line voltage drops (less than or equal to 180 V) or a short interruption (longer than or equal to 50 ms) occurs, an alarm occurs and the output is turned OFF.	If an error is detected and the alarm trips, the alarm cannot be reset using alarm reset.
EXT\ALM (PFX2500 series only)	When the external alarm input becomes active, it becomes the alarm to be activated and the output is turned off.	To become the external alarm active, short-circuit the alarm common for more than 0.5 s.
CD/B	PFX2000 series 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 CD/B alarm may occur if the DUT is not connected or the output cable breaks in the middle of the test.
	PFX2500 series During discharge operation, if any abnormality on the DUT or the output cable were found, the alarm occurred at the electronic load, or any failure found at the electronic load, it becomes the alarm to be activated and the output is turned off.	When the DUT is not connected, the voltage drop of the output cable is large, the discharge voltage exceeds the rated value of the electronic load (or lower than minimum operating voltage), or the setting of discharge operation were incorrectly arranged, the CD/B alarm will be occurred.
PS/B	PFX2000 series When the internal power supply circuit section is abnormal (overvoltage or overheat), an alarm occurs and the output is turned OFF.	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.
	PFX2500 series During charge operation, if any abnormality on the DUT or the output cable were found, the alarm occurred at the power supply, or any failure found at the power supply, it becomes the alarm to be activated and the output is turned off.	When the DUT is not connected, the voltage drop of the output cable is large, the charge voltage exceeds the rated value of the electronic load (or lower than minimum operating voltage), or the setting of charge operation were incorrectly arranged, the PS/B alarm will be occurred.

*1 Typical Value: Typical value do not guarantee the performance.

Warnings

Type	Description	Note
Idle (DUT Connection Warning) (PFX2000 series only)	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 ***Test Conditions*** > ***Module*** settings. You cannot start the test when a warning is activated. (Test conditions cannot be assigned.)
Idle (Shock Detect Warning) (PFX2500 series only)	When the shake or the shock is detected in the standby state with the vibration sensor is on, or if the PFX2500 series is not installed on the level surface, it becomes the warning state.	The vibration sensor is set to OFF position at the factory shipment. The test can not be executed when the warning occurs. (The test condition can not 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.	You cannot start the test when a warning is activated. (Test conditions cannot be assigned.)

List of Status Codes

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.

The status can be displayed using a code (hexadecimal code) or mnemonic.

Status Code of status

Code*1	Mnemonic	Description
#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) 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.
#0003 (#0103)	Idle (Protection Warning)	Idle status (test execution not possible/protective function activated) A warning occurs when the DUT voltage is in the H_OVP or H_UVP trip range in idle status.
#0004 (#0104)	H Protection	Hardware OVP/UVP setup mode
#0006 (-)	Idle (Shock Detect Warning)	Standby state (Disable to execute the test, the protection function activated) When the shake or the shock is detected in the standby state with the vibration sensor is on, or if the PFX2500 series is not installed on the level surface, it becomes the warning state.
#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	Charging
#000F (#010F)	Discharge Rest	Charge rest
#0010 (#0110)	Discharge SYNC	Charge rest (synchronization)
#0011 (#0111)	Discharge End	Charge 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.

Bit	Bit Weight	Mnemonic	Description
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	Vibration sensor alarm, Over current (Hardware) protection, External alarm
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).

Cell condition status codes

The status of the cells is shown on the Graph Result Pane's cell monitor

Code	Mnemonic	Description
#0001	CONN	Option board connection error detected
#0002	S_OVP	Overvoltage protection (software)
#0004	S_UVP	Undervoltage protection (software)
#0008	BURN OUT	Thermocouple burn-out
#0010	OTP	Overheat protection
#0020	UNBAL	Unbalance voltage protection
#0040	COMM	Option board communication error detected

Cause of Alarms and Their Correction (PFX2000 series only)

Alarm Code	Cause		Corrective Action
OHP #C000	The heat sink temperature of the internal electronic load exceeded approximately 95 °C.	Maximum rated operation was performed in an environment with an ambient temperature of 40 °C or greater.	Use the system in the operating temperature range (0 °C to 40 °C).
		Malfunction of the fan or the fan control circuit. Malfunction of the internal circuit (power loss control).	Request repairs.
PS/B #A000	The heat sink temperature of the internal bias power supply exceeded approximately 100 °C.	Maximum rated operation was performed in an environment with an ambient temperature of 40 °C or greater.	Use the system in the operating temperature range (0 °C to 40 °C).
		Malfunction of the fan or the fan control circuit. Malfunction of the internal bias power supply.	Request repairs.
	The overvoltage protection circuit of the internal bias power supply was activated.	Malfunction of the internal bias power supply.	
CD/B #9000	The impedance of the DUT (battery) has become extremely large preventing current from flowing through the internal electronic load section.	Malfunction of the internal bias power supply. Blown output fuse in the PFX series.	Request repairs.
		Disconnection of the current wire, poor contact to the battery holder, or open circuit at the point of connection with the DUT (battery).	Check the connection of the current wire, battery holder, and DUT (battery.)
		The voltage drop caused by resistance such as the current wire resistance and the contact resistance of the battery holder is extremely large. (Approx. 8 V or more)	Check that the diameter and length of the current wire, the contact resistance of the battery holder, and other components are appropriate.
H_UVP #8400	The hardware undervoltage protection of the load was activated.	The DUT (battery) voltage dropped below the H_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 H_UVP setting. Set the H_UVP setting in the Test Condition Editor to an appropriate value.
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 in the Test Condition Editor to an appropriate value.
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. Request repairs.
Comm #8040	A communication error occurred between the control unit and the PFX series.	Malfunction in the PFX series.	Request repairs.
		A disconnection or short circuit in the TP-BUS connection or a connector drop out.	Check the TP-BUS connection.

