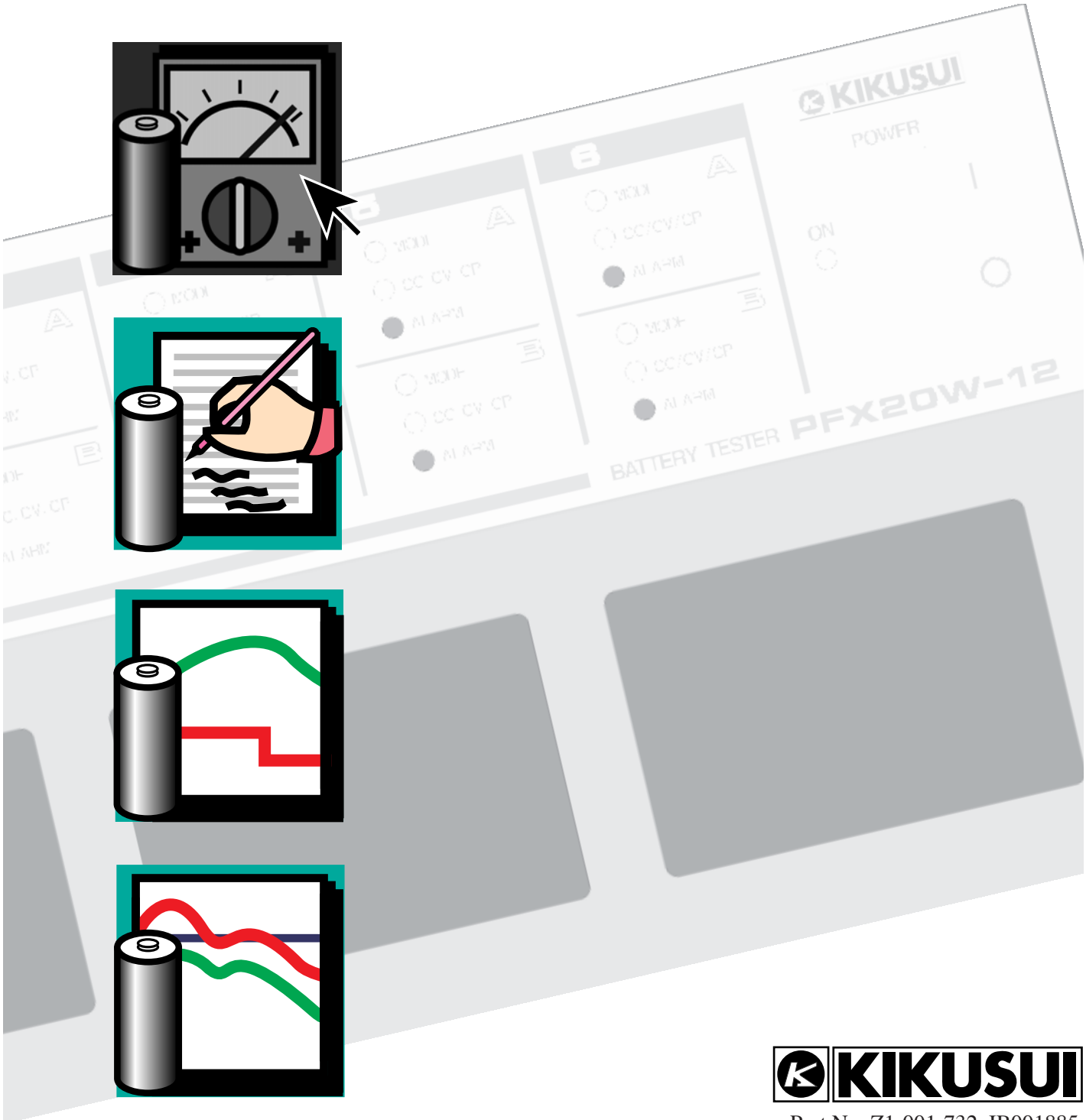
Electronic Test
Instruments &
Power Supplies

Battery Performance Checker 12

SD03-PFX(E)

Version 1.3
for PFX20W-12

User's Manual



KIKUSUI

Part No. Z1-001-732, IB001885

About the User's Manual

Read this User's Manual thoroughly before using the product and keep it handy for ready reference. When transporting the product to another location, remember to bring the manual.

If your copy of the manual has pages missing or out of order, please contact us to obtain a replacement copy. If the manual is lost or damaged, a new User's Manual may be purchased by contacting Kikusui distributor/agent and providing the "Kikusui Part No." given on this page.

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

Notices:

Trademarks

Battery Performance Checker 12
SD03-PFX(E) Version 1.3
for PFX20W-12
User's Manual

Printed in Japan

Request for Owner's Registration

You must complete and send in the enclosed owner's registration card to receive news of software upgrades and technical support. Please read the Software License Agreement enclosed, complete the user registration card, and directly fax or mail it to us. If you do not return the user registration card, you can't receive the above service.

Understanding Symbols

The symbols used in this manual are explained below.

CAUTION

Indicates risk of damage to the PFX20W-12 tester or connected equipment. Always follow the correct operating procedures.

Before proceeding past a CAUTION sign, make sure all indicated conditions are understood and met.

NOTE

Indicates additional information, such as operating procedures.

Contents

Chapter 1 Introduction

1.1 Product Outline

The SD03-PFX(E) Battery Performance Checker 12 application software, hereafter referred to as the BPChecker, is a battery characteristics testing system that performs charge-discharge characteristics tests of batteries by controlling PFX20W-12 testers (hereafter referred to as frames) via a PC and analyzing test results.

With the BPChecker, up to six frames may be connected. A single PC (Personal computer) can control up to 72 channels.

Charge-discharge tests are performed by creating patterns (data clusters involving detailed settings for voltage, current, time, and other charge-discharge characteristics) with the Test Condition Editor, then running Test Executive. Up to 15 such patterns may be set for a single test, and up to 2000 repetitions may be run, giving the BPChecker the capacity to handle initial characteristics and battery life tests.

Using the BPChecker with a TABAI ESPEC protocol converter and temperature chamber allows tests to be carried out in sync with the temperature chamber.

Pattern-based charge-discharge data and life capacity data for the entire cycle are saved as files during testing. These test data files are then converted into graphs by CD Data Graph or Life Data Graph to provide waveform numeric data display, test result display, and information in other useful formats. The BPChecker comes with a function that allows test data in text format to be copied and pasted to the clipboard for manipulation in spreadsheet applications.

The frame has six charge-discharge power supply units of 20 W/2 channels, for a total of 12 channels. Two channels (A and B) in a power supply unit may be connected in parallel. By changing the configuration of these channels, the tester can be used as a charge-discharge power supply unit of 50 W/channel.

The BPChecker is made up of the following four programs, with the following functions.

1. Test Condition Editor

The Test Condition Editor is a software that is used to create and edit all test conditions related to charge-discharge tests carried out by the frames. Test conditions can be entered per power supply unit, with data required for testing such as test titles and charge-discharge patterns (data clusters involving detailed settings for voltage, current, time, and other charge-discharge characteristics) set by the user. The Test Executive may be run directly from the Test Condition Editor, allowing tests to be performed instantly under the test conditions currently being edited.

2. Test Executive

The Test Executive sends and receives data for the test conditions prepared with the Test Condition Editor to and from frames via the GPIB interface for performing charge-discharge tests.

During the test, the Test Executive monitors voltage, current, capacity, time, and other parameters for each frame, displaying detailed test conditions and real-time data graphs. It also saves pattern-based charge-discharge data and life capacity data for the entire cycle as data files.

3. CD Data Graph

The CD Data Graph handles data files for charge-discharge, converting data for predischarge, charge, and discharge characteristics into graphs and displaying waveform numeric data, test results, and other information. It offers several helpful functions, including search function for file-reads. It also has a function that allows test data in text format to be copied and pasted to the clipboard for manipulation in spreadsheet applications.

4. Life Data Graph

The Life Data Graph handles files for life data, converting charge-discharge capacity data into graphs, switching graph display (the capacity (Y) axis may be switched between 1.0, 100%, and measured capacity values, and the cycle (X) axis may be switched between linear and logarithmic displays) and displaying waveform numeric data, test results, and other information. It offers a search function for file-reads. It also has a function that allows test data in text format to be copied and pasted to the clipboard for manipulation in spreadsheet applications.

1.2 System Requirements

The following are the minimum requirements for running the BPChecker application software.

■ PC(Personal computer)

PC with a processor of Pentium 100 MHz or better, using WindowsNT Workstation 4.0, Windows95 or Windows98.

OS:	WindowsNT Workstation 4.0, Windows95 or Windows98. For tests that it takes 49 days or more from turning on a personal computer to completion of test, you should use WindowsNT Workstation4.0.
Memory:	32 MB or greater
Hard disk:	540 MB or greater (the application itself occupies 3 MB of disk space). The required hard disk capacity differs from test method to test method.
Floppy disk drive:	3.5" FD (1.44 MB)
Mouse:	Required
Display monitor:	We recommend a 17-inch monitor with a resolution of 1024 x 768 or better. The display must be capable of a minimum resolution of 800 x 600.
Printer:	OS-compatible printer

NOTE

- If there is advanced power management (APM) function in the system setting of your personal computer, turn off the function. When you perform a test at turning on APM, your personal computer may not work normally because the interrupt called SMI for CPU occurs periodically. To enable APM, click "Start" button on taskbar, select "Help", and select "Index." Type "APM", "advanced power management", or "power management" on the text box, and search for the word. Set APM according to the help.

■ Communications requirements

GPIB board: GPIB board with National Instruments NI-488.2 specifications

GPIB driver: National Instruments NI-488.2M Software for Windows95 Ver. 1.1 or later, or NI-488.2M Software for WindowsNT

The use of a GPIB board requires installation of the GPIB driver. For instructions on installing the GPIB driver, see the documentation for the driver. For NI-488.2 settings configured in the device manager, always set the Interface Name to "GPIB0" and GPIB Address Primary to "0."

GPIB cables IEEE-STD488-compliant cables must be provided according to the number of the PFX20W-12 testers used.

NOTE

- Turn off the Automatic Serial Polling function in the setup property of your GPIB board when you use the SD03-PFX. Otherwise, the SD03-PFX can not a test normally.

■ Requirements for tests synchronized with a temperature chamber

Protocol converter TABAI ESPEC PMS-CA or PMS-CG

Temperature chamber Controllable by a TABAI ESPEC protocol converter

1.3 Software Configuration

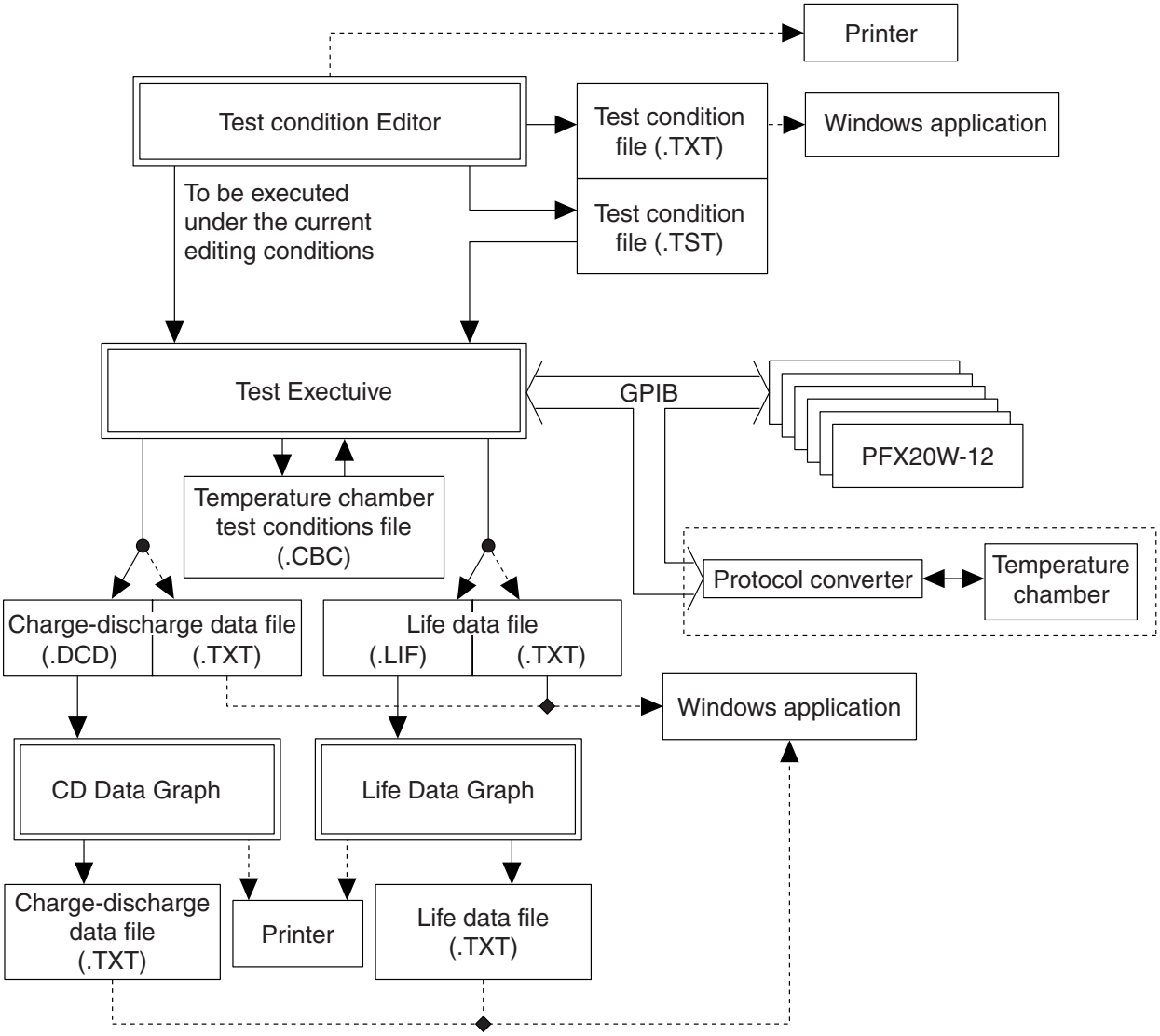


Fig. 1 Software Configuration

Flow of test procedure:

1. – Prepare the test conditions: Test Condition Editor

   Prepare the test conditions. That is, determine the test type to be performed.

2. – Carry out the test: Test Executive

   Connect DUT to frames and assign the prepared test conditions to the frames. That is, determine which channel of which unit of which frame will perform this test. Then, specify the frames, units, and channels to perform the test.

3. – Analyze and evaluate the test data acquired: CD Data Graph/Life Data Graph

   Convert the obtained test results into graphs and tables for analysis and evaluation.

Chapter 2 Setup

2.1 Package Contents

This BPChecker package contains the following items:

■ Program diskettes	2 (1.44 MB formatted)
■ User's Manual	1

2.2 Install

Before using the BPChecker, you must install the Battery Performance Checker application programs to the hard disk. The installation process is handled by the setup program provided on the setup disk.

1. – Insert the No. 1 setup disk into the floppy disk drive.
2. – Click the [Start] button, point to [Settings], and click on [Control Panel].
3. – Double-click the [Add/Remove Programs] icon.
4. – Click on [Setup] in the [Install/Uninstall] tab.
5. – Follow the setup prompts displayed on the screen.

2.3 Uninstall

1. – Click the [Start] button, point to [Settings], and click on [Control Panel].
2. – Double-click the [Add/Remove Programs] icon.
3. – Select the application you want to uninstall from the list provided in the [Install/Uninstall] tab, and click on [Add/Remove].
4. – Follow the deletion prompts displayed on the screen.

CAUTION

- Before uninstalling the BPChecker programs, save the required test conditions and test data into another directory, on this disk or another disk.

2.4 Setting the GPIB Addresses

Up to six frames may be connected to a single PC. When connecting frames, you must set the GPIB address for each frame. The addresses must be set using the DIP switches on the rear of each frame. Each address is set according to the number of a frame to be connected; set the addresses as follows. Set the SRQ function to ON in the same way.

The frames are factory-set to frame 1: address 1.

Setting the DIP switches

Frame 1: address 1

		□					□	1
□	□		□	□	□	□		0
•	•	SRQ	16	8	4	2	1	

Frame 2: address 2

		□				□		1
□	□		□	□	□		□	0
•	•	SRQ	16	8	4	2	1	

Frame 3: address 3

		□				□	□	1
□	□		□	□	□			0
•	•	SRQ	16	8	4	2	1	

Frame 4: address 4

		□			□			1
□	□		□	□		□	□	0
•	•	SRQ	16	8	4	2	1	

Frame 5: address 5

		□			□		□	1
□	□		□	□		□		0
•	•	SRQ	16	8	4	2	1	

Frame 6: address 6

		□			□	□		1
□	□		□	□			□	0
•	•	SRQ	16	8	4	2	1	

CAUTION

- Do not touch any switches other than those for address and SRQ.
- After setting up the GPIB addresses, turn the power switch for the frames off, then on again.

2.5 Connecting the GPIB Cables

Turn off the power switches for the frames and the PC.

Connect one of the GPIB cable connectors to the PC GPIB port and secure the connector using the terminal screws.

Connect the other GPIB cable connector to the 1st frame and secure using the terminal screws.

Connect the 2nd and later frames in series with a GPIB cable.

2.6 Checking Connections

Turn on the frame power switches. After initialization of the frames is complete (about 30 seconds), start the BPChecker's Test Executive to confirm that the Operation column on the Test Executive main screen shows "idle" with respect to the connected frames.

2.7 For Safe Use

Before conducting a battery test with this software, carefully read the Operation Manual for the frame to ensure that the DUT (the batteries) are connected correctly and that the frames are functioning normally. Improper connection of a DUT or the frame function may lead to DUT damage or serious accidents, such as explosions. For safety, always set OVP (overvoltage protection, or overcharge prevention), UVP (undervoltage protection, or over discharge prevention), and OAH (overcharge capacity protection), unless there are specific reasons for not doing so.

Chapter 3 PFX20W-12 Charge-Discharge Testers

This chapter describes the configuration of PFX20W-12's (frames) and the charge-discharge test modes to be used.

3.1 Frame Configuration

One frame (one PFX20W-12) consists of six electrically isolated units and the channels separating the output of each unit into two lines.

Each unit is capable of performing tests individually, since each is electrically isolated from the others. Note that charge-discharge tests cannot be simultaneously conducted on the channels (A and B) of the same unit. In this case, tests are restricted to the same test conditions.

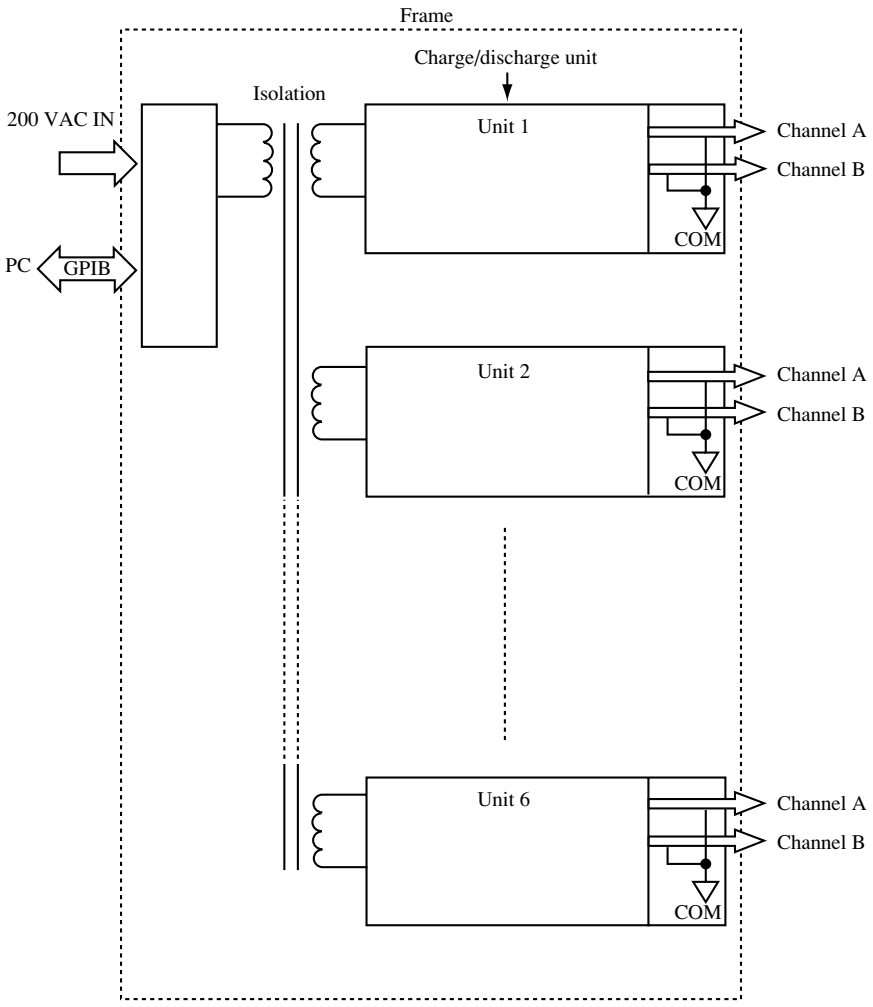


Fig.2 Frame Configuration

3.2 Channel Configuration

A frame is equipped with six 50 W charge-discharge power supplies (hereafter referred to as units). Each unit can perform charge-discharge tests for a total of 12 channels by dividing the output into 20 W/2 channels.

PFX20W-12 frame					
Unit 1A	Unit 2A	Unit 3A	Unit 4A	Unit 5A	Unit 6A
Unit 1B	Unit 2B	Unit 3B	Unit 4B	Unit 5B	Unit 6B

Charge-discharge tests may be carried out at different schedules for separate units. The following chapters describe how to create the test conditions and perform testing.

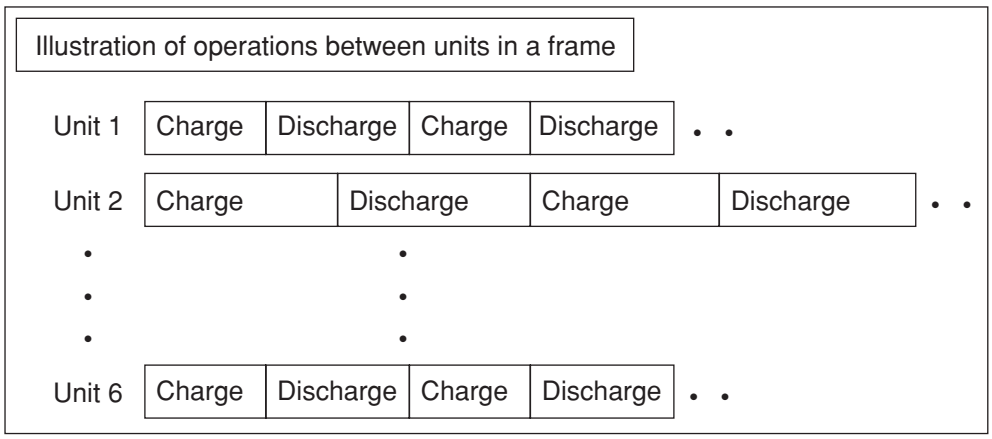


Fig. 3 Image of Operations between the Units

You can set units to a 50 W/6 channel configuration (referred to as a 6-channel configuration) or 20 W/12 channel configuration (referred to as a 12-channel configuration) on a per-frame basis.

When a frame is used in 12-channel configuration, the two channels (A and B) in the units must perform charge-discharge tests under the same testing conditions.

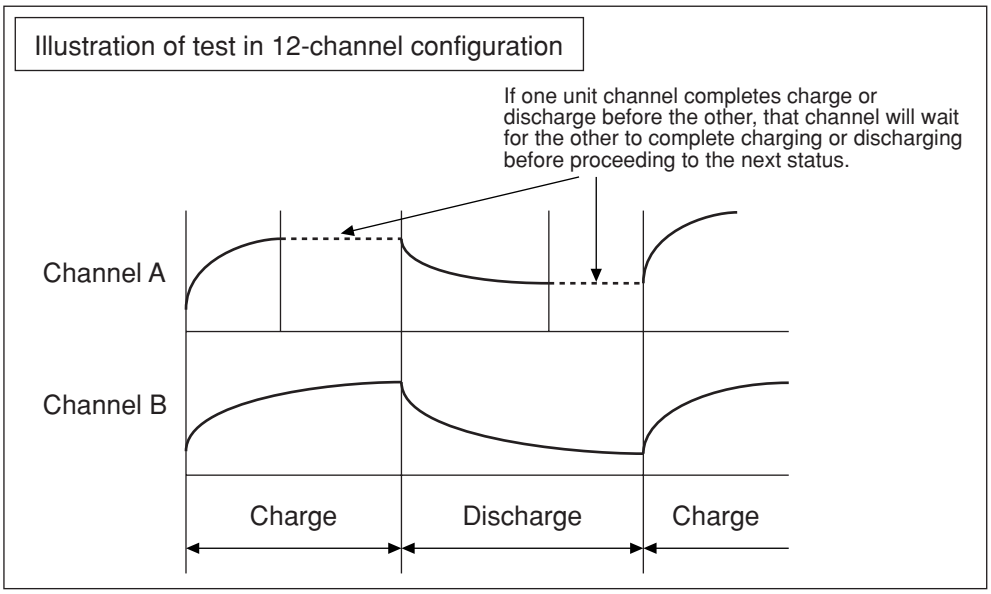


Fig. 4 Illustration of Operations between the Channels

In other respects, the 12-channel configuration differs from the 6-channel configuration in test operations.

If one channel for a unit has already begun testing, the other channel which has not started testing may not be started at a subsequent time.

If an alarm is issued to one of the channels, the other channel ceases output. To resume testing, you must clear the alarm from the channel for which it was issued.

3.3 Details of Possible Charge-Discharge Tests

3.3.1 Constant current—constant voltage charge (CC-CV)

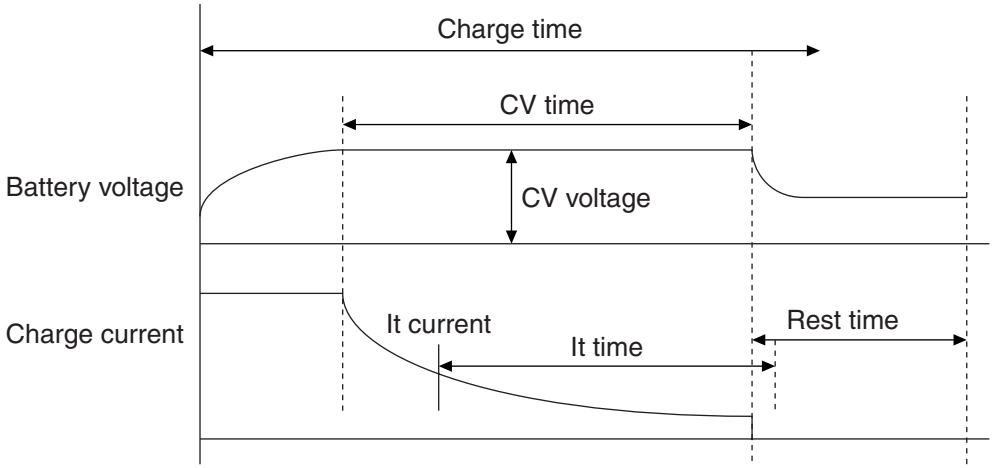


Fig. 5 Illustration of Operations in Constant Current - Constant Voltage Charge

The above figure illustrates the transition from constant current charge to constant voltage charge, reaching CV time, to resting from charge.

Additional descriptions are given below.

■ Charge time

Indicates the maximum time for a charge period. Charging stops after this time elapses, if it has not already ended.

■ CV time

CV time refers to the period between the instant at which battery voltage rises to shift the DUT to constant voltage action and the instant at which charging ends.

■ It current and It time

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 after the time set by It time elapses.

3.3.2 Constant current charge (CC)

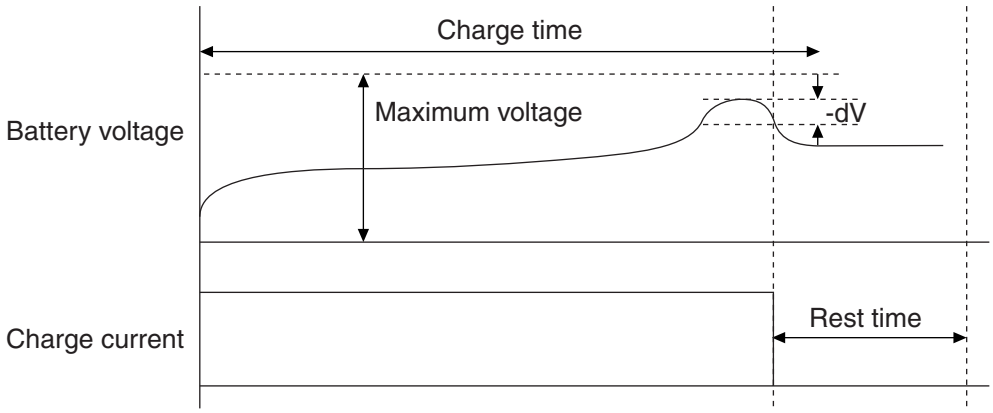


Fig. 6 Illustration of Operations in Constant Current Charge

The above figure illustrates the transition from constant current charge to -dV detection, end of charge, to resting from charge. Additional descriptions are given below.

■ Maximum voltage

When the battery voltage reaches this voltage during a charge period, charging ends. This item is set only in CC charge.

■ -dV voltage

Charging ends when the battery voltage rises to a peak during a charge period, and a subsequent voltage drop of -dV is detected. This detection may be disabled for the time set by the -dV mask time, or for a shorter period.

3.3.3 Constant current discharge (CC)

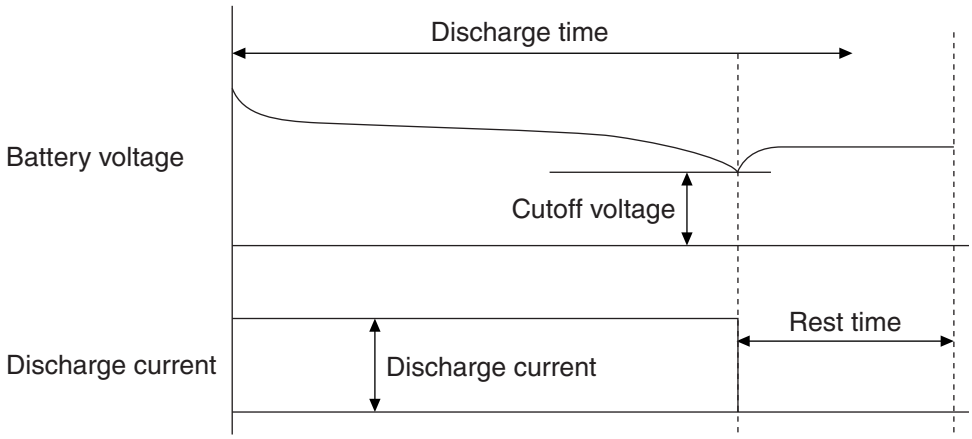


Fig. 7 Illustration of Operations in Constant Current Discharge

The above figure illustrates the transition from constant current discharge to a drop in battery voltage to cutoff voltage, end of discharge, to resting from discharge. Additional descriptions are given below.

■ Discharge time

Indicates the maximum time for a discharge period. If it has not already finished due to other factors, discharge halts after this time elapses.

■ Discharge current

Constant current value in constant current discharge

■ Cutoff voltage

This is the battery voltage value at which discharging terminates. When battery voltage drops to this level, discharge ends.

3.3.4 Constant power discharge (CP)

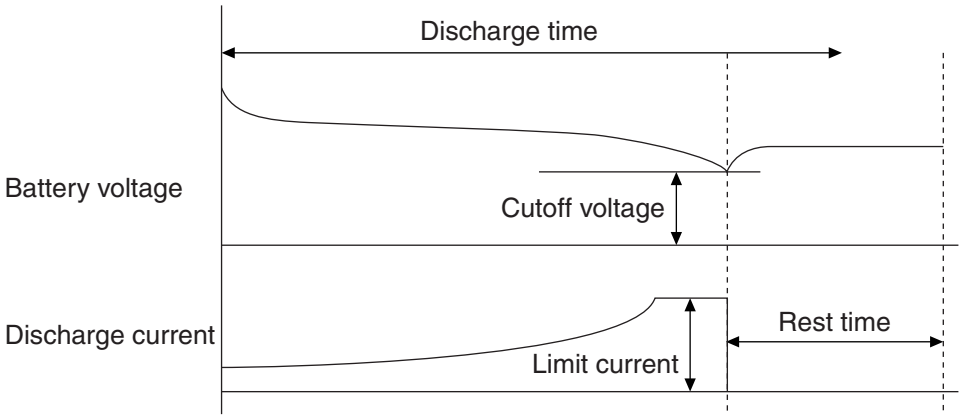


Fig. 8 Illustration of Operations in Constant Power Discharge

The above figure illustrates the transition from constant power discharge to a drop in battery voltage to cutoff voltage, end of discharge, to resting from discharge. Additional descriptions are given below.

■ Discharge time

Indicates the maximum time of a discharge period. If it has not yet finished due to other factors, discharge halts after this time elapses.

■ Discharge current

Discharge current changes with battery voltage to maintain the constant power value.

■ Limit current

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

■ Cutoff voltage

This is the battery voltage value at which discharging terminates. When the battery voltage lowers to this voltage, discharge ends.

3.3.5 Pulse discharge (pulse)

Discharge is achieved by the following pulse currents. (The figure below illustrates the waveform for discharge.)

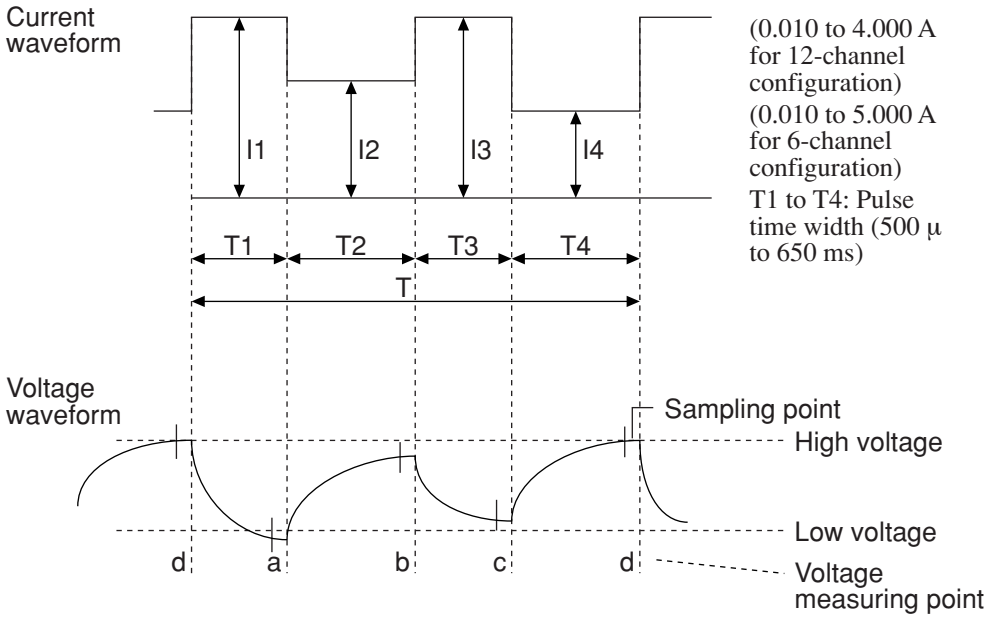


Fig. 9 Illustration of Operations of Pulse Currents

■ Current setting

As shown above, up to four current values (I1 to I4) may be set within one cycle.

NOTE

- Current values may be set starting at 0.01 A only for pulse discharge.

■ Time setting

As shown in the figure above, you may set an On time (T1 to T4) for each current value.

■ Voltage measurement function

In pulse discharge, the voltage measurement function measures battery voltage at points “a” to “d” (voltage measurement points) in a single cycle (T) in the figure above, then acquires the High voltage (upper peak) and Low voltage (lower peak) from among the values.

Note that more than one cycle may be required to acquire High and Low voltages, depending on the setting of the pulse time width.