Alarm Code	Cause		Corrective Action
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 in the Test Cpmdoton Editor.
		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 in the Test Condition Editor.
		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 Test condition Editor.
S_OCP #8008	A large current flowed as compared with the specified current.	An abnormal current flowed due to some load condition (when using a constant current source).	Check the load conditions.
		This normally does not occur. A current greater than the setting flowed due to a problem in the PFX series.	Request repairs.
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 in the Test Condition Editor to an appropriate value.
S_OVP	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 in the Test Condition Editor to an appropriate value.
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.)	Connect properly. See p. 96
		The output cable (current wire or sensing wire) is not connected.	Clear the Enable DUT Connection Check check box in the Test Condition Editor.

If the Connection between the Frame and 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.

Incorrect Connection through the DUT Connector (UTP Cable)

Cause	Description
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.
A CONT connector modular cable was inserted into the DUT connector.	There is no danger, but normal measurement is not possible.
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).
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.

Incorrect Connection through the CONT Connector (Modular Cable)

Cause	Description
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.
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).
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.

When the Test Is Executed with Improperly Connected Output Cables

Operation examples are given 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

■ When the connection check function is enabled (abnormalities can be detected using the connection function)

Test Mode	Current Wire	Sensing Wire	Battery Voltage	H_OVP Setting	H_UVP Setting	Cutoff Voltage	If the Tes Is Contimued Ignoring the Connection Check Function	Danger Level	Stop or Cutoff Condition
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
Discharge	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
Charge	Correct	Reverse	1.2 V or greater	---	---	---	Test execution not possible due to UVP.	❖	Warning
Charge	Correct	Reverse	---	---	0.0 V or greater	---	Test execution not possible due to UVP.	❖	Warning
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
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
Charge	Correct	Reverse	0.0 V to 1.2 V	---	Min.	---	---	---	---
Discharge	Correct	Reverse	1.2 V or greater	---	---	---	Test execution not possible due to UVP.	❖	Warning
Discharge	Correct	Reverse	---	---	0.0 V or greater	---	Test execution not possible due to UVP.	❖	Warning
Discharge	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
Discharge	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
Discharge	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
Discharge	Correct	Reverse	0.0 V to 1.2 V	---	Negative battery voltage or less	Negative battery voltage or less	Cutoff voltage is never reached, because the voltage increases even though the DUT is discharged.	‡	Discharge time
Discharge	Correct	Reverse	0.0 V to 1.2 V	---	Min.	Negative battery voltage or less	Cutoff voltage is never reached, because the voltage increases even though the DUT is discharged.	‡	Discharge time

Test Mode	Current Wire	Sensing Wire	Battery Voltage	H_OVP Setting	H_UVP Setting	Cutoff Voltage	If the Tes Is Contimued Ignoring the Connection Check Function	Danger Level	Stop or Cutoff Condition
Charge	*1	Correct	---		---	---	CV or maximum voltage is never reached, because no current flows through the DUT.	❖	Charge time
Discharge	*1	Correct	---		---	---	Cutoff voltage is never reached, because no current flows through the DUT.	❖	Discharge time
Charge	Correct	*1	---	0.0 V or less	---	---	The voltage of the DUT cannot be measured (0 V is displayed), because the sensing line is shorted. Test execution not possible due to OVP.	❖	Warning
Charge	Correct	*1	---	---	0.0 V or greater	---	The voltage of the DUT cannot be measured (0 V is displayed), because the sensing line is shorted. Test execution not possible due to UVP.	❖	Warning
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
Discharge	Correct	*1	---	0.0 V or less	---	---	The voltage of the DUT cannot be measured (0 V is displayed), because the sensing wire is shorted. Test execution not possible due to OVP.	❖	Warning
Discharge	Correct	*1	---	---	0.0 V or greater	---	The voltage of the DUT cannot be measured (0 V is displayed), because the sensing wire is shorted. Test execution not possible due to UVP.	❖	Warning
Discharge	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
Discharge	Correct	*1	---	---	---	0.0 V or greater	Discharge ends immediately, because the detected voltage is below the cutoff voltage.	❖	Cutoff voltage
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
Discharge	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
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
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
Discharge	Correct	Open	---	Max.	Min.	Measured voltage or greater	Discharge ends immediately, because the detected voltage is below the cutoff voltage.	❖	Cutoff voltage
Discharge	Correct	Open	---	Max.	Min.	Measured voltage or less	Cutoff voltage is never reached, because the battery voltage cannot be measured.	‡	Discharge time
Charge	Open	Open	---	---	---	---	Stops immediately with an alarm.	❖	Warning CD/B
Discharge	Open	Open	---	---	---	---	Stops immediately with an alarm.	❖	Warning CD/B

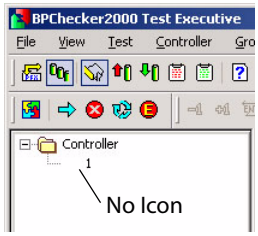
*1 The wire is shorted at the - (or +) terminal of the DUT.

■ When the connection check function is disabled (abnormalities cannot be detected using the connection function)

Test Mode	Current Wire	Sensing Wire	Battery Voltage	H_OVP Setting	H_UVP Setting	Cutoff Voltage	If the Tes Is Contimued Ignoring the Connection Check Function	Danger Level	Stop or Cutoff Condition
Charge	Reverse	Reverse	1.2 V or greater	---	---	---	Test execution not possible due to UVP.	❖	Warning
Charge	Reverse	Reverse	---	---	0.0 V or greater	---	Test execution not possible due to UVP.	❖	Warning
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
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
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
Discharge	Reverse	Reverse	1.2 V or greater	---	---	---	Test execution not possible due to UVP.	❖	Warning
Discharge	Reverse	Reverse	---	---	0.0 V or greater	---	Test execution not possible due to UVP.	❖	Warning
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
Discharge	Reverse	Reverse	---	---	---	0.0 V or greater	Discharge ends immediately, because the detected voltage is below the cutoff voltage.	❖	Cutoff voltage
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
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
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
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
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
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

The Test Executive Cannot Identify Controllers (The icon of the controller is not displayed)

If the Test Executive Cannot Identify Contorollers, 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.