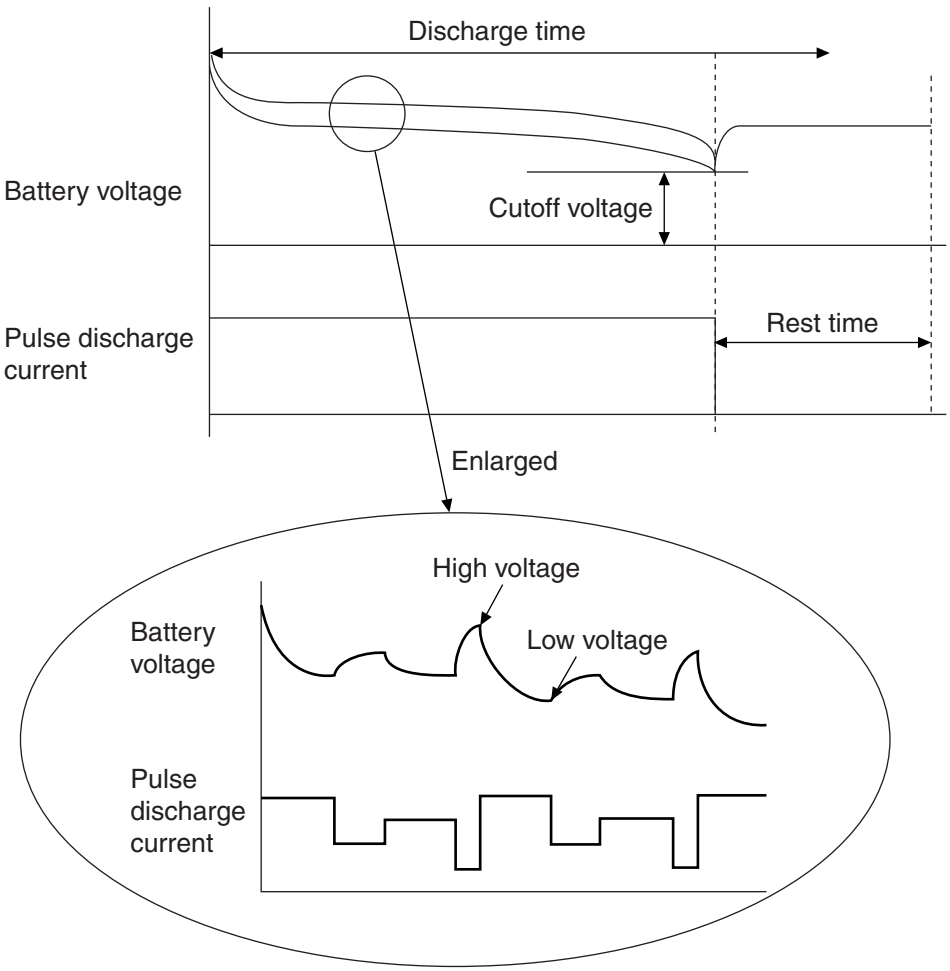


Fig. 10 Illustration of Operations in Pulse Discharge

The above figure illustrates the transition from pulse discharge to a drop in battery voltage to cutoff voltage, end of pulse discharge, to resting from discharge. Additional descriptions are given below.

■ Cutoff voltage (for pulse discharge)

This is a battery voltage value at which discharge terminates. For pulse discharge, discharge ends if the Low voltage in the above figure drops to the cutoff voltage.

Chapter 4 Creating and Controlling Test Conditions

Test Condition Editor

This chapter explores the Test Condition Editor and explains how to create test conditions.

4.1 What is the Test Condition Editor?

The Test Condition Editor is an application which creates and edits all test conditions involving charge-discharge testing.

Using the Test Condition Editor, you may set discharge (predischarge) for removing the electrical charge from a battery before beginning a test, and 15 charge and discharge patterns.

You may also make settings for a sequence of 15 charge and discharge patterns for testing, for battery information, and for protection information to prevent overcharge and over discharge.

After you specify a file name for test conditions, a binary file is created with the extension ".tst". The Test Condition Editor also allows you to save files in text format (extension: .txt) or to copy data to the clipboard.

4.2 Creating a Test Conditions File

You may create a test conditions file from scratch, or by modifying an existing file. If you have just started the Test Condition Editor, no file will be open.

To create new test conditions, select [New] from the [File] menu to open a new file.

To open an existing test conditions file, select [Open] from the [File] menu and select that file.

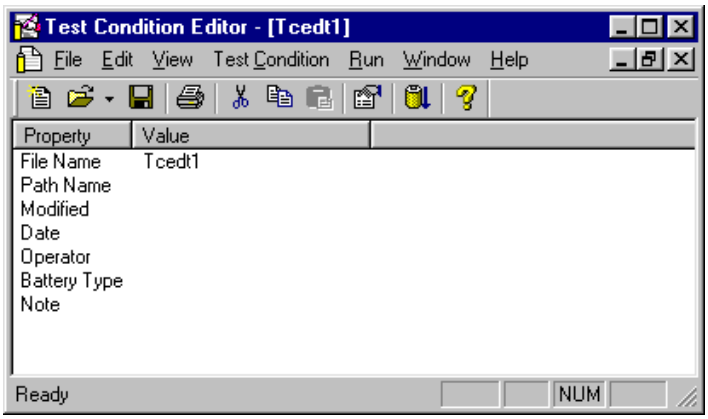


Fig. 11 Screen Displayed When You Open a New File

4.3 Creating the Test Conditions

To create the test conditions, select the object file window and select [Properties] in the [Test Condition] menu. The Test Conditions properties sheet is opened.

The Test Conditions properties sheet consists of the following four pages.

1. A “Comment” property page, into which you enter date, operator, battery type, and other information
2. A “Sequence” property page, into which you set battery information, battery protection information, and a test sequence of charge and discharge patterns
3. A “Predischarge” property page, into which you set the conditions of discharge for removing an electrical charge from a battery before starting charge and discharge testing
4. “Pattern” property pages, into which you set the conditions for charge and discharge testing. Property pages for “Pattern 1” to “Pattern 15” are available.

Each property page is described below.

4.3.1 [Comment] property

Enter date, operator, battery type, and other information into this property page.

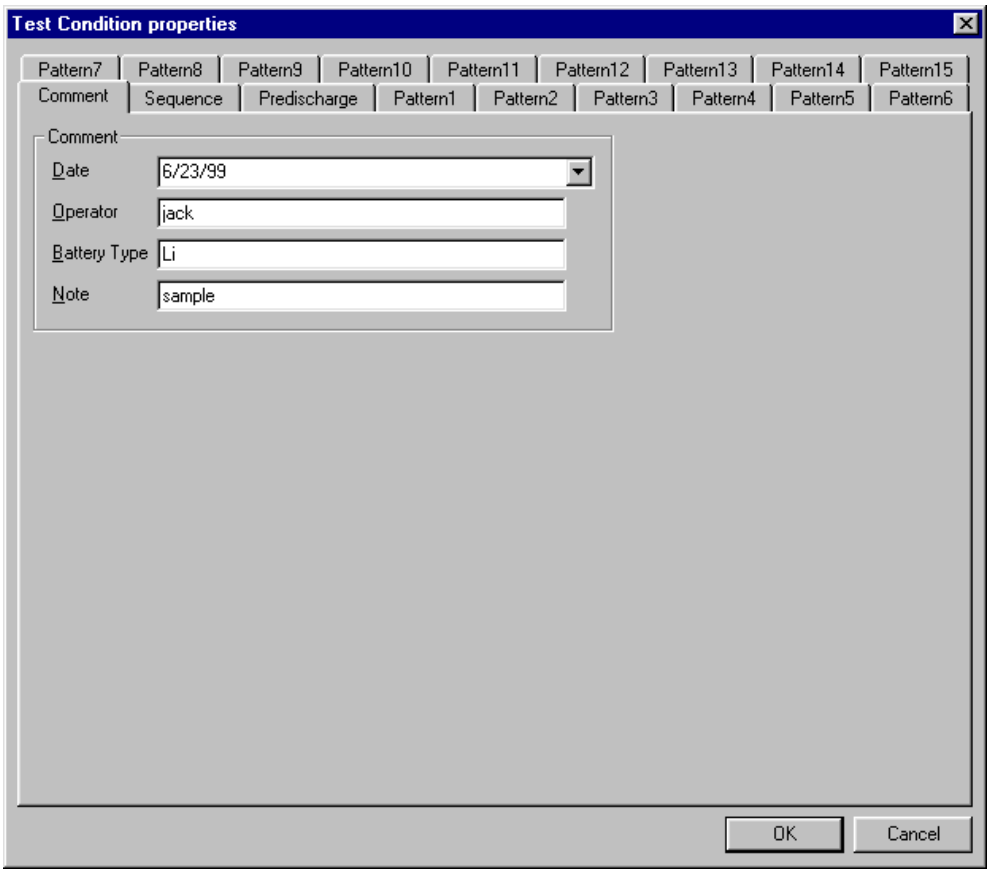


Fig. 12 Comment Property

The valid input range for each item is given below:

[Date] box

Input range	Max 30 characters in single-byte

[Operator] box

Input range	Max 30 characters in single-byte

[Battery Type] box

Input range	Max 30 characters in single-byte

[Note] box

Input range	Max 30 characters in single-byte

4.3.2 [Sequence] property

Enter battery information, battery protection information, and a test sequence of charge and discharge patterns into this property page.

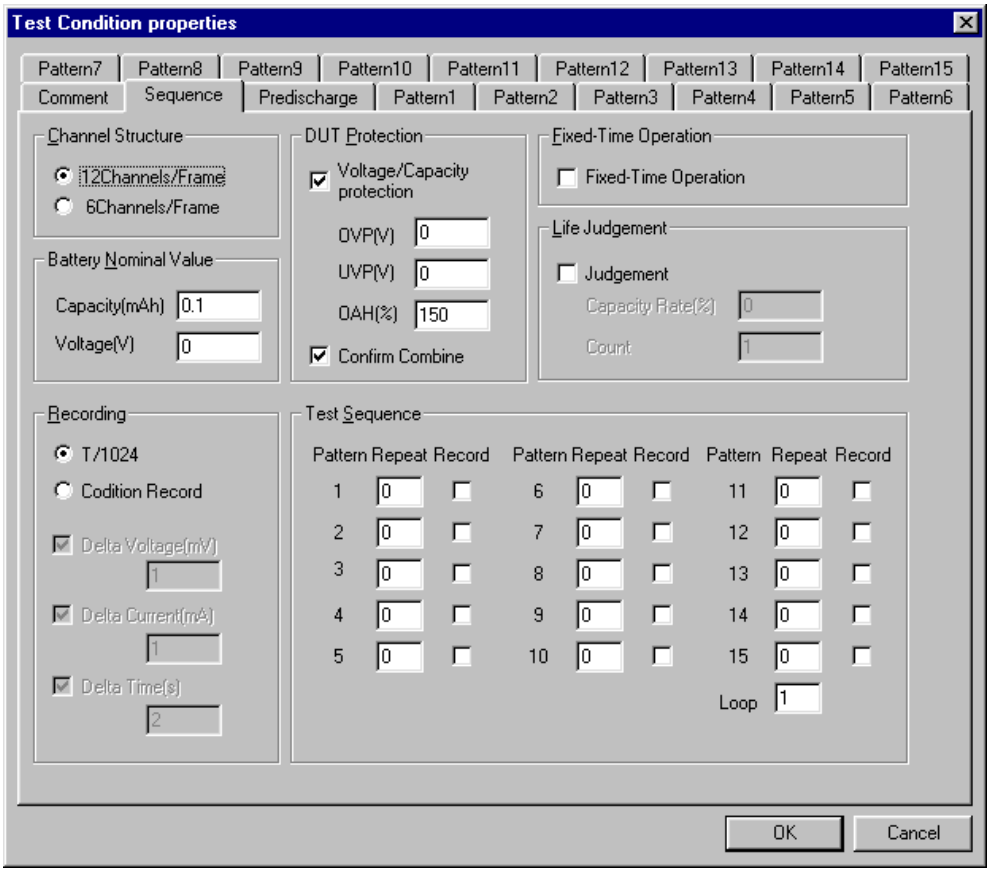


Fig. 13 Sequence Property

■ Channel Structure

Set frame usage to 6 channels or 12 channels configuration.

The channel configuration setting determines the input ranges for current, voltage, and power values for the following “Predischarge” and “Pattern 1” to “Pattern 15”.

[12Channels/Frame]

Sets frame operation to 12 channels per frame.

[6Channels/Frame]

Sets frame operation to 6 channels per frame.

■ Battery Nominal Value

Enter the nominal capacity (mAh) and nominal voltage (V) of the battery to be tested in this section.

[Capacity (mAh)] box

The nominal capacity value is treated as a reference value for life judgement and OAH (over charge capacity protection).

[Voltage (V)] box

The nominal voltage value entered is used to determine the axes of a real-time graph displayed by the “Test Executive.”

■ DUT Protection

Use these functions to prevent damage to a DUT (battery) and to avert serious accidents, such as battery explosions.

[Voltage/Capacity protection] check box

Check this box to provide voltage/capacity protection. When the check box is checked, settings for the [OVP (V)], [UVP (V)], and [OAH (%)] boxes are enabled.

[OVP (V)] box

Enter an OVP (V) (overcharge protection) value.

If battery voltage exceeds the OVP (V) value during testing, and the frame aborts the testing as a warning.

[UVP (V)] box

Enter an UVP (V) (over-discharge protection) value.

If battery voltage falls below the UVP (V) value during testing, and the frame aborts testing as a warning.

[OAH (%)] box

Enter an OAH (%) (overcharge capacity protection) value.

This value is a ratio to the nominal capacity entered in the battery nominal values.

If battery capacity exceeds the value set by OAH (%) during testing, and the frame aborts testing as a warning.

CAUTION

- To prevent damage to a DUT (battery) or serious accidents such as battery explosions, always set the DUT protection functions unless there are specific reasons for not doing so.

NOTE

- The maximum handling capacity of the frame is 214.748836 (Ah). The value obtained by multiplying nominal capacity by the ratio entered in OAH must be less than this capacity.

[Confirm Combine] check box

Check this box to confirm the connection status of the DUT.

The Connection check measures the voltage difference between the current wires and voltage sensing cable immediately before testing to confirm normal connections, based on the voltage difference value obtained. An alarm is issued if the result is abnormal.

NOTE

- Before using the connection check function, make sure you read and have understood Appendix 5, Connection Check Function, of the PFX20W-12 12CH Charge-Discharge Tester Operation Manual.

■ Fixed-Time Operation

[Fixed-Time Operation] check box

Check this box when performing testing for which the test time is fixed to one cycle (charge time + rest time and discharge time + rest time). Fixed-time operation is carried out on a unit basis. In fixed-time operation, the test is performed as follows:

- For charge, the terminating factor is CV time, It time, maximum voltage, -ΔV, or charge time. However, in fixed-time operation, even when charge action ends in response to CV time, It time, maximum voltage, or -ΔV, the remaining charge time is treated as rest time in order to correct the test time.
- For discharge, the terminating factor will be cutoff voltage or discharge time. However, in fixed-time operation, even when discharge terminates in response to cutoff voltage, the remaining discharge time is treated as rest time in order to correct the test time.

■ Life Judgement

Battery capacity generally degrades as batteries are repeatedly charged and discharged. In this life judgement section, you will set a percentage relative to nominal capacity (set to 100%), which is then used to determine whether the battery is at the end of its life.

[Judgement] check box

Check this box to perform a life judgement. Checking the box enables setting of the [Capacity Rate (%)] and [Count] boxes. It may be left unchecked if you will not perform life judgement.

[Capacity Rate (%)] box

Enter a capacity rate (%) for life judgement.

The capacity rate is a rate relative to the nominal capacity entered in the Battery Nominal Values section.

Input range	0 to 100 (%)

[Count] box

Enter the number of times to determine that the battery is at the end of its service life if discharge capacity continuously falls below the capacity ratio (%).

■ Recording

Set the method for recording a charge-discharge data file created by “Test Executive” in this section.

[T/1024] button

The T/1024 records data for predischarge time + rest time, charge time + rest time, and discharge time + rest time for each test, divided into 1024 data points.

– Data-recording intervals

The data-update interval for a frame is two seconds. Thus, data is recorded only at two-second intervals. For example, when test conditions are set with a charge time of 0:05 (for five minutes) and a rest time of 0:01 (for one minute), the recording interval by calculation is (0:05 + 0:01)/1024 = 0.35 (s), but data can’t be updated at 0.35 (s). In this case, the count of individual data points to be recorded is (0:05 + 0:01)/2 (s) = 180 data items or points. Note that this division time is calculated from the entered charge time + rest time or discharge time + rest time. The number of data items to be recorded will thus be fewer if a test is terminated by other factors (cutoff voltage for discharge, or CV time, It time, maximum voltage, or -ΔV for charge).

[Condition Record] button

Charge-discharge data are recorded by determining whether conditions are satisfied. When condition recording is selected, the input for delta voltage, delta current, and delta time is available. Data is recorded by OR for each condition.

[Delta Voltage (mV)] check box

Sets data recording based on delta voltage.

[Delta Voltage (mV)] box

Data is recorded if battery voltage changes by more than the entered value.

[Delta Current (mA)] check box

Sets data recording based on delta current.

[Delta Current (mA)] box

Data is recorded if the current changes by more than the entered value.

Input range	1 to 999 (mA)

[Delta Time (s)] check box

Sets data recording by delta time.

[Delta Time (s)] box

Data is recorded if time changes by more than the entered value.

NOTE

- The recording area for the charge-discharge data is a maximum of 1024 items. When the number of recorded data items exceeds 1024, data is overwritten to the final point (1024).

■ Test Sequence

Set the type of sequence in which “Pattern 1” to “Pattern 15” of charge-discharge (described later) are executed in this section. The “Test Executive” performs a charge-discharge test according to the sequence of patterns set here.

The setting is made by entering the number of times to repeat a pattern by “Repeat” and entering the number of times to repeat all the patterns (15 patterns) by “Loop.” Charge-discharge tests are performed in sequence, starting at pattern 1.

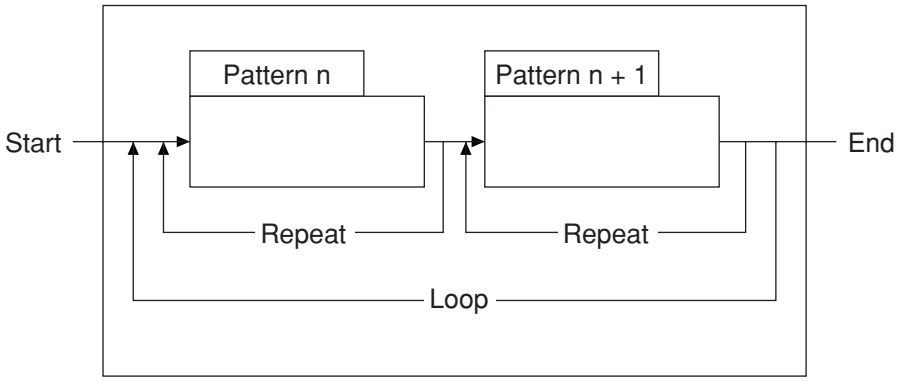


Fig. 14 Illustration of Operations in Patterns, Repeats, and Loop

[Repeat] box

Enter the number of times to repeat a pattern. When this value is set to 0, the particular pattern is skipped.

[Record] check box

Checking this box determines whether or not to save data for voltage, current, and elapsed time to a file when the relevant pattern is executed (charge, discharge, and each rest status). When this check box is left unchecked, no data file is saved.

[Loop] box

Enter the number of times to repeat the test of “Pattern 1” to “Pattern 15”, taken as a whole.

NOTE

- Up to 2000 whole cycles including [Repeat] and [Loop] may be set.

4.3.3 [Predischarge/Pattern 1 to Pattern 15] property

This subsection describes the specific settings used to determine the kinds of charge-discharge testing actually performed.

Predischarge is described along with the discharge item.

■ Charge

Settings for charge conditions and terminating factors in each mode are described below.

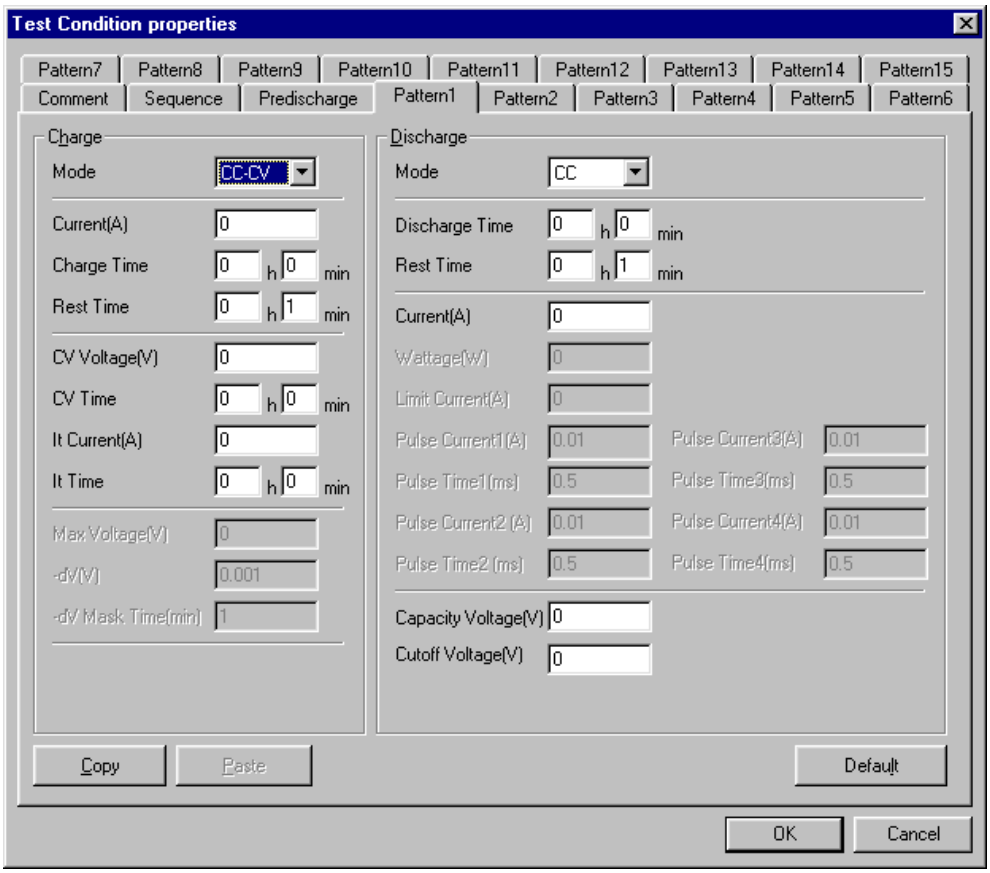


Fig. 15 Pattern 1 to Pattern 15 Properties (Charge)

[Mode] combo box

Enables selection of mode, CC-CV (constant current - constant voltage) or CC (constant current), in which charge is tested.

The setting items related to the mode selected here are available for input.

[Current (A)] box

Enter a charge current value.

[Charge Time (h:min)] box

Enter the charge time. Charge time is one of the factors that can terminate charging. Charge always terminates when this time elapses. When the input is 0:00, charge is skipped.

Input range	0:00 to 999:59 (h:min)

[Rest Time (h:min)] box

Enter the rest time (rest status before shifting to discharge) to follow charging. When the input is 0:00, rest time is skipped.

Input range	0:00 to 999:59 (h:min)

[CV Voltage (V)] box

Enter a CV voltage value. Set a voltage value at which the battery voltage moves to constant voltage (CV) action. This box is settable when the mode is CC-CV.

[CV Time (h:min)] box

Enter CV time. CV time is one of the factors that can determine charging termination. Charging ends when this CV time elapses after constant voltage (CV) action has started. Setting of this box is enabled in CC-CV mode.

Input range	0:00 to 999:59 (h:min)

[It Current (A)] box

Enter an It current value.

Enter a current value to be detected during constant voltage (CV) action. Setting of this box is enabled in CC-CV mode.

[It Time (h:min)] box

Enter the It time. It time is one of the factors that can terminate charging. When this amount of time has elapsed after the It current has been detected, charging ends. Setting of this box is enabled in CC-CV mode.

Input range	0:00 to 999:59 (h:min)

[Max Voltage (V)] box

Enter the maximum voltage value. Maximum voltage is one of the factors that can terminate charging. Charging ends when the battery voltage reaches the maximum voltage. Setting of this box is enabled in CC mode.

[-dV (V)] box

Enter a -dV value. -dV is one of the factors that can terminate charging. Charging terminates if the battery voltage drops by -dV. Setting of this box is enabled in CC mode.

Input range	0.001 to 1.000 (V)

[-dV Mask Time (min)] box

Enter the -dV mask time. Detection of -dV voltage drop will be disabled for the time set here. Setting of this box is enabled in CC mode.

NOTE

- If a test is conducted with the total for charge time and rest time set to 0:00, the sequence of patterns, repeats, and loop may not function properly due to problems related to data processing time. Thus, the total of the charge time and rest time must be set to at least 0:01 (for 1 minute). For example, if you set the charge time to 0:00, rest time must be set to 0:01.

■ Discharge

Settings for discharge conditions and terminating factors in each mode are described below.

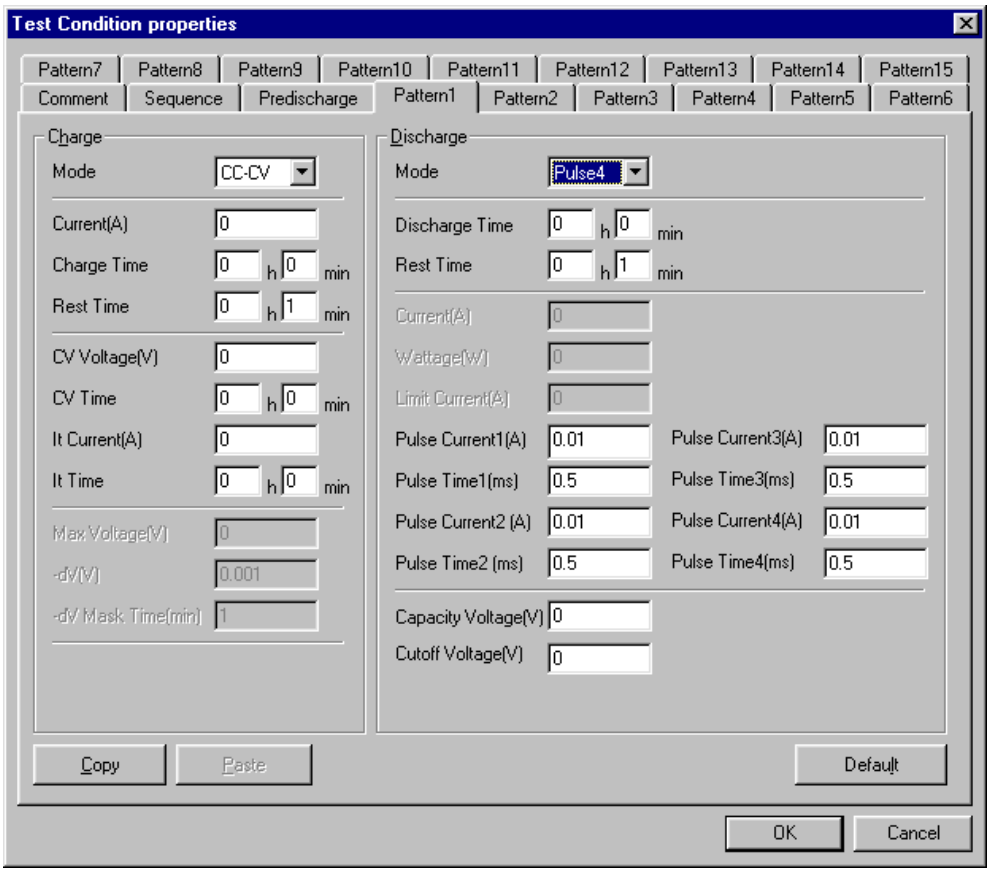


Fig. 16 Pattern 1 to Pattern 15 Properties (Discharge)

Set test conditions related to discharge in this section.

[Mode] combo box

Enables selection of mode—CC (constant current), CP (constant power), pulse 2 (two values), and pulse 4 (four values)—in which discharge is tested. Setting items related to the mode selected here are then available for input.

[Discharge Time (h:min)] box

Enter the discharge time. Discharge time is one of the factors that can terminate discharging. When this discharge time elapses, discharge will terminate even when battery voltage has not yet reached a cutoff voltage. When input is 0:00, discharge is skipped.

Input range	0:00 to 999:59 (h:min)

[Rest Time (h:min)] box

Enter a rest time (rest status after end of discharge) to follow the end of discharge. When the input is 0:00, rest is skipped.

Input range	0:00 to 999:59 (h:min)

[Current (A)] box

Enter a discharge current value. Setting of this box is enabled only in CC mode.

[Wattage(W)] box

Enter a discharge wattage value. Setting of this box is enabled only in CP mode.

[Limit Current (A)] box

Enter a limit current value. Setting of this box is enabled only in CP mode.

[Pulse Current 1 to 4 (A)] boxes

Enter pule current 1 to 4 values. Pulse Current 1 and 2 can be set when in Pulse 2 mode, while Pulse Currents 1, 2, 3, and 4 may be set in Pulse 4 mode.

[Pulse Time 1 to 4 (ms)] boxes

Enter pulse time 1 to 4 values. Pulse Time 1 and 2 can be set when in Pulse 2 mode, while Pulse Time 1, 2, 3, and 4 may be set in Pulse 4 mode.

[Capacity Voltage (V)] box

Enter a capacity calculation voltage. Capacity calculation voltage is described later.

[Cutoff Voltage (V)] box

Enter a cutoff voltage. The cutoff voltage is one of the factors that can terminate discharging. Discharging terminates when the battery voltage reaches the cutoff voltage, even when discharge time remains.

NOTE

- If a test is conducted with the total for discharge time and rest time set to 0:00, the sequence of patterns, repeats, and loop may not function properly due to problems related to data processing time. The total for discharge time and rest time must be set no lower than 0:01 (for 1 minute). For example, if you set the discharge time to 0:00, rest time must be set to 0:01.

■ Capacity Voltage

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

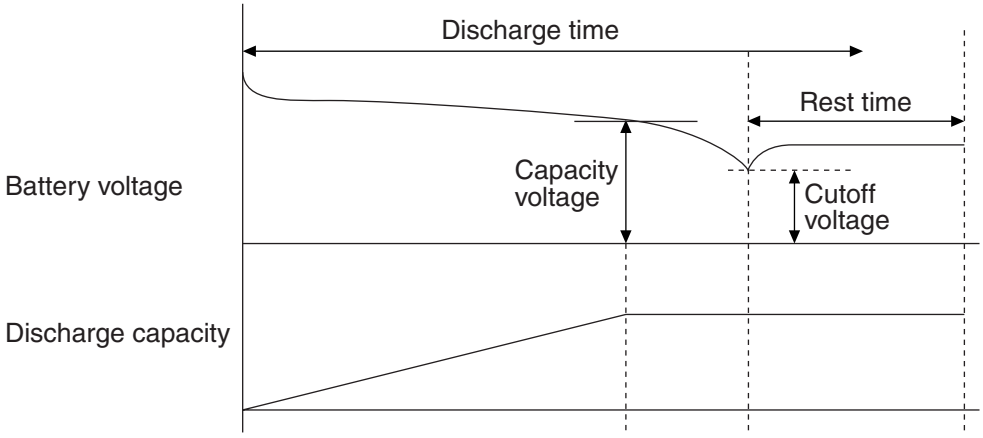


Fig. 17 Calculation of Total Discharge Capacity, terminating at the Capacity Voltage

This capacity voltage must be set in any discharge mode.

In constant-current pulse discharge mode, the capacity voltage is determined based on the Low voltage.

■ For all Pattern 1 to Pattern 15 properties

[Copy] button

Copies and saves pattern data (charge-discharge data) to the clipboard.

[Paste] button

Pastes clipboard contents to the current pattern data.

[Default] button

Clears pattern data. Selecting this button sets rest time (h:min) for charge to 0:01, rest time (h:min) for discharge to 0:01, and all other items to 0.

4.4 Storing a File

After creating the test conditions, click the [OK] button to close the Test Conditions Property screen. If any conflicts are found in the data range or other test conditions information, an alarm message is displayed. To correct conflicts, follow the prompts given on the screen.

To save the test conditions, select [Save] or [Save As] from the [File] menu. The file name extension will be ".tst".

A test data file created by the "Test Executive" uses the file name specified here.

4.5 Test Condition Editor Menus

Menu		Function
File	New	Creates new test conditions.
	Open...	Opens an existing Test Condition Editor file. Files that may be opened have a (*.tst) extension.
	Close	Closes the test conditions file being edited.
	Save	Saves the edited test conditions data, overwriting the original file (if it exists).
	Save As...	Lets you specify a name for saving a new test conditions data file, or saves test conditions data under a new name. Save an existing file under a new name to leave the original file unchanged. Selecting [Save As] does not close the file; you may continue editing the file just saved.
	Save As Text	Let you specify a file name for saving test conditions data in text format. The extension for a text format file is (*.txt).
	Print...	Prints test conditions data.
	Print Preview	Provides an on-screen preview of the data (test conditions) printout. - About print preview: Some printer drivers may not return correct character widths for certain font types, such as TrueType, resulting in longer lines in the print preview screen (possibly falling off the right margin of the page) than would actually be printed. However, data will print properly in actual printing.
	Print Setup...	Allows selection of a printer and a printing method. The particular items that need to be set depend on the particular printer.
	Exit	Closes the current test conditions file and exits the Test Condition Editor. Before exiting, it allows you to save the test conditions data just edited.
Edit	Copy Text	Copies and saves test conditions data to the clipboard in text format.
	Cut	Cuts and saves test conditions data.
	Copy	Copies and saves test conditions data.
	Paste	Pastes data saved by [Cut] or [Copy] to the current test conditions data.
View	Toolbar	Switches between displaying and hiding the toolbar.
	Status bar	Switches between displaying and hiding the status bar.
Test Condition	Properties	Allows you to create test conditions.
Run	Test Executive	Starts the Test Executive under the current editing conditions, immediately carrying out a test under these test conditions. [NOTE] If the "Test Executive has failed to run" is displayed, the correct startup path may not have been set. Start the Test Executive manually and select [Run] - [Test Executive] again from the Test Condition Editor to enable automatic registration of the Test Executive path; the Test Executive will start up normally from the next time.
Window	Cascade	Overlays windows by incrementally shifting their screen position. This arrangement shows each window title bar, allowing quick selection of any window.
	Tile Horizontally	Tile windows horizontally. All windows are displayed, without overlap.
	Tile Vertically	Tile windows vertically. All windows are displayed, without overlap.
	Arrange Icons	Arranges icons at equal intervals, horizontally and vertically.
	Close All	Closes all windows.

Chapter 5 Performing Tests

Test Executive

This chapter describes test screens and procedures involved in running the tests.

5.1 Introduction

The Test Executive application runs charge-discharge tests according to test conditions files created in the Test Condition Editor.

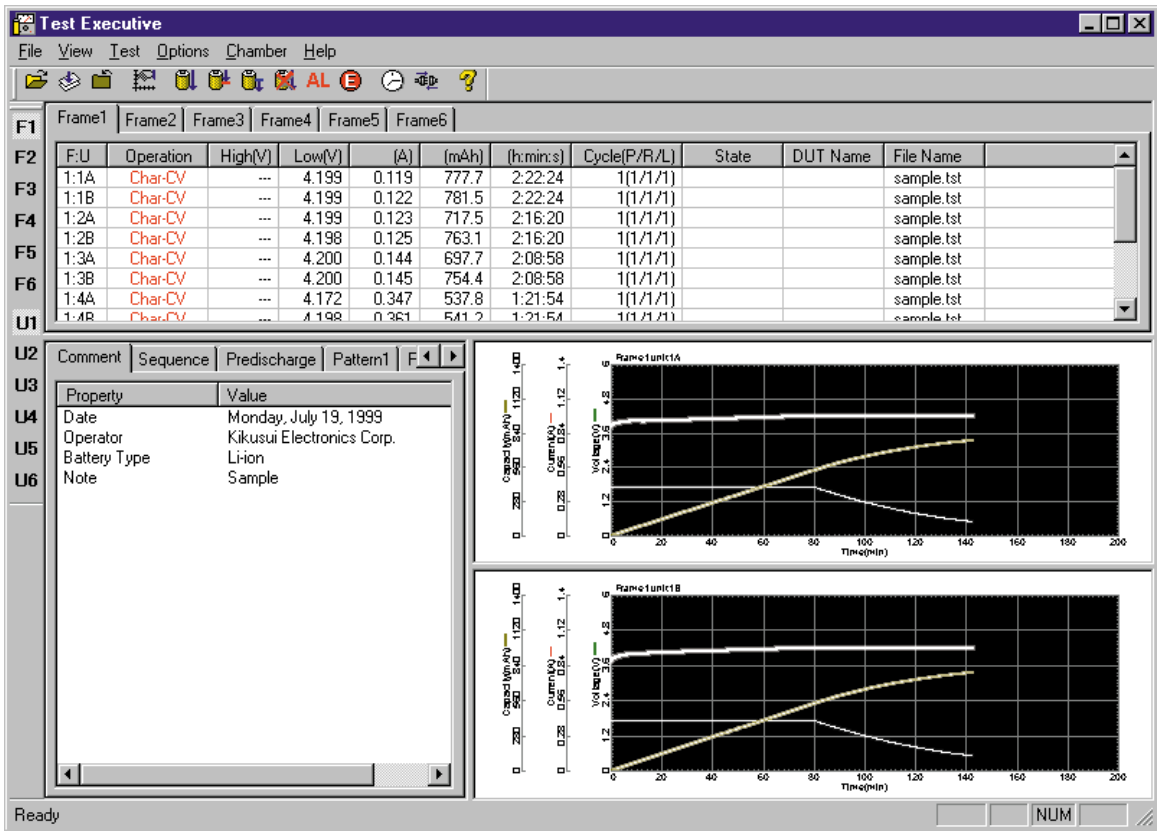


Fig. 18 Test Executive Main Screen

The Test Executive consists of three windows.