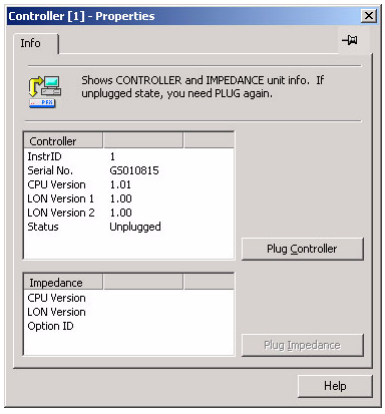
If the controller unit (PFX2121) is not being recognized as a USB device by the PC, the "Test Executive" can not recognize as a controller.

Confirm that the USB cable between the PC and the Control unit are connected properly.

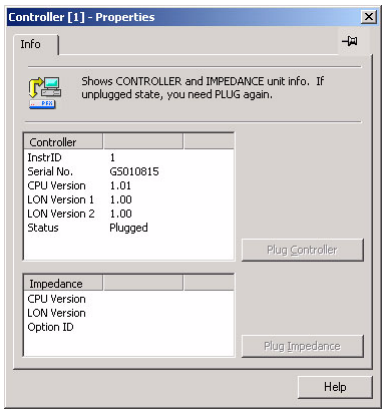
If the cables are connected properly, activate the device manager from the Windows control panel and confirm connecting status of the USB device. It is properly recognized if "Kikusui PFX2000/2500 Controller (non-USBTMC)" is displayed below "USB Test and Measurement Devices".

If the controller unit is being recognized properly, right click "Controller" of the Controller/Group Properties pane and display the property. The dialog box displays the Status as Unplugged.

Unplugged example



Plugged example



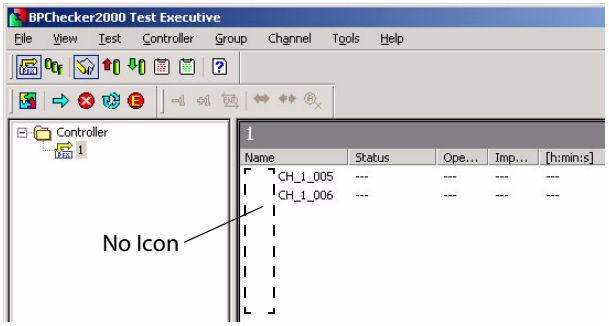
To reconnect, click ***Plug Controller***. If the Status changes to Plugged a few seconds later, reconnection is complete.

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.

The Test Executive Cannot Identify Channels (The icon of the channel is not displayed)

The "Test Executive" can be activated when the controller is being recognized even though the channel can not be specified. 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.

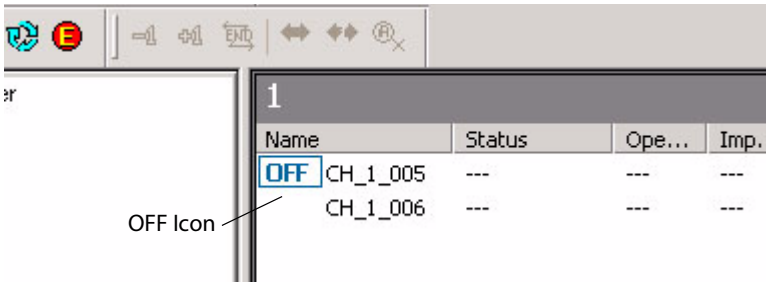
The name of the control unit is displayed properly. Click the control unit name. The Channel Pane displays a list of channels that should be connected to the control unit. Icons are not displayed to the right of the channels that are not identified.



The possible reasons for this type of problem are improper insertion of charge/discharge power supply units in the frame (PFX2000 series) or improper connection of the TP-BUS. 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 contextual menu. And choose ***Recognize*** from the menu.

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

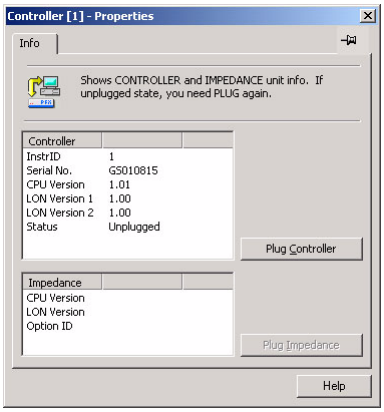


The Test Executive Cannot Identify Impedance Measurement Units (when PFX2211 is used)

If the impedance measurement unit is selected in the system configuration, the Test Executive selects 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.

When the Impedance Measurement Unit and the Control Unit are not connected properly by the TP-BUS, or the power of the Impedance Measurement Unit is not turned on, the "Test Executive" can not recognize the Impedance Measurement Unit.

After correcting the problem, click the contorol unit of the contoroller/group pain and then right-click to display the property. The dialog box shows that the controller itself is plugged, but the impedance measurement unit is unplugged.



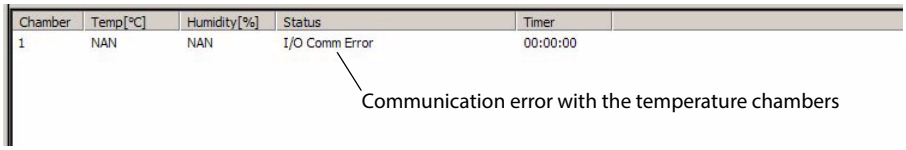
As for re-connection, click ***Plug Impedance***. In a few seconds after , if the status becomes "Plugged", the reconnection is completed.