1. Monitoring window

Called the monitoring window, the upper window displays real-time data for current, voltage, and other values for six frames (the update time can be set using [Monitor Data Update Interval] from the [Options] menu).

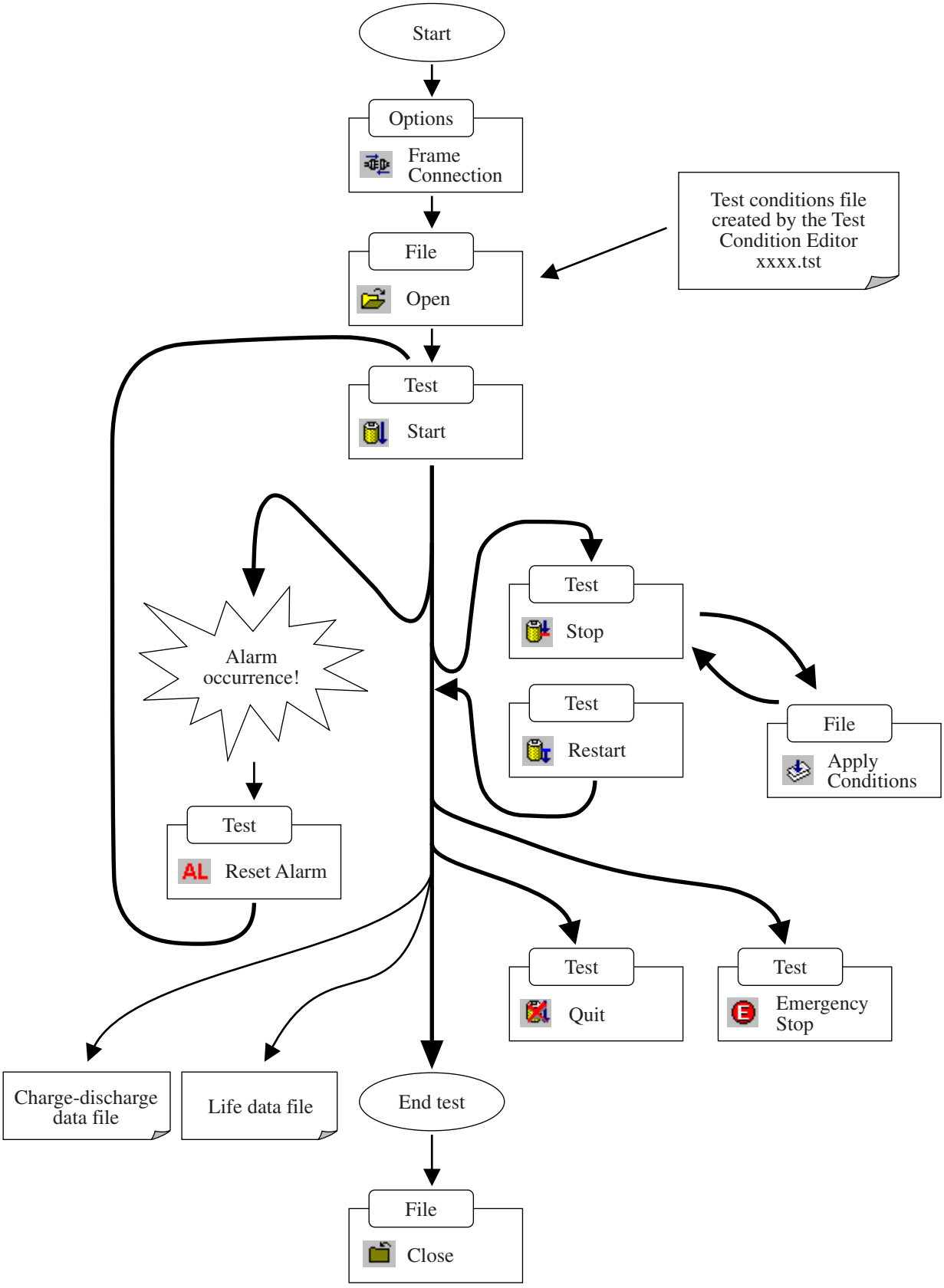
2. Test conditions window

The window at the lower left is called a test condition window. It displays test conditions for a selected unit (a unit may be selected from the [View] menu).

3. Real-time window

The window at the lower right is a real-time window that displays graphs of voltage and current in real-time while the selected unit operates. Real-time graphs are displayed in separate top and bottom parts, with the top part displaying a graph for channel A of the unit and the bottom part showing a graph for channel B. No graph is displayed in the bottom section when the frame is used in 6-channel configuration.

5.2 Operational Flowchart



5.3 Starting the Test Executive

The Test Executive is capable of controlling a maximum of six frames, identifying frames to be controlled at startup.

If power to a frame is off or a GPIB address has been specified incorrectly, the frame cannot be identified and will fall outside the list of frames to be controlled.

Confirm that a frame is connected by checking the [State] item in the following dialog box (it should indicate “Connected” at the relevant frame).

This Frame Connection dialog box may be opened by selecting [Frame Connection] from the [Options] menu.

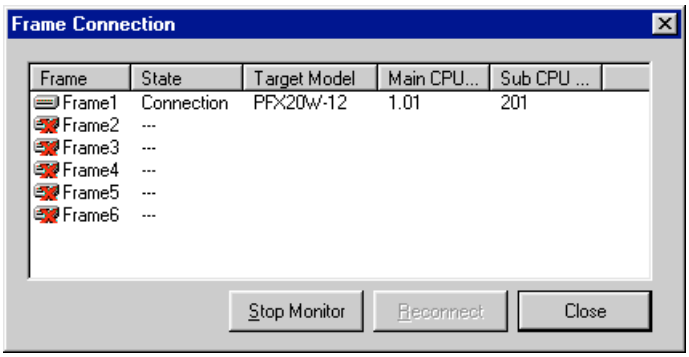


Fig. 19 Checking the Frame Connection

If a frame that needs to be connected is not indicated as “Connected” in this dialog box, reconfirm that power for the frame is on, the GPIB address setting is correct, and that the GPIB cable has been connected properly, then press the [Stop Monitor] button in the Frame Connection dialog box.

The [Reconnect] button becomes selectable; press the [Reconnect] button. Recheck the connectable frames.

5.4 Setting and Running the Test Conditions

5.4.1 Setting the test conditions

Before performing a test, you need to assign to the units a test conditions file (extension: *.tst) created by the Test Condition Editor.

To assign a test conditions file, select [Open] from the [File] menu.

Select a file name from the dialog box displayed. Select the test conditions file created by the Test Condition Editor.

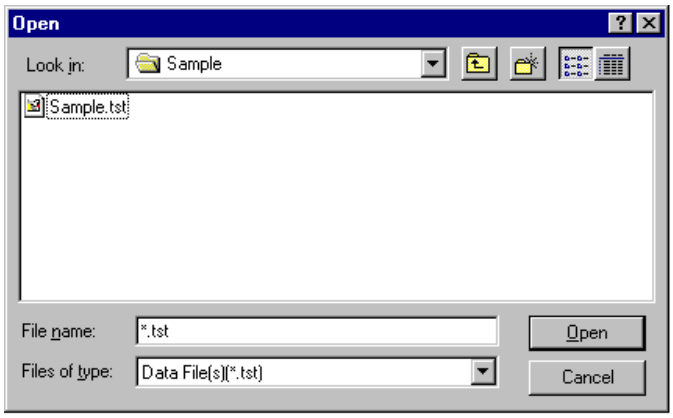


Fig. 20 Opening a File

Set the units to which the selected test conditions file is to be assigned. You may not select a unit currently performing a test.

If you start the Test Executive directly from the Test Condition Editor, the file selection step is omitted, and the procedure begins from this section.

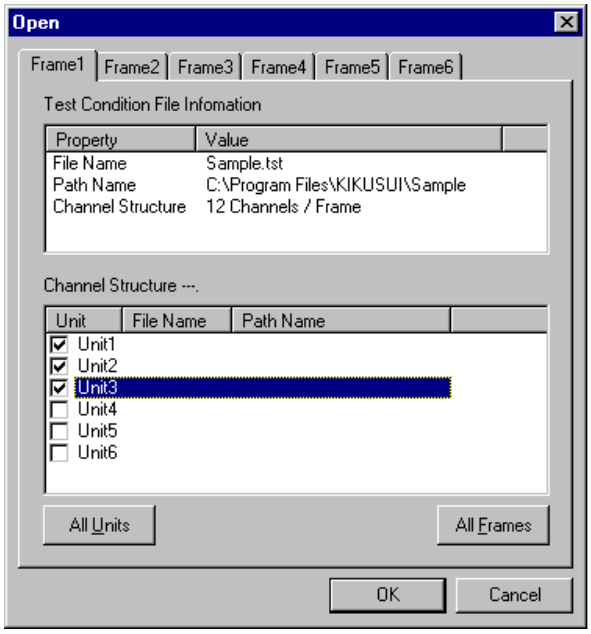


Fig. 21 Selecting a Frame and the Units for Which the File is Opened

5.4.2 Running the test

The test can be run after the test conditions are assigned to the unit.

Select [Start] from the [Test] menu. The following dialog box appears to the unit.

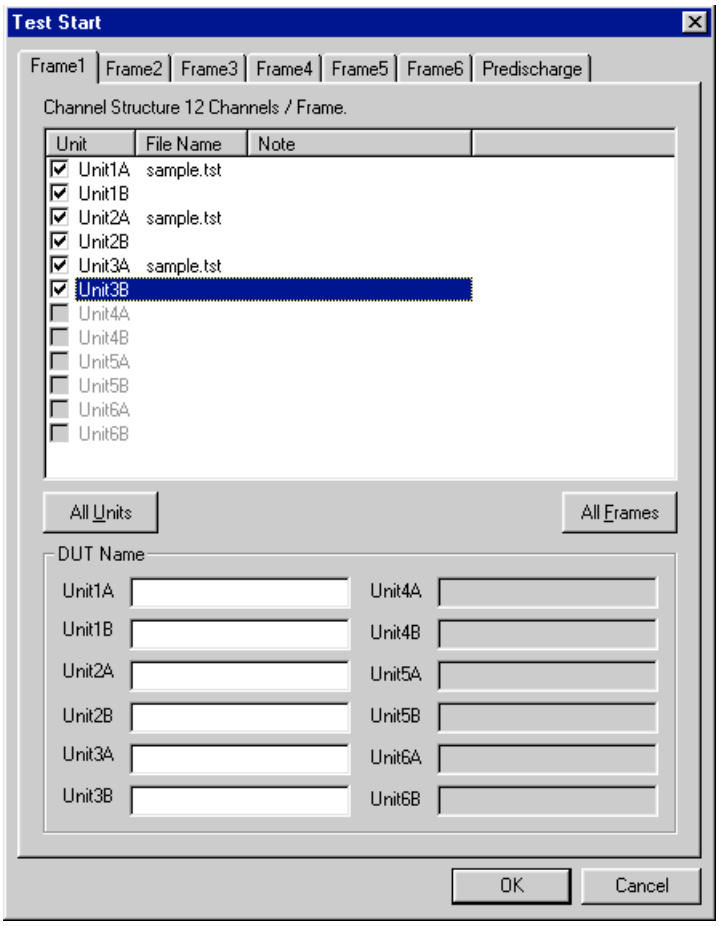


Fig. 22 Selecting a Frame and the Units for which the Test is Run

Select the units to run. You may select only those with assigned test conditions.

The units that may be run allow entry of up to 16 characters into [DUT Name] for comments. Comments entered here are printed by the CD Data Graph application (described later).

When starting the test beginning at charge, press the [OK] button after selecting the object units.

If you wish to start the test from predischarge, open the Predischarge property page to check the “Do Predischarge” check box, then press the [OK] button.

The test starts in the selected units.

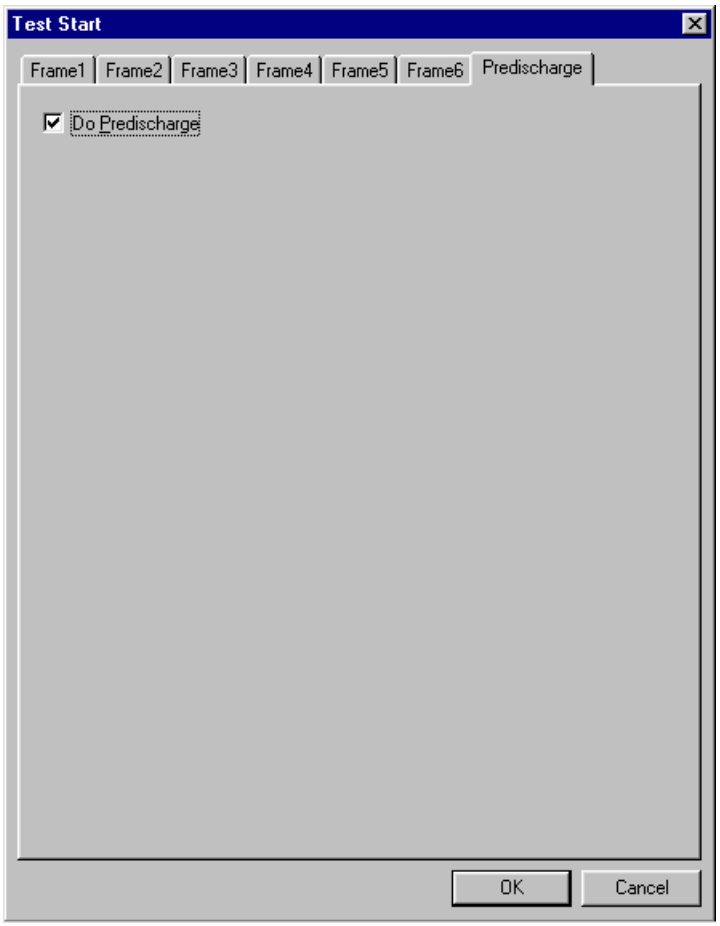


Fig. 23 Check This Item When Starting the Test at Predischarge

5.4.3 Quitting the test

To quit the test, select [Quit] from the [Test] menu. The following dialog box appears.

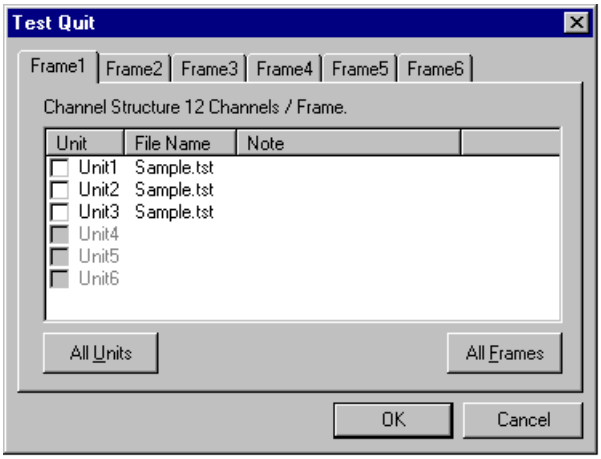


Fig. 24 Selecting a Frame and the Units at which the Test is Quitted

The test quits once a unit has been selected.

5.4.4 Pausing the test

To pause the test, select [Stop] from the [Test] menu. The following dialog box appears.

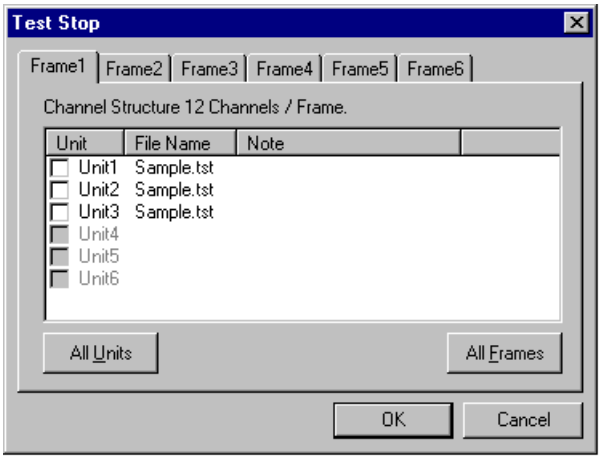


Fig. 25 Selecting a Frame and the Units at which the Test is Paused

When you set the unit at which you wish to pause the test, the test pauses when the current cycle is complete, with this state persisting until the test is resumed or quitted.

5.4.5 Resuming the test

To restart the test previously paused, select [Restart] from the [Test] menu. The following dialog box appears.

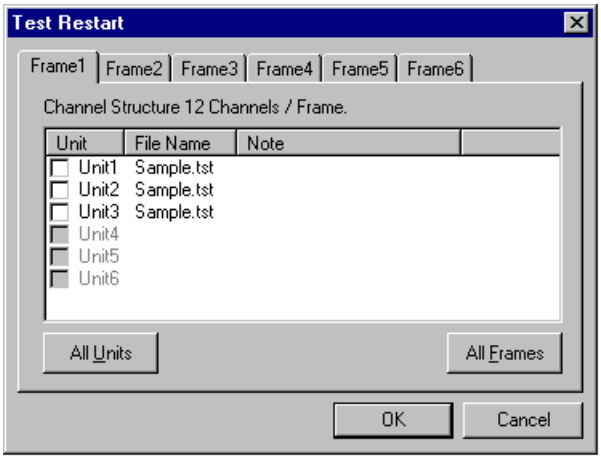


Fig. 26 Selecting a Frame and the Units at which the Test is Resumed

In this dialog box, select only those units that have been paused. Once you select the object units, the test restarts. When the test is restarted after the test have been paused for a long time, characteristics of batteries may have changed.

5.5 Functions Related to the Screen Display

5.5.1 How to view the monitoring window

[F:U]

Indicates frame and unit numbers. With the frame configured to operate in 12-channels, the units are identified by assigning “A” or “B” to their numbers. To switch frames, select [Frame] from the [View] menu.