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.

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 recognition of the temperature chamber failed, 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.

If the temperature chambers are not connected correctly or if VISA is not set setup correctly, The "Test Executive" can not recognize the temperature chamber.



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, close the Test Executive once, wait a few seconds, and restart the Test Executive.

When the test synchronizing with the temperature chamber, the channel can not be selected.

When the test condition is being inconsistency in sequence, or the number of completed cycle are not matched to the entire channels, the channel can not be selected.

The setting condition of the temperature chamber can be set by each charge/discharge sheet. If various test conditions exist in the same group, it may cause to combine the setting condition of the temperature chamber and the condition at the time of execution of the charge/discharge sheet. The test can not be performed with synchronizing the temperature chamber when there is a inconsistency.

The "Test Executive" allows you to perform synchronized operation with the temperature chamber only when all the channels in the group for synchronizing temperature chamber which shall not occur any sequence inconsistency. The following two conditions must be satisfied to perform the synchronized operation with the temperature chamber.

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

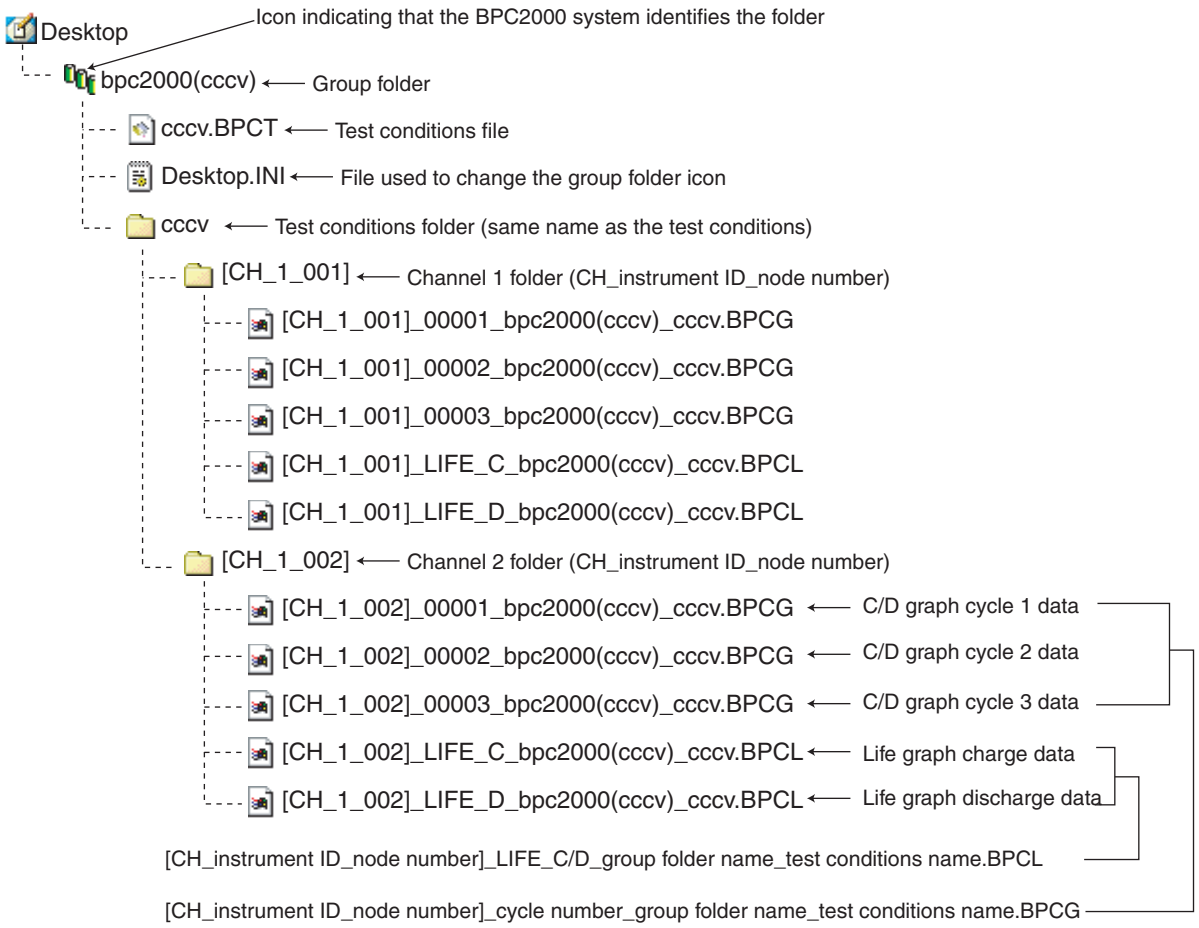
The sequence inconsistency of the test condition can be avoided if the “common sequence plate” controlled by the "Test Condition Editor" is used.

The cycle number can be changed by the Tool Bar or to follow by ***Channel*** > ***Increment Cycle Number +1/Decrement Cycle Number -1/Enter Cycle Number***.

Folders and Files

The following shows the folder or the file created by the BPChecer 2000 when the test is executed with the conditions as indicated.