[Operation]

Indicates the operational state for each channel. The items to be indicated and their meaning are given below:

Indication	Description
Idle	Waiting state
Sidle	Waiting state for synchronisation
PDis-CC	Predischarge - constant current
PDis-CP	Predischarge - constant power
PDis-Pulse	Predischarge - pulse
PDis-Power Limit	Predischarge - power limitation
PDis-Rest	Predischarge - rest
PDis-Sync	Predischarge - synchronization
Char-CC	Charge - constant current
Char-CV	Charge - constant voltage
Char-Rest	Charge - rest
Char-Sync	Charge - synchronization
Disc-CC	Discharge - constant current
Disc-CP	Discharge - constant power
Disc-Pulse	Discharge - pulse
Disc-Power Limit	Discharge - power limitation
Disc-Rest	Discharge - rest
OHP	CD board OHP (overheat protection) activated
PS/B	PS board error
CD/B	CD board error
OVP	OVP (overcharge protection) activated
UVP	UVP (overdischarge protection) activated
OAH	OAH (overcharge capacity protection) activated
Connection Error	DUT connection error
----	Frame/unit has been disconnected, or SRQ switch is off.

[High (V), Low (V), (A), (mAh), (h:min:s)]

Indicates voltage (V), current (A), capacity (mAh), and charge-discharge times (h:min:s) for batteries.

NOTE

- The High (V) column denotes High (V) data emitted only during pulse discharge, displaying "---" emitted during any charge or discharge other than pulse discharge.
- The Low (V) column denotes Low voltage emitted during pulse discharge, or steady-state voltage emitted during any charge or discharge other than pulse discharge.
- The current value for pulse discharge shows an average current calculated from the set pulse current value and the value of the pulse time width. This value is also used to calculate battery capacity.
- The PFX20W-12's current measuring capability does not assure an accuracy of 2 mA or below. Thus, if a measured current value is less than 2 mA, capacity will not be calculated to avoid measurement error.

[Cycle (P/R/L)]

Displays the total number for test cycles, pattern, repeat, and loop being executed.

[State]

Displays the pause state or the state in which a test was terminated. This state is cleared when the test resumes.

Indication	Description
Pause	Test is being paused.
-END-	Normal termination, according to setting conditions
Quit	Termination due to selection of Stop or Emergency Stop
Life	Termination due to life judgement
OHP	Stop due to tripping of OHP (overheat protection) of CD board
PS/B	Stop due to PS board error
CD/B	Stop due to CD board error
OVP	Stop due to tripping of OVP (overcharge protection)
UVP	Stop due to tripping of UVP (over discharge protection)
OAH	Stop due to tripping of OAH (overcharge capacity protection)
Connection Error	Stop due to DUT connection error
Communication Error	Stop due to frame power failure or a GPIB error
CPU error	Stop due to frame CPU error
AC Line	Stop due to sudden AC power line failure

[DUT Name]

Displays the DUT name entered when selecting a unit to run a test.

[File Name]

Displays file name for a test conditions file.

5.5.2 Changing the update time of the monitoring window

The data update time for the monitoring window can be set to 3, 6, 15, or 30 seconds by selecting [Monitor Data Update Interval] from the [Options] menu.

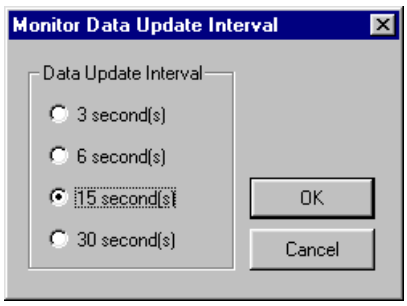


Fig. 27 Changing the Monitoring Data Update Interval

5.5.3 Changing the axes for the real-time data

Select [Graph Scale] from the [View] menu to change the vertical (Y) and horizontal (X) axes of the graphs displayed.

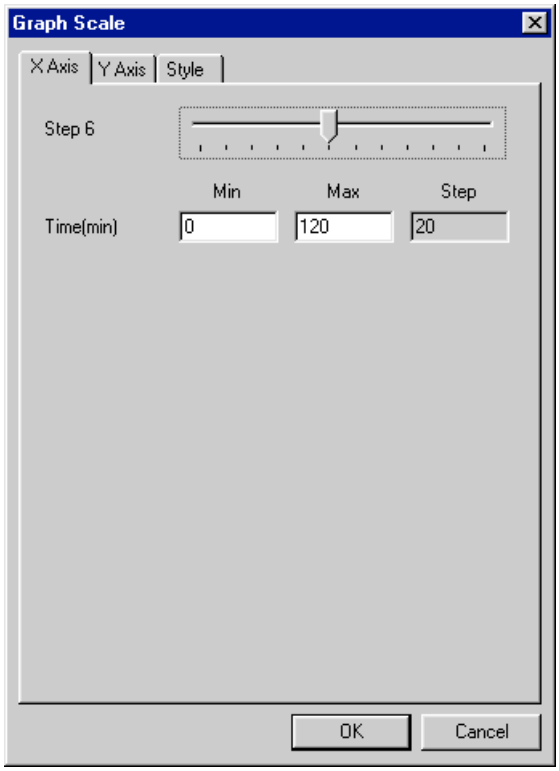


Fig. 28 Screen for Changing Graph Axes

The Graph Scale properties sheet consists of the “X axis”, “Y axis”, and “Style” pages.

■ Setting items in the [X Axis] and [Y Axis] properties

[Step] slider

Adjust the slider knob to change the number of axis scale marks. The number of divisions that may be set range from 1 to 12.

[Min], [Max] and [Step] boxes

For the X axis page, enter the minimum and maximum values for the time axis of graphs.

For the Y axis page, enter the minimum and maximum values of graphs of voltage, current, and capacity.

The present value per division is displyed at the [Step] box.

■ Setting items in the [Style] property

[Grid] check box

Check this check box to superimpose grids upon graphs.

[Step] slider

Set the size of the grid squares by moving the slider knob. The number of divisions that may be set is 2, 4, and 5.

[Pen Width]

Sets the width of the pen of the data.

[Back Color, Axis Color, Axis Width]

Sets the Back Color, Axis Color and Axis Width of Graph.

5.6 Reconnecting a Frame

If a frame issues a GPIB communications error due to defects, power supply problems, or other reasons, the Test Executive automatically shuts off the connection for the frame where the communications error occurred, in order to continue tests on other frames.

To reconnect the frame, follow the procedure below.

1. – When multiple frames are connected, pause all channels currently running tests.
2. – Select [Frame Connection] from the [Options] menu to open the Connect Frame dialog box.

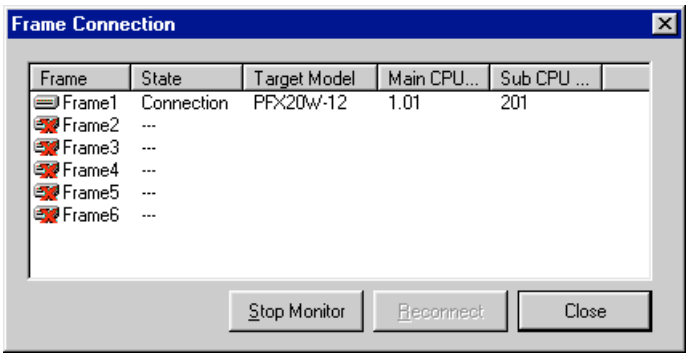


Fig. 29 Connect Frame Dialog Box

3. – Press the [Stop Monitor] button. Then press the [Reconnect] button and confirm that “Connected” is indicated at the relevant frame. After checking the frame connections, press the [Close] button to close the dialog box.
4. – Select [Restart] from the [Test] menu to restart the test.

Precautions for reconnection

- When multiple frames are running tests, set all channels concerned to pause state, then reconnect. This is done to maintain testing continuity for the channels through which tests are being run.
- Resolve the error or problem in the frame whose connection has been shut off, then reconnect.

5.7 Resuming the Previous Test

If a test is terminated in midcourse under the following conditions, the Test Executive allows you to resume this test when it is launched.

Conditions of termination under which a test may be resumed:

1. The Test Executive is terminated by setting all channels running tests to pause state by selecting [Stop] from the [Test] menu
2. If the personal computer power supply is interrupted for some reason, such as power failure
3. If the power supply for a frame running a test is shut down, resulting in a GPIB communications error

NOTE

- If the power supply for the frame was shut down, set the channels for the frames currently running tests without problems to pause state, then exit the Test Executive.

If channels exist through which the test may be continued, the Test Executive displays the following dialog box, on being launched. To continue testing, select [Yes] in this dialog box.

If you select [No], the Test Executive starts by resetting continuity information.

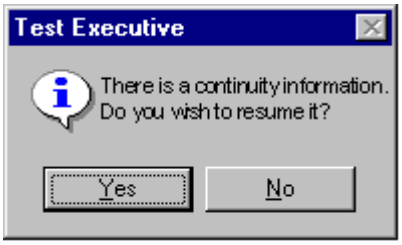


Fig. 30 Dialog box displayed if a channel exists through which a continuation test may be resumed when the Test Executive is started

The dialog box allowing selection of units to resume testing is displayed. Select the channels through which the test is to be resumed in this dialog box.

To carry out discharge before resuming the test, open the Predischarge property page and click the check box. This performs a preliminary discharge first, then resumes the test.

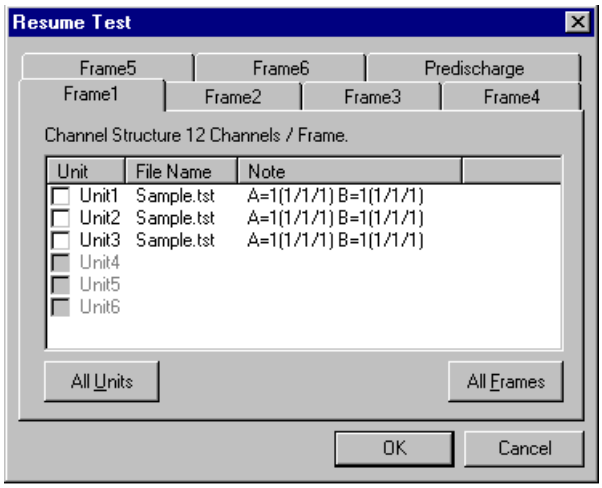


Fig. 31 Selecting the Frame/Units to Resume Testing

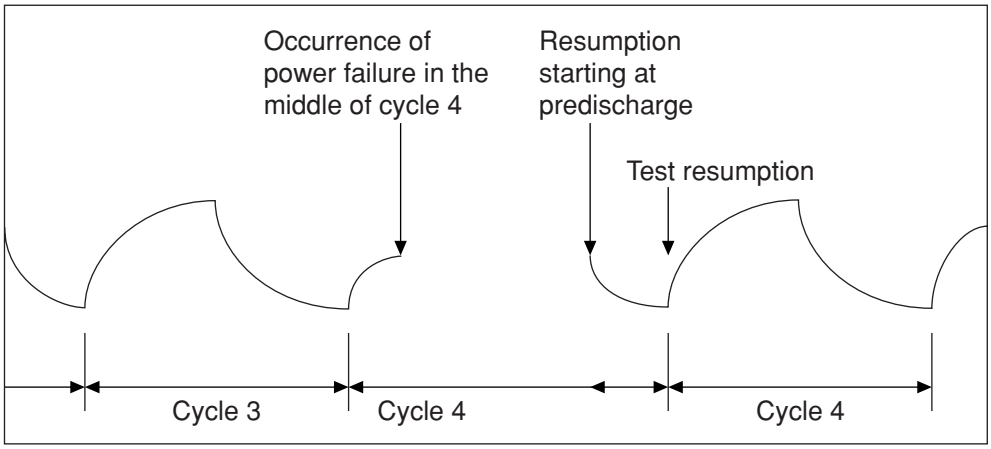


Fig. 32 Illustration of Resumption after a Power Failure

The capacity of the cycle when the test was restarted without a predischarge becomes a smaller one. Note that the capacity of a cycle depends on conditions at a power failure. It is reason why the battery is not in a condition after a discharge was paused, but is in a condition that the battery was charged to a certain extent. When the test was restarted with a predischarge, characteristic of a battery may be back to conditions near to initial one. The Test Executive can adjust the number of cycle at restarting a test after a power failure, but cannot correspond to a change of characteristic of a battery.

5.8 Changing Test Conditions during a Test

A function within the Test Executive allows you to change test conditions for a unit in the middle of testing.

To modify test conditions during a test, set the unit to pause state by selecting [Stop] from the [Test] menu.

Start the Test Condition Editor and change the test conditions file assigned to the unit. In this case, the object items are the contents of the test of “Pattern 1” to “Pattern 15” for charge and discharge.

Altering this sequence renders the Test Executive incapable of updating the test conditions file.

After changing the test conditions file, select [Apply Condition] from the [File] menu.

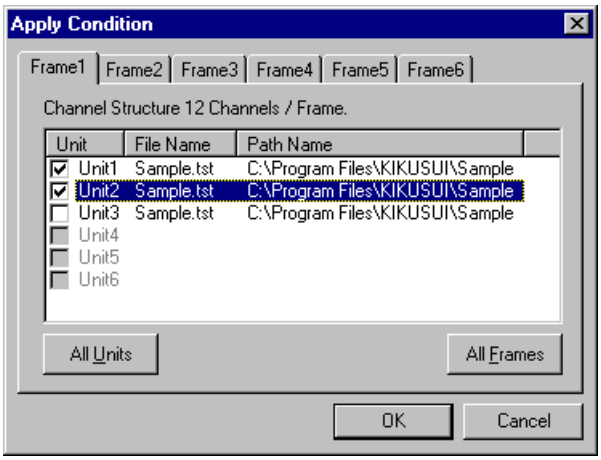


Fig. 33 Selecting the Frame/Units Whose Test Conditions are to be Updated

In this dialog box, you may check only those units whose test conditions may be updated. Specify a unit whose test conditions file is to be updated and press the [OK] button. This completes the update.

Select [Restart] from the [Test] menu to resume testing.

5.9 Testing in Synchronization with a Temperature Chamber

The Test Executive allows a test to be carried out in synchronization with a temperature chamber on a per-frame basis.

Performing testing synchronized with a temperature chamber requires the following.

- Equipment required (manufacturer: TABAI ESPEC CORP.)
  1. Protocol converter PMS-CA or PMS-CG
  2. Temperature chamber controllable by a protocol converter

- Setting the protocol converter and temperature chamber
  1. Protocol converter GPIB address: 10
  2. Temperature chamber address: 1

NOTE

- For information on connections between the protocol converter and temperature chamber, see the operation manual for those pieces of equipment.

When the operation requirements are met, turn on the protocol converter and temperature chamber power switches before starting the Test Executive.

Once launched, the Test Executive identifies and initializes the connected temperature chamber system.

If the Test Executive is unable to identify the chamber, open [Properties] from the [Chamber] menu. The Temperature Chamber property appears as shown in Fig. 34.

You cannot edit any conditional settings related to the test synchronized with the temperature chamber.

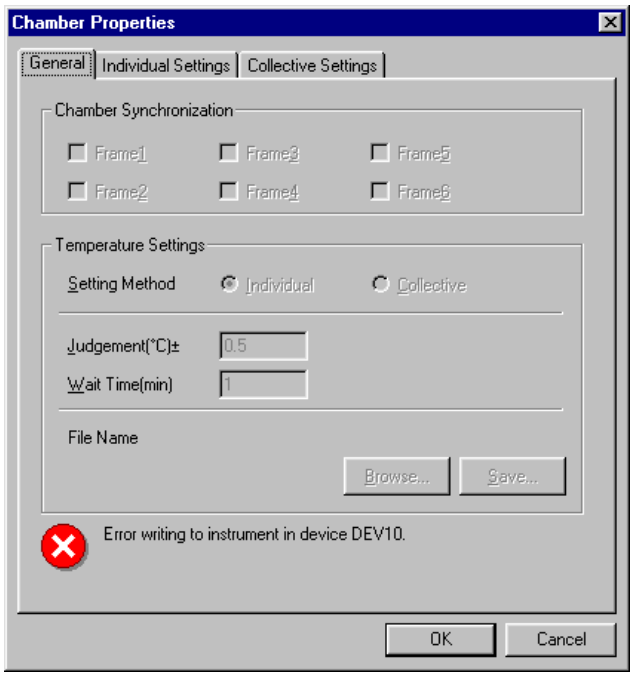


Fig. 34 Screen Showing Conditions under which Synchronized Testing with the Temperature Chamber is Disabled

When the temperature chamber system is connected correctly, the setting items for each property become valid.

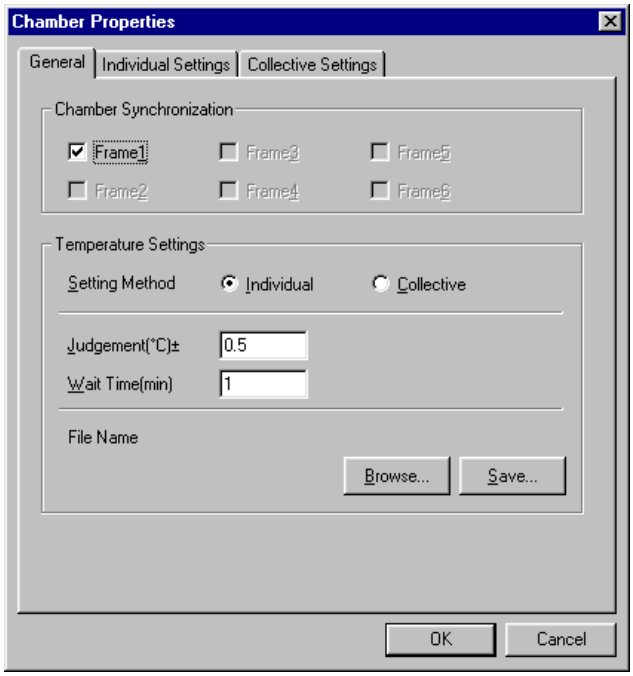


Fig. 35 Screen Showing Conditions under which the Test Synchronized with the Temperature Chamber is Enabled

The Temperature Chamber properties consist of the “General,” “Individual Settings,” and “Collective Settings” pages.

The following provides detailed information for each property page.

5.9.1 [General] property

In the General property page, specify a frame to run a test in synchronization with the temperature chamber, select the method for setting the temperature for synchronization with the chamber, and browse and save a temperature chamber test conditions file.

[Chamber Synchronization] check box

Check a frame that runs a test in synchronization with the temperature chamber. All channels of the frame checked will conduct the synchronization test.

A frame cannot be specified for the test synchronized with the temperature chamber under the following conditions:

1. A frame is already running a charge-discharge testing.
2. There is no object frame.

[Setting Method] radio buttons

You can select the method for setting temperatures for the temperature chamber. Select either individual or collective settings.

The setting method selected here determines which setting conditions for “Individual Settings” or “Collective Settings” property apply to synchronization with the temperature chamber.

The individual settings and collective settings are described in the following subsections.

[Judgement (°C) ±] and [Wait Time (min)] boxes

For “Judgement,” enter a temperature at which the counting of waiting time starts as the temperature of the temperature chamber approaches a set temperature.

For “Wait Time,” set the time taken by temperature chamber to stabilize after reaching the judgement temperature. A charge-discharge test starts when the time set in this box has elapsed.

Set a temperature on “Individual settings” or “Collective settings” property page.

At the setting temperature is 40 °C and the judgement temperature is ±0.5 °C, the range from 39.6 °C to 40.4 °C is the range for judgment. The temperature of the temperature chamber changes until it has settled down to the setting temperature. The temperature of the temperature chamber is watched every 15 seconds. Therefore, the wait time may be started when the temperature went across the range for judgment at first, or may not be started until the temperature actually settls down. Set a wait time considering such a time.

	Input range
Judgement (℃) ±	0.0 to 10.0
Wait time (min)	0 to 120

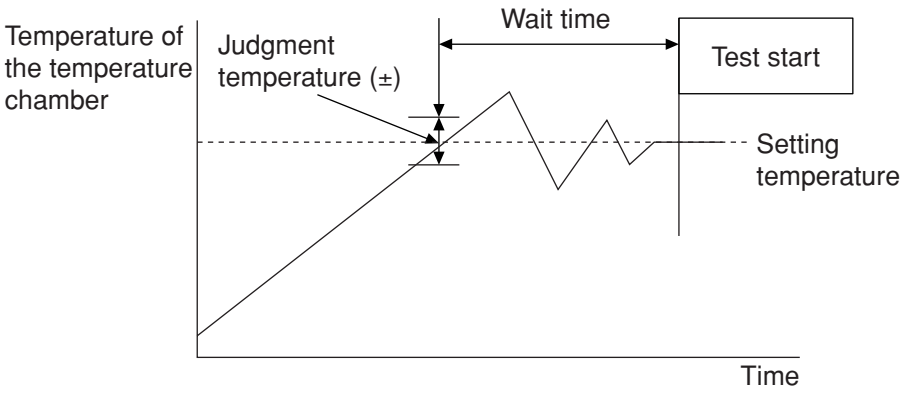


Fig. 36 Illustration of Setting Temperature for the Temperature Chamber and Start of Testing

When the test synchronized with the temperature chamber starts, the following message box is displayed until the temperature of the temperature chamber reaches the “Judgement temperature” and the “Wait time” elapses.

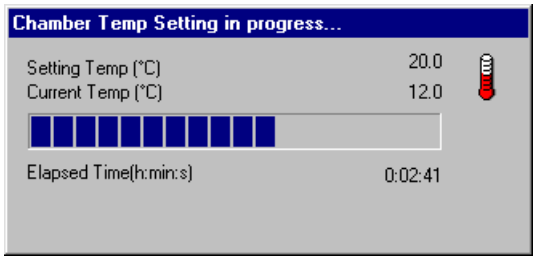


Fig. 37 Message Box Displayed as Temperature of the Temperature Chamber is Brought to the Set Temperature

[Save] button

The setting condition may be saved as a file. Always save the test conditions before starting a test.

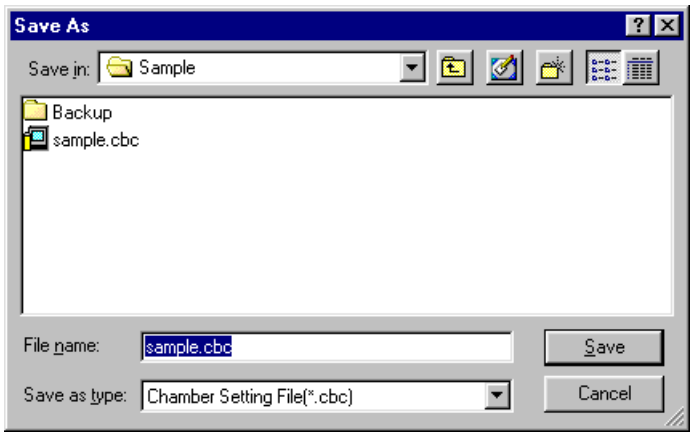


Fig. 38 Saving Temperature Chamber Test Conditions (Extension: .cbc)

[Browse] button

Click this button to load test conditions which are already saved to a file.

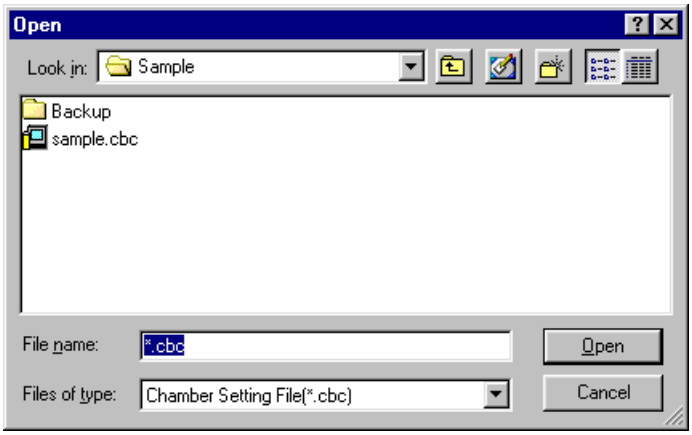


Fig. 39 Browsing a Temperature Chamber Test conditions file

5.9.2 [Individual Settings] property

Individual setting is selected when temperatures of the temperature chamber are changed at points.

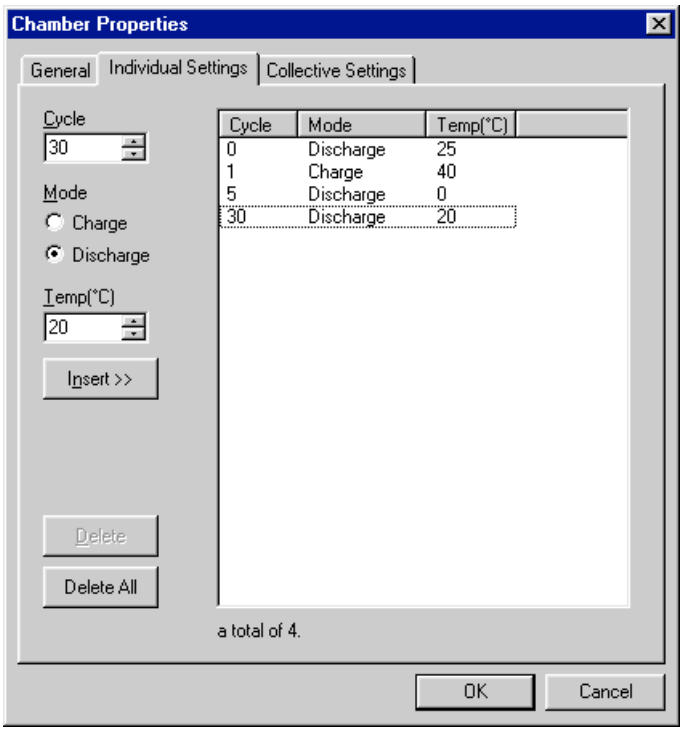


Fig. 40 Individual Settings Property

[Cycle] box

Enter the number of the cycle at which the temperature chamber is set.

[Mode] button

Select either the Charge or Discharge button for [Cycle].

[Temp (°C)] box

Enter the temperature to be set to the temperature chamber.

[Insert] button

Inserts the set values for [Cycle], [Mode], and [Tempe (°C)] to the list. The settings for [Cycle], [Mode], and [Tempe (°C)] set the target temperature the temperature chamber reaches from charge or discharge for the particular cycle. Cycle number 0 is regarded as the predischarge.

For example, when the following are set,

Cycle	Mode	Tempe (°C)
0	Discharge	25
1	Charge	40
5	Discharge	0
30	Discharge	20

temperature of the temperature chamber is raised to 25 °C from cycle 0 (predischarge), raised to 40 °C from cycle-1 charge, lowered to 0 °C from cycle-5 discharge, and then raised to 20 °C from cycle-30 discharge.

[Delete] button

Deletes a specified condition from the list.

[Delete All] button

Deletes all conditions in the list.

5.9.3 [Collective Settings] property

Collective setting is selected when the patterns of temperature chamber temperatures are fixed to some extent in charge and discharge. You can set the temperatures in charge and discharge in a single pattern, and a value for number of repetitions for each pattern.

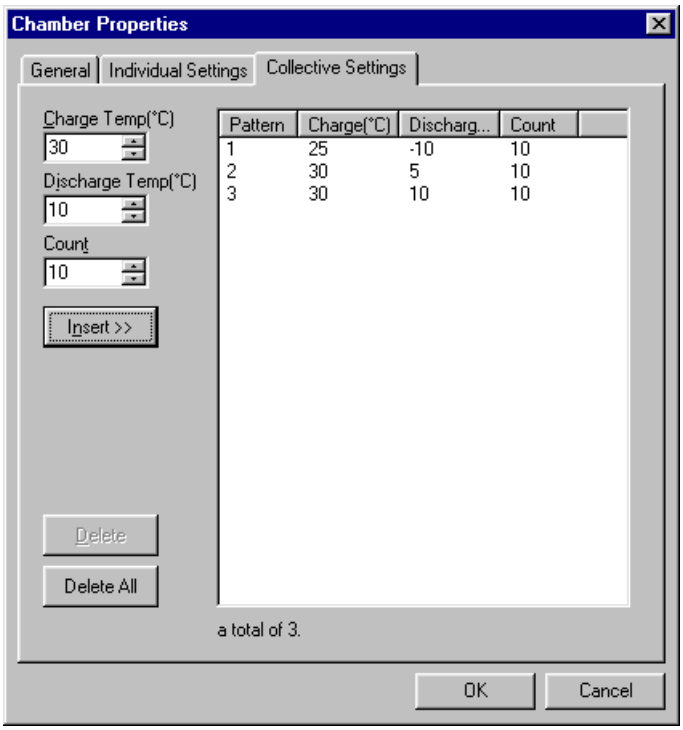


Fig. 41 Collective Settings Property

[Charge Temp (°C)], [Discharge Temp (°C)], and [Count] boxes

Set temperature of the temperature chamber in charge and discharge and the number of times to repeat the patterns of charge and discharge.

	Input range
Charge temperatures (°C) Discharge temperature (°C)	-50 to 100
Count	1 to 2000

For example, when the following are set,

Pattern 1 Charge temp.: 25 °C, discharge temp.: -10 °C, number of times: 10

Pattern 2 Charge temp.: 30 °C, discharge temp.: 5 °C, number of times: 10

Pattern 3 Charge temp.: 30 °C, discharge temp.: 10 °C, number of times: 10

temperature of the temperature chamber can be changed to 25 °C in charge and -10 °C in discharge from cycles 1 to 10, to 30 °C in charge and 5 °C in discharge from cycles 11 to 20, and to 30 °C in charge and 10 °C in discharge from cycles 21 to 30.

[Insert] button

Inserts the set values in [Charge Temp (°C)], [Discharge Temp (°C)], and [Count] to the list.

[Delete] button

Deletes a specified condition from the list.

[Delete All] button

Deletes all conditions in the list.

NOTE

- The maximum number of temperature patterns that may be set in individual settings and collective settings is 100.
- A frame cannot be added to a test synchronized with the temperature chamber while a test is being performed.
- If an alarm occurs in a channel during a test synchronized with the temperature chamber, the test of that channel will be halted at the occurrence of such an alarm. The other channels will continue the test synchronized with the temperature chamber.
- The conditions for a test synchronized with the temperature chamber may be checked but not edited or changed during testing.
- Pay attention to dew condensation in sudden temperature change.

5.10 Graph Data to be Created

The Test Executive saves charge-discharge data for each cycle and life data to data files.

■ Charge-discharge data files

For charge-discharge data files, the test data for one channel of one basic pattern (charge + rest, and discharge + rest) is saved as a single file.

Data files are stored in the folder containing the test conditions file.

Data files are created for patterns for which the [Recording] check boxes in the Sequence page of the Test Condition Properties have been checked.

The last cycle of a test will always be saved as a file, regardless of the setting in the Test Condition Properties.

File names assigned

FUC0001TST.dcd:	**F** =	frame number (1 to 6)
F**U**C0001TST.dcd:	**U** =	unit number (1 to 6)
FU**C**0001TST.dcd:	**C** =	channel number A or B for 12-channel configuration or X for 6-channel configuration
FUC**0001**TST.dcd:	**0001** =	number of accumulated cycles (0000 to 2000)
FUC0001**TST**.dcd:	**TST** =	test conditions file name
FUC0001TST**.dcd**:	**dcd** =	extension dcd or txt (extension differs with the setting of the file format)

The number of accumulated cycles “0000” indicates predischarge data.

■ Life data files

For life data files, the capacity data for the whole charge and discharge of one channel is saved as a single file.

Life data files are stored in the folder containing test conditions files.

Capacity data for all cycles will be saved to a file, regardless of the setting in the Test Condition Properties.

File name assigned

FUCTST.lif:	**F** =	frame number (1 to 6)
F**U**CTST.lif:	**U** =	unit number (1 to 6)
FU**C**TST.lif:	**C** =	channel number A or B for 12-channel configuration or X for 6-channel configuration
FUC**TST**.lif:	**TST** =	test conditions file name
FUCTST.**lif**:	**lif** =	extension lif or txt (extension differs with the setting of the file format)

Files may be saved in binary or text formats, depending on the setting made in the Test Executive. Select [Save File Format] from the [Options] menu and make the desired setting.

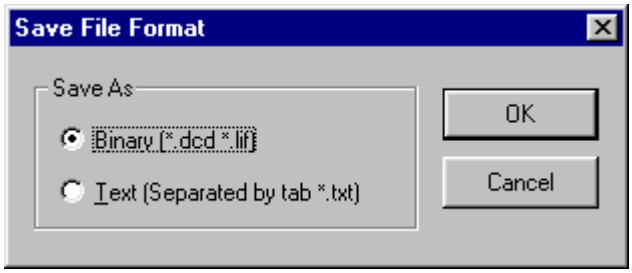


Fig. 42 Selecting the Format of Files to be Saved

[Binary (*.dcd, *.lif)] radio button

Selecting this option saves charge-discharge data and life data in binary format (*.dcd or *.lif), which can be read by CD Data Graph or Life Data Graph.

[Text (separated by tab *.txt)] radio button

Selecting this option saves charge-discharge data and life data in text format, with tab data delimiters.

NOTE

- The file format may not be set during testing.
- When the system saves test data in text format, measured data may not be fully captured, depending on the processing time required to perform the conversion into text format for large data quantities.
- Do not move with the folder(s) and file(s) related to the test during a test. When the folder(s) and file(s) are not found, your system cannot store data.

5.11 Test Executive Menus

Menu		Function
File	Open	Loads a test conditions file into specified frame and unit. Select the page for the specified frame and click the appropriate unit check boxes.
	Apply Condition...	Updates test conditions for specified frame and unit. Select the page of the specified frame and click the appropriate unit check boxes. Test conditions may be updated only for those units that have been paused during testing. For those not currently running a test, a new test conditions file may be created, or an existing one overwritten, by selecting [File] - [Open].
	Close	Closes the test conditions file for specified frame and unit. Select the page of the specified frame and click the appropriate unit check boxes. - Possible reasons file close is disabled: No test conditions data has been loaded. A test is running.
	Exit	Exits the Test Executive. You can exit the Test Executive only when no tests are being carried out or when the units have been paused and are in "Idle" or "Sidle" state (condition where they are in pause state and the current cycle has been complete). If any unit is still running a test, you will not be allowed to exit Test Executive. For tests that were terminated in pause state, the relevant test information is written to the database; the test state can be recovered when the Test Executive is next launched.
View	Frame	Allows you to select from active frames 1 to 6 displayed.
	Unit	Allows you to select from active units 1 to 6 displayed.
	Standard Toolbar	Displays or hides the standard toolbar.
	Frame : Unit Toolbar	Displays or hides the frame & unit toolbar.
	Statusbar	Displays or hides the state bar.
	Graph Scale...	Allows you to set the scale value for real-time graphs.
Test	Start	Starts a test for specified frame and unit. - Possible factors preventing the start of testing: No test condition data has been loaded. A test is running. Sufficient space (at least 3 MB) is unavailable on the data storage drive. The relevant frame or unit is not connected. An alarm has occurred.
	Stop	Pauses the test for specified frame and unit at the current pattern (after resting from discharge). When testing is paused, the "state" column in the monitoring window displays "Pause" at the relevant frame:unit. - Possible factors preventing pause: No test is running.
	Restart	Resumes testing for specified frame and unit previously paused. - Possible factors preventing resumption: No test has been paused.
	Quit	Stops testing for specified frame and unit, saving charge-discharge data and life data, before halting testing. Once the test is stopped, "Quit" appears in the monitoring window. - Possible factors preventing stop: No test is running.

Menu		Function
Test	Reset Alarm...	Resets an alarm occurring at specified frame and unit. A test will be stopped at the instant an alarm occurs, with each error displayed in the "state" column in the monitoring window. - Possible factors disabling use of the check box: No alarm has occurred.
	Emergency Stop	Immediately stops all tests, after saving charge-discharge data and life data. The monitoring window displays "Quit."
Options	Monitor Data Update Interval	Allows you to set the update time for the monitoring window.
	Frame Connection...	Identifies the frames connected and reconnects a frame. If a defect or error occurs at a specific frame, select [Test] - [Quit] to stop the test for the specific frame, then select [Test] - [Stop] to pause all other normal units currently running the test. When those units enter "Idle" state, press the [Stop Monitoring] button to remove the object frame from the GPIB system, then select [Reconnect] and [Test] - [Restart] to resume testing for other units. This allows you to remove the defective frame from the system without aborting the test; it also allows you to add a frame to the system. A Test Executive function permits forcibly shutting off the connection for a frame that has caused a GPIB communications error.
	Save File Format...	Allows you to select the file format for the saved file.
Chamber	Properties...	Allows you to set the conditions for a test synchronized with the temperature chamber.

5.12 Detailed Alarm Information and Appropriate Corrective Action

DUT (battery) protection related alarms

Symbol	Name	ALRM lamp	Description	Remedy
OVP	Overcharge protection	On	DUT (battery) voltage has exceeded an OVP voltage value during testing.	Release by reset alarm.
UVP	Over-discharge protection	On	DUT (battery) voltage has fallen below an UVP voltage value during testing.	Release by reset alarm.
OAH	Overcharge capacity protection	Off	Totalized capacity has exceeded an OAH capacity value during charge testing.	Release by reset alarm.
Connection Error	DUT (battery) connection error	On	DUT (battery) has not been connected properly. Possibly this is the result of an incorrect wire connection with the DUT or poor connections, such as a broken wire. Confirm connections.	Release by reset alarm.