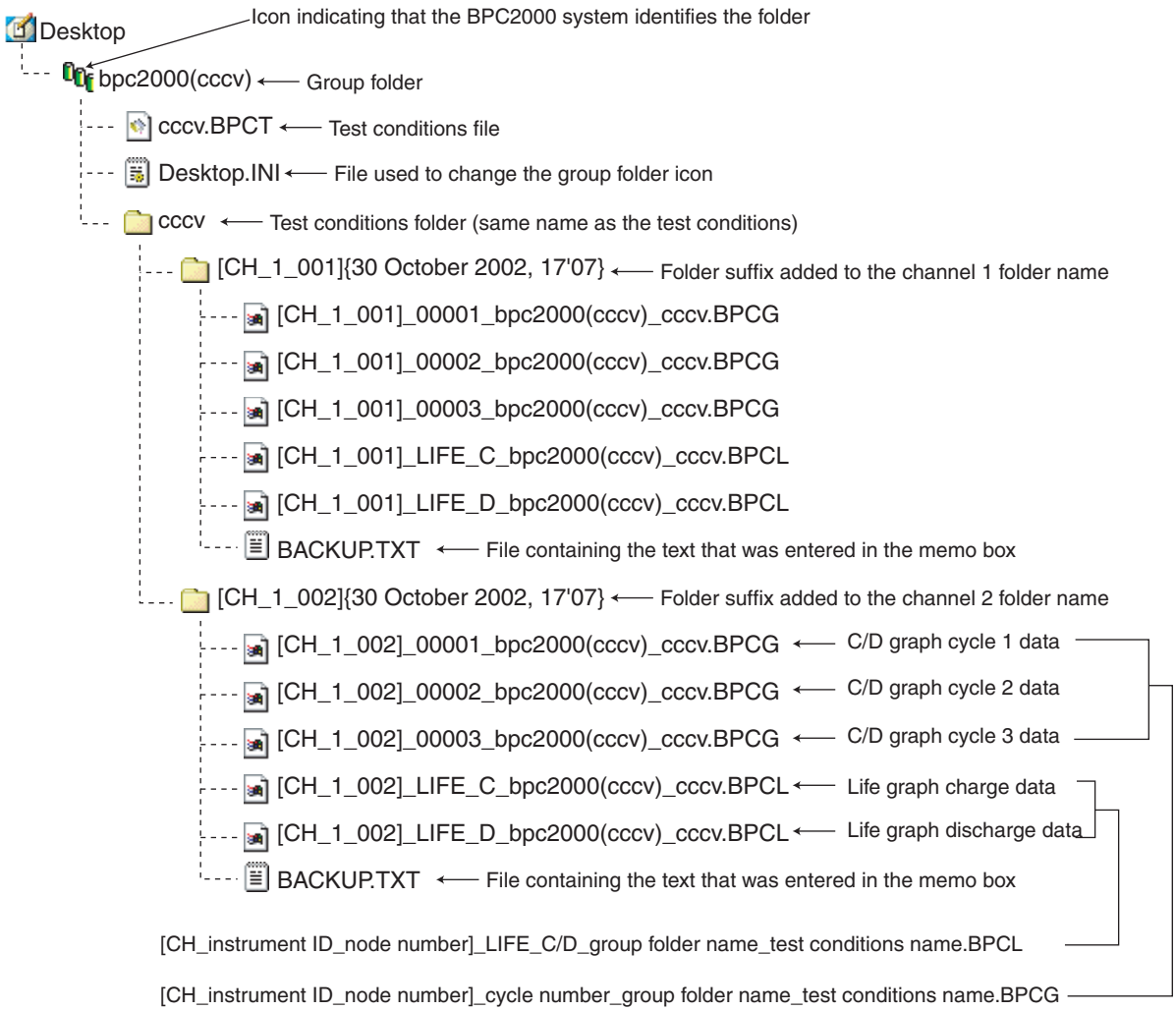
- Control Unit — Using 1 system (Instrument ID: 1)
- Channel — 2 channels (Node numbers: 001 and 002)
- Group folder — bpc2000(cccv)
Location: Desktop
- Test conditions — cccv
3 cycles of execution



Next, after the test is finished, it indicates the folder or the file which will be created when the ***Recycle this channel, with data backup*** is selected for both "channel 1" and "channel 2" in the dialog of "Channel Recycle (And Data Backup)."

We assume that the folder suffix and memo boxe are entered as follows.

- Folder suffix — {30 October 2002, 17'07}
- Memo box (both CH1 and CH2) — backup data



The channel folder is renamed, 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.

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 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)

  When the overlay condition of the graph is saved by the "Graph Viewer", the graph file (file name extention "BPCO") is 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.

5

Analyzing Test Results

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

Starting the 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

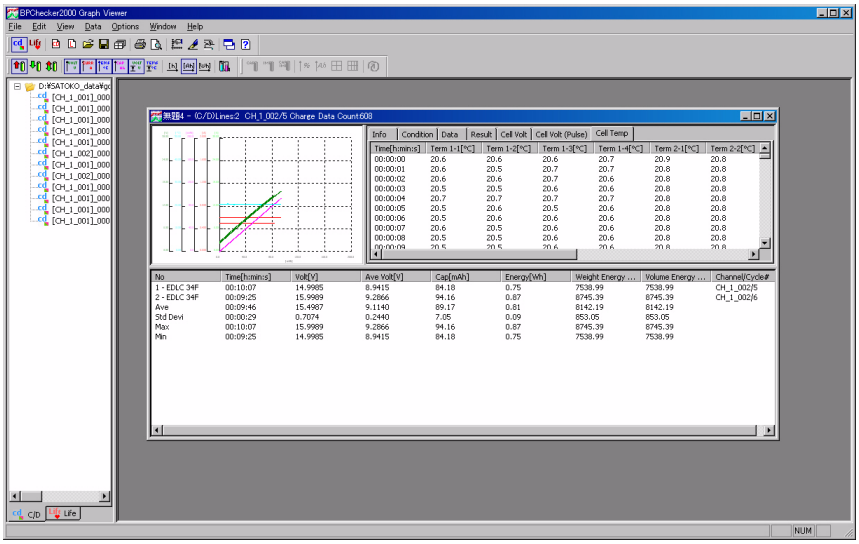
  This graph indicates the changes in the capacity of the DUT (battery) with respect to the number (cycle) of charge/discharge tests. A graph is drawn using the test data from the first cycle to the last cycle for a given battery.

- Charge/Discharge characteristics (C/D) graph

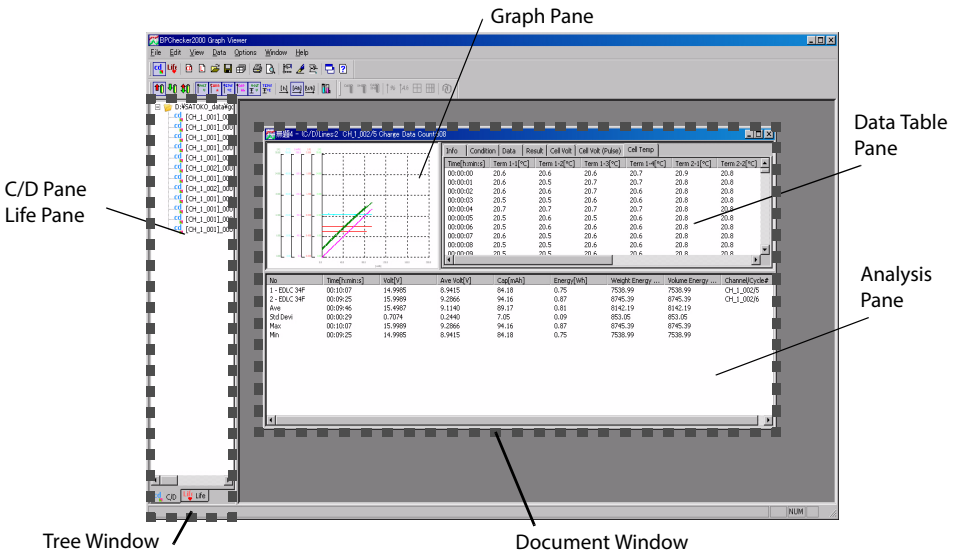
  This graph indicates the charge/discharge characteristics of the battery over an arbitrary cycle of the charge/discharge test (cycle) performed on a given battery. A graph is drawn using the test data of the selected cycle.

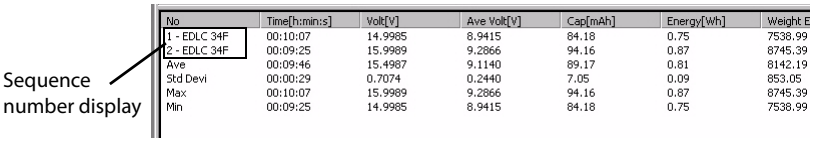
Starting the Graph Viewer

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



The Graph viewer consists of 2 windows and 5 panes.



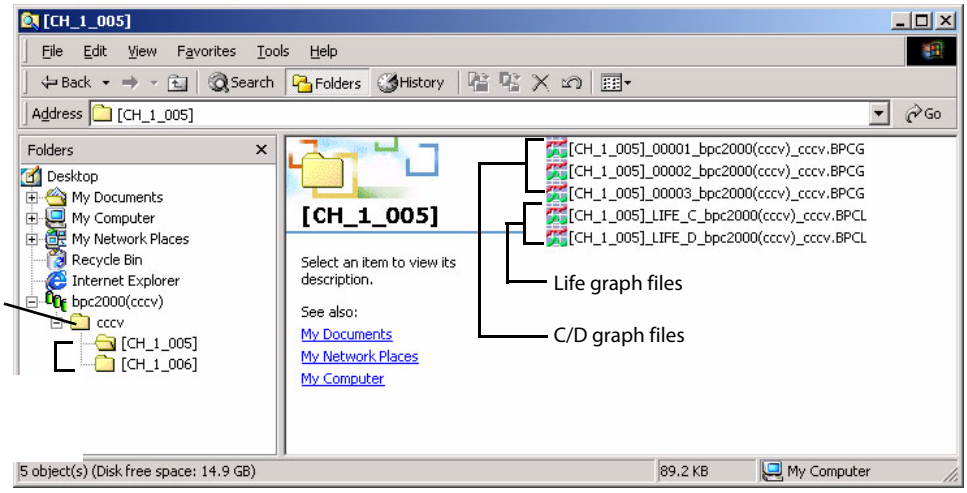
Item	Description
Tree window	The window for changing the tab. This window is always displayed while the Graph Viewer is running regardless of whether graph documents are present. Clicking the C/D tab shows the C/D Pane, and a list of C/D graph data (charge/discharge data) that can be displayed is shown. 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	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 document window contains three panes. The C/D graph and Life graph screens are constructed in the same way. Graph pane (upper left) This displays the cycle life characteristics (Life) or charge/discharge characteristics (C/D) graph. Data table pane (upper right) This displays the test information, test conditions, test data, test results, cell voltages, cell voltages (pulse), and cell temperatures. Analysis pane (bottom section) This displays the analysis data that is calculated from the test data. The analysis data is listed by sequence number (the name of the DUT is included beside the sequence number).  Sequence number display

Displaying Graphs

Before displaying the graph

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 following example describes which folder should be selected for each graph.



To display Life graphs, select the test conditions folder.

To display Life graphs, select the [CH_1_005] folder.

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 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.

Independent Graph and Superimposing Graph

The type of graph is available for the "Independent Graph" and the "Superimposing Graph".

- Independent graph

  The "Life Graph" indicates to displays the capacitance variation of the cycle of each battery, and the "C/D Graph" indicates to display the characteristics of charge/discharge of the specified cycle of each battery.

- Superimposing Graph

  Displays to superimpose of the graph over the plural numbers of same type of graph. You cannot superimpose C/D graphs and Life graphs together. You can superimpose the graph or the data, or delete from the superimposed graph afterwards. You can save the selected graph (superimposing conditions).

See p. 118

Displaying Graphs

The procedure for displaying the graph describes as follows.

- Using the Select Graph dialog box

  You can create "Independent Graph" or "Superimposed Graph", and add or delete the graph.

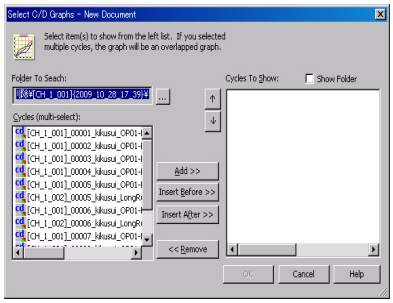
- Using the tree window/ Using Windows Explorer

  You can create "Independent Graph" or "Superimposed Graph", and add the graph. However, you can not delete the graph.

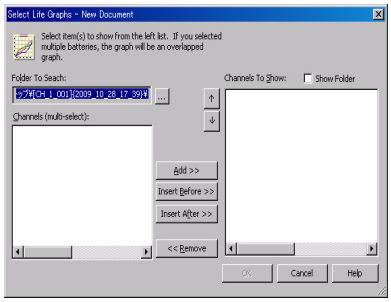
- Using Graph Explorer

  You can add the graph.

Using the Select Graph dialog box



C/D



Life

1 **Choose *C/D Graph* or *Life Graph* > *New* > *File*.**

The Select Graph dialog box appears.

See p. 110

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

For the "C/D Graph", select the folder of the channel.

For the "Life Graph", select the folder of the test condition.

When the Show Folder is selected, the file is displayed as a fullpath name.

3 **Select the folder/file from the cycle/channel to displaying the graph, and click *Add>>*/*Insert Before>>*/*Insert After>>*.**

Move to the "Cycle to Show" or "Channel to Show".

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, the item is inserted before or after the selected item.

The file or the folder displayed in the "Cycle to Show" or "Channel to Show" is applied to displaying the graph.

When selecting plural number of the folder or file, the graph will be superimposed.

Click file or the folder displayed in the "Cycle to Show" or "Channel to Show", and click >>Remove, it returns to the "Cycle/Channel".

4 **Click *OK*.**

Displays the graph.

■ Superimposing graph over the other graph

1 **Activate the graph document you wish to superimpose.**

2 **Choose *Select Graph* > *Data*.**

Displays the dialog "Choose Select Graph". The file or the folder displayed in the "Cycle to Show" is applied to displaying the superimposed graph.

See p. 110

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

For the "C/D Graph", select the folder of the channel.

For the "Life Graph", select the folder of the test condition.

4 **Select the folder/file from the cycle/channel to displaying the graph, and click *Add*>>/*Insert Before*>>/*Insert After*>>.**

Move to the "Cycle to Show" or "Channel to Show".

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, the item is inserted before or after the selected item.

5 **Click *OK*.**

The graph will be added.

■ Removing the graph from the superimposed graph (Displaying the superimposed graph)

1 **Make active for the graphed document of which graph you wish to remove.**

2 **Choose *Select Graph* > *Data*.**

Displays the dialog "Choose Select Graph". The file or the folder displayed in the "Cycle to Show" is applied to displaying the superimposed graph.

3 **Select the file or the folder displayed in the "Cycle to Show" or "Channel to Show", and click <<*Remove*.**

The selected folder or file returns to the "Cycle/Channel".

4 **Click *OK*.**

The graph is removed.

Using the tree window

You can not remove the disused graph from the superimposed graph.

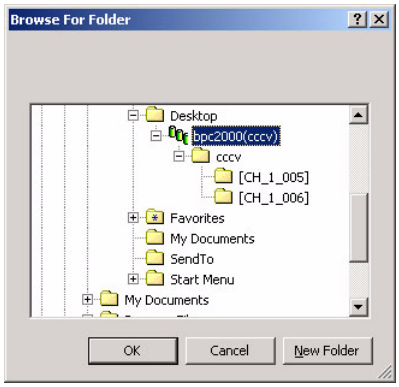
1 **From the tree window, select the C/D Pane or the Life Pane.**

2 **Click the folder at the top in the Tree Window.**

A contextual menu appears.

3 **From the contextual menu, choose *Change Folder*.**

A dialog box used to select the folder appears.



See p. 110

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

For the "C/D Graph", select the folder of the channel. The list of BPCG file is displayed in the Tree Window.

For the "Life Graph", select the folder of the test condition. The list of channel folders is displayed in the Tree Window.

5 **Select the folder or the file you wish to display from the Tree Window, and move it to the out side (in the gray area) of the document window using a drag-and-drop operation.**

The graph is displayed. When selecting plural number of the folder or file, the graph will be superimposed.

■ Superimposing graph over the other graph

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 **The folder or the file you wish to add from the displayed list, move it to the document window that is already opened using a drag-and-drop operation.**

The graph will be added.

Using Windows Explorer

You can not remove the disused graph from the superimposed graph.

1 **Open Windows Explorer.**

2 **Select the data file you wish to display the graph, and move it to the out side (in the gray area) of the document window using a drag-and-drop operation.**

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.

Displays the graph. If multiple files are selected, multiple graphs are displayed superimposed.

■ Superimposing graph over the other graph

1 **Activate the graph document you wish to superimpose.**

2 **Open Windows Explorer.**

3 **Select the data file of graph you wish to add, and move it to the active window of the opened document using a drag-and-drop operation.**

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

For Life graphs, select files with .BPCL extension or channel folder.

The graph will be added.

Using Graph Explorer

Superimpose the graph over the other graph to display. It is not possible to create a new graph or delete the graph.

1 **Choose *Options* > *Graph Explorer*.**

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.**

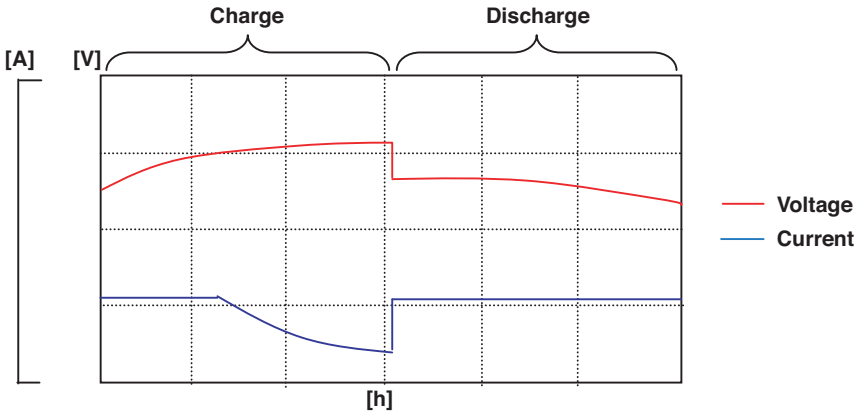
Changing the type of C/D graph display

When selecting ***View*** > ***Graph Type***, the graph display of the "C/D graph" can be selected.

- Charge/Discharge graph
- Charge graph
- Discharge graph

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

The charge and discharge graphs are continued to display from the charge characteristcs, followed by the discharge characteristics as shown in figure below.



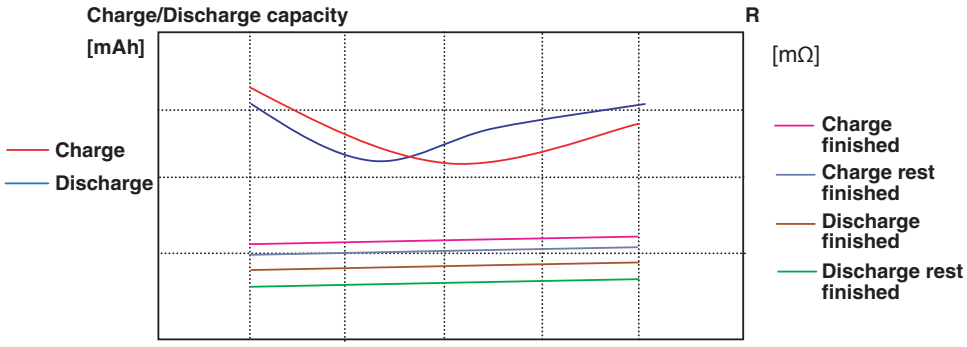
Changing the type of Life graph display

When selecting ***View*** > ***Graph Type***, the graph display of the "Life graph" can be selected.

- Capacity/Impedance graph
- Capacity graph
- Impedance graph (When the PFX2211 is used)

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

The impedance graph can be displayed only when the PFX2211 is used. It consists of four lines which are after the "Charge finished", "Charge rest finished", "Discharge finished", and "Discharge rest finished" for each display description of "R, JX, Z, θ". The four items, R, JX, Z, and θ can be shown or hidden. Thus, if all items are shown, 16 lines are displayed. The following figure is shown when the "Capacity/Impedance graph" is selected to display the "R".

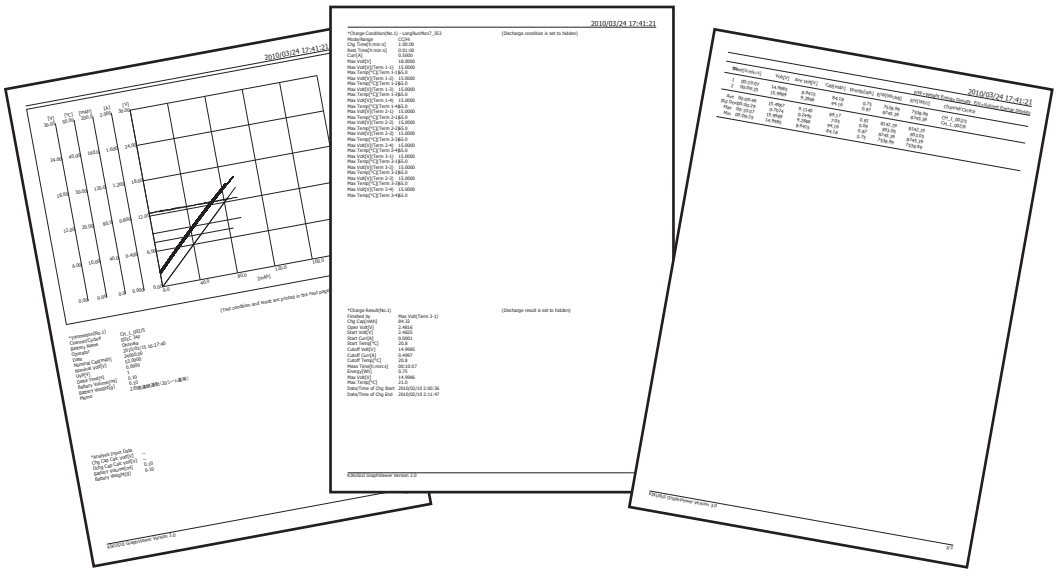


In the Graph Viewer, the displayed unit for measured impedance is [mΩ].

Printing Graphs

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

Figure below shows a printed image of C/D graphs. Depending on the settings, the contents or the number of pages that are printed may differ.



Saving Graphs

Save the selected graph (overlay condition) of the superimposed graph.

You can add the name of the overlay condition for the superimposed graph.

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

To open a saved graph, choose ***File*** > ***Open Overlay Condition***. Specify the file name.

Copying of the graph image

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 ***Edit*** > ***Copy Graph***.

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 ***File*** > ***Save Text***. 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 ***Edit*** > ***Copy Data***.

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