System/hardware-related alarms

*1 If CPU communications errors occur frequently, the frame may be defective. Contact Kikusui distributor/agent.

*2 If the alarm persists even when problems are resolved, the frame may be defective. Contact Kikusui distributor/agent.

Chapter 6 Graphing the Charge and Discharge Results

CD Data Graph

This chapter describes procedures for graphing charge-discharge data (extension: *.dcd) created by the Test Executive, for on-screen display or printout.

6.1 Opening a Charge-Discharge Graph File

Graphs may be displayed either by directly specifying folder and file names or by retrieving a charge-discharge graph file for certain conditions.

6.1.1 Graphing by specifying a file name

To display graphs by specifying a file name directly, select [Open] from the [File] menu.

Select a file name from the displayed dialog box. Specify the name of the folder containing charge-discharge data files created by the Test Executive, and select a desired file. Graphs for the specified file are displayed.

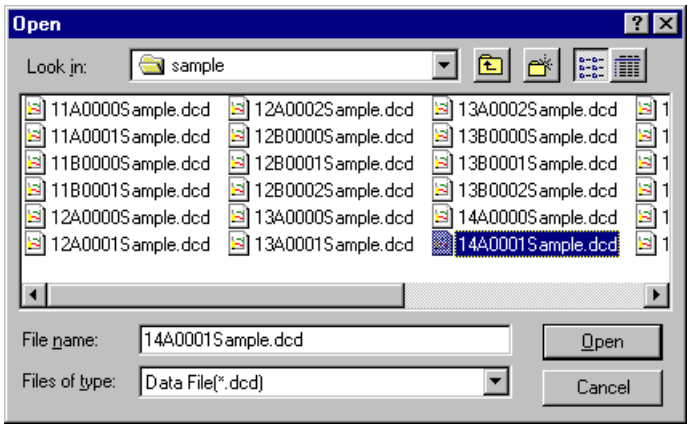


Fig. 43 Opening a Charge-Discharge Graph File

6.1.2 Graphing by retrieving a file

To display graphs by retrieving charge-discharge data files, select [Find File] from the [File] menu. The following Find File dialog box appears.

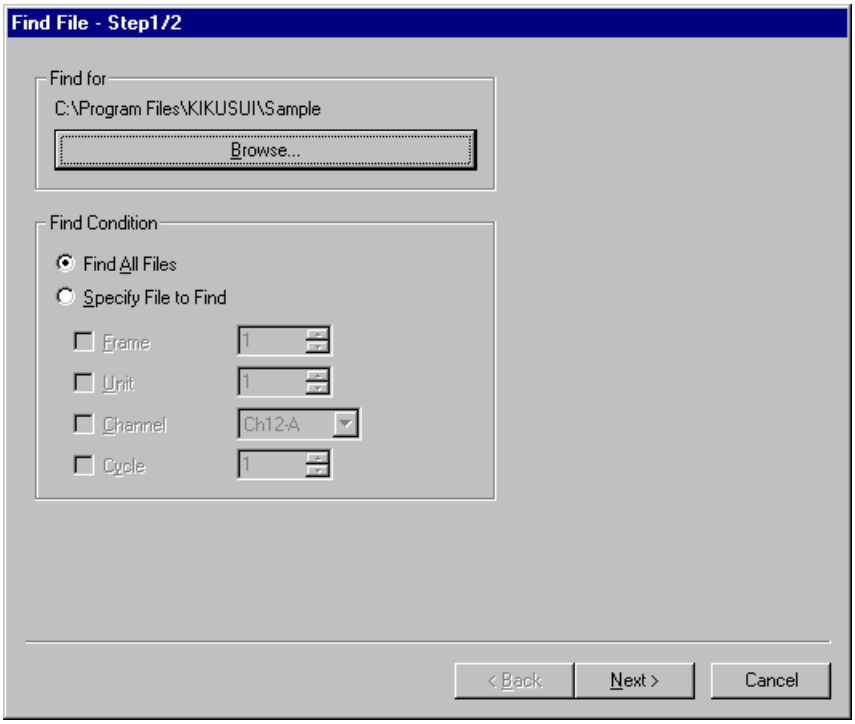


Fig. 44 Finding a File 1/2

Next, click the [Browse...] button at the "Find for" to specify the folder name of the charge-discharge data files created by the Test Executive.

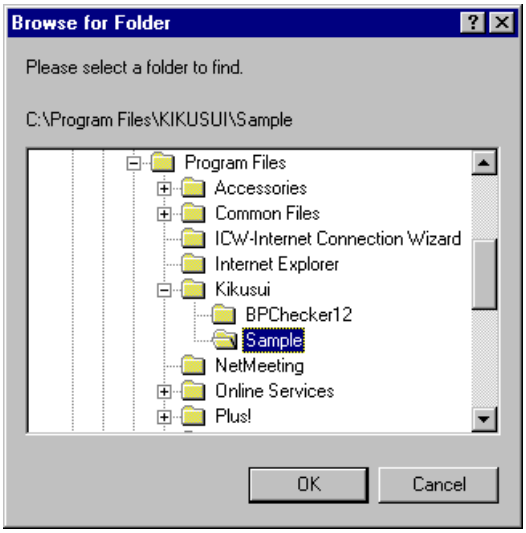


Fig. 45 Specifying the Folder

Specify the folder and click the [OK] button. This returns you to the previous dialog box.

After specifying the folder, set the retrieval conditions. There are two retrieval conditions: a method for “Find All Files” and for “Specify File To Find.”

When you select “Specify File To Find,” the Find File dialog box allows you to specify a frame, unit, channel, and cycle. The CD Data Graph executes retrieval by OR of the condition specified here.

After specifying the retrieval conditions, click the [Next] button. The following dialog box appears, listing the files meeting the retrieval conditions.

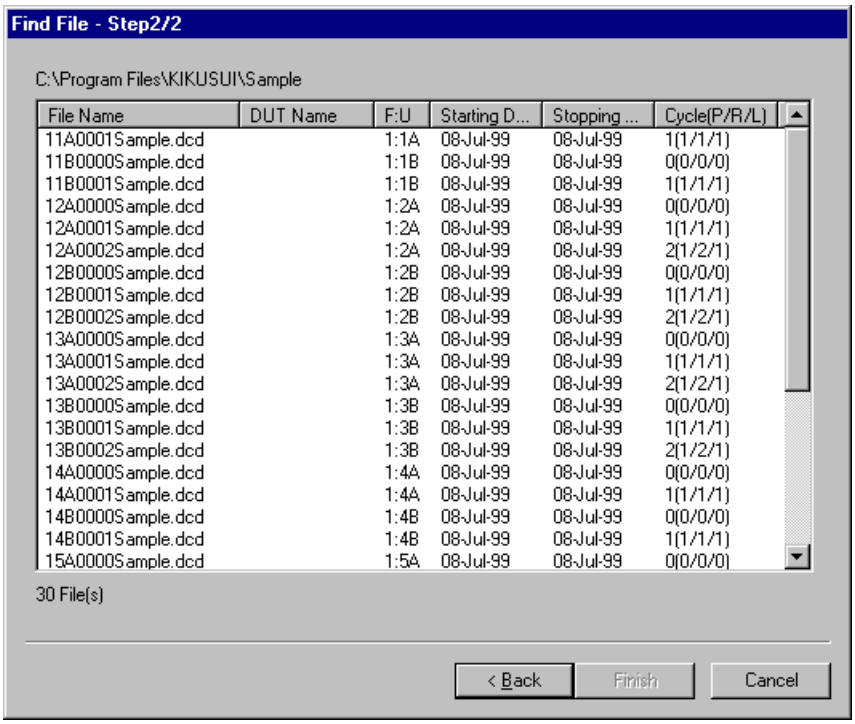


Fig. 46 Finding a File 2/2

Select a charge-discharge data file you wish to graph and click the [Finish] button.

NOTE

- The maximum number of files that may be retrieved is 2000 maximum.

6.2 Displaying Graphs

Graphs display charge and discharge data individually, but shows voltage and current data together. When you first display graphs, the CD Data Graph displays graphs for charge data.

To switch graphs between charge and discharge data, select [Charge Graph]/ [Discharge Graph] from the [View] menu.

The graph types are indicated by color, as shown below:

Voltage → green

Current → red

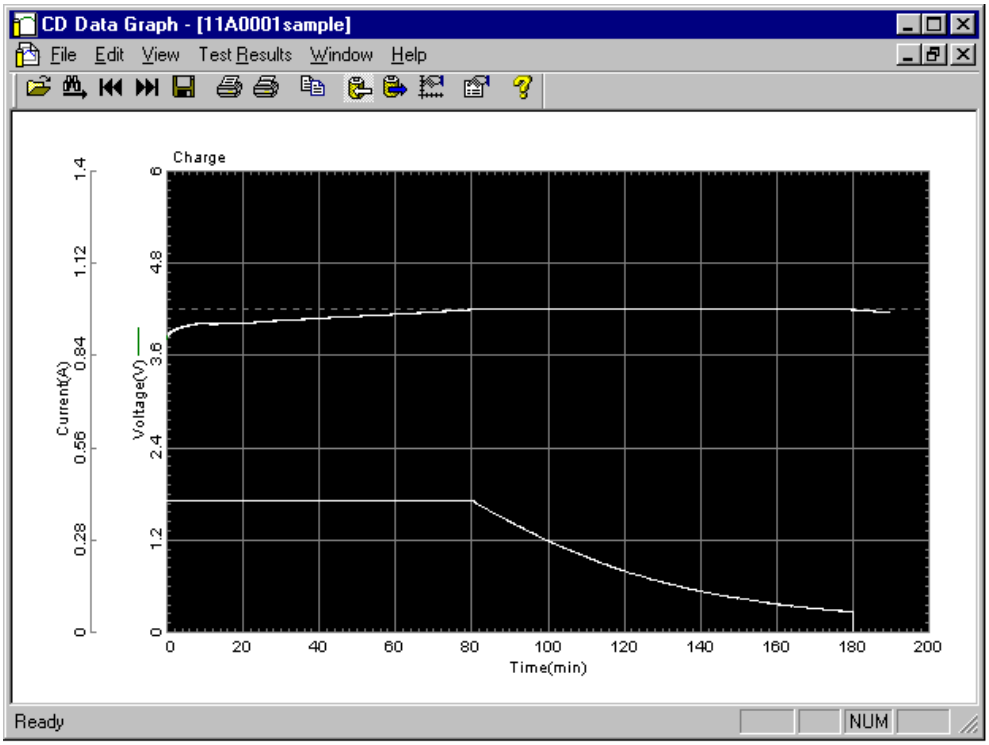


Fig. 47 Graph Display Screen

6.3 Setting Graph Axes

Select [Graph Scale] from the [View] menu to change the formats for the vertical (Y) and horizontal (X) axes of the displayed graphs.

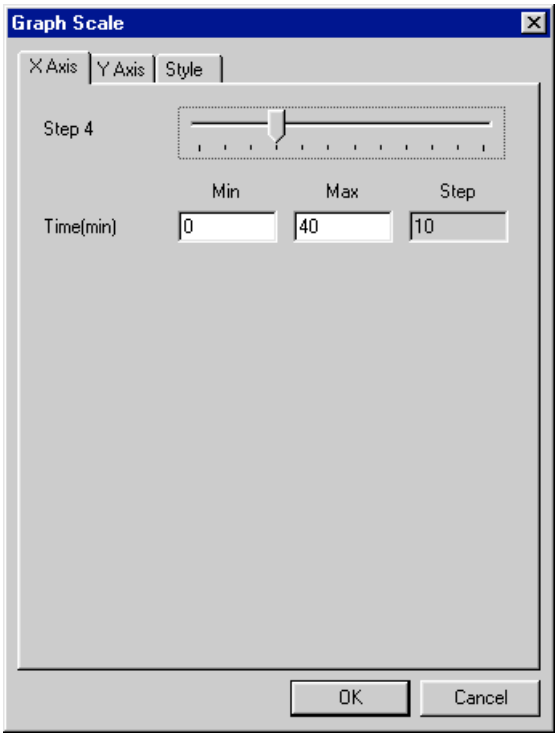


Fig. 48 Screen for Changing the Graph Axes

The Graph Scale properties sheet consists of the “X axis”, “Y axis”, and “Style” pages.

■ Setting items in the [X axis] and [Y axis] properties

[Step] slider

Use the slider knob to set the number of divisions of the axis scale marks from 1 to 12.

[Min], [Max] and [Step] boxes

For the X axis page, enter the minimum and maximum values for the graph’s time axis.

For the Y axis page, enter the minimum and maximum values for graphs of voltage and current.

The present value per division is displyed at the [Step] box.

■ Setting items in the [Style] property

[Grid] check box

Check this check box to superimpose grids upon graphs.

[Step] slider

Use the slider knob to set the size of the grid squares to 2, 4, or 5.

[Pen Width]

Sets the width of the pen of the data.

[Back Color, Axis Color, Axis Width]

Sets the Back Color, Axis Color and Axis Width of Graph.

6.4 Displaying the Test Results

You can browse the test conditions and test results data for the displayed graphs.

To display test results, select [Properties] from the [Test Results] menu.

The Test Result properties sheet consists of the following three pages.

1. “General Info” property page, displaying nominal values for the battery being tested, data recording conditions, and other information
2. “Charge” property page displaying test conditions and test results for charge
3. “Discharge” property page displaying test conditions and test results for discharge

6.4.1 [General Info] property

This property lists the object information for the test data file.

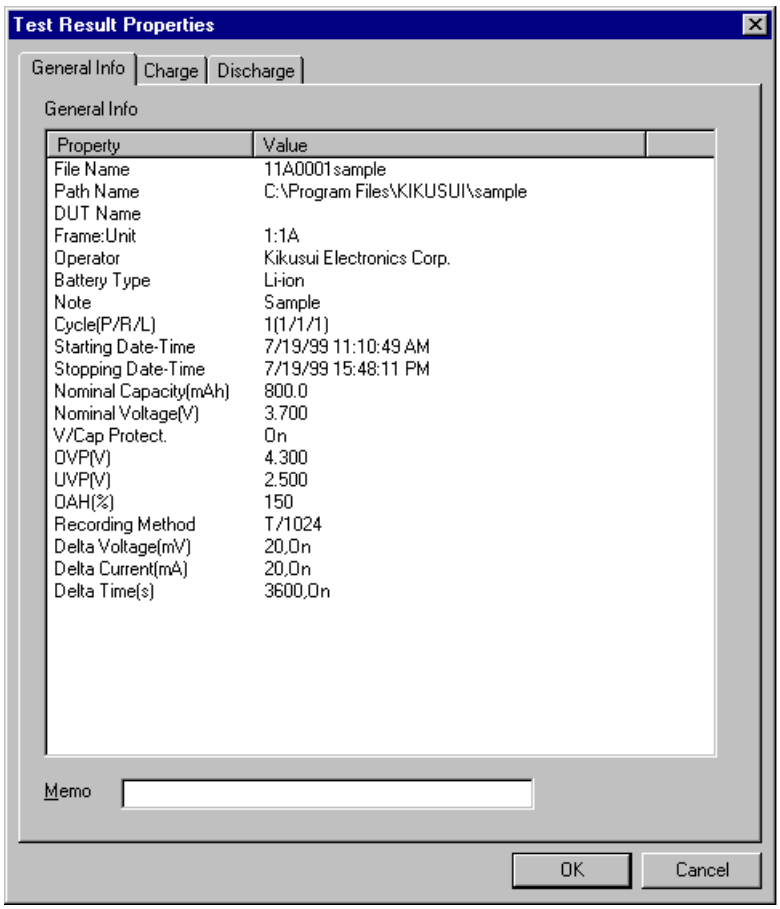


Fig. 49 Test Results of General Info

[Memo] box

Allows entry of up to single-byte 30 characters of comments. A character string entered here is displayed in the memo item in printing.

6.4.2 [Charge] property

This property displays the test conditions and test results for charge.

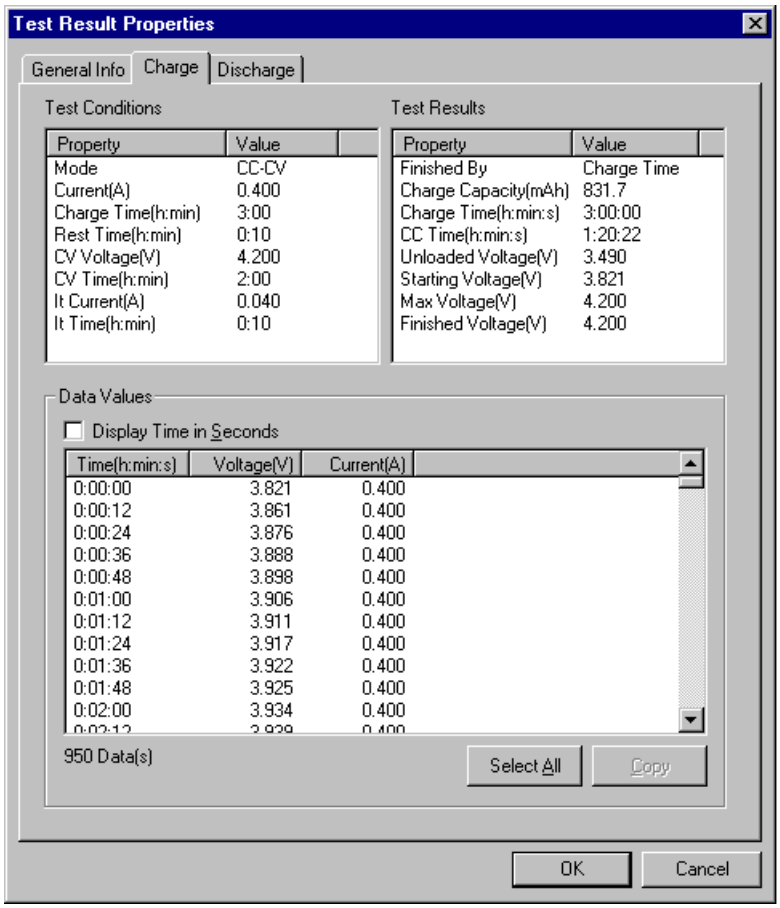


Fig. 50 Test Results of Charge

■ Test Results

This section displays the results for charge testing.

Test result item	Description
Finished By	Max. time: Charge ends at charge time. Max. voltage: Charge ends at the maximum voltage. CV time: Charge ends at CV time. It time: Charge ends at It time. -dV: Charge ends due to a voltage drop of -dV. OAH: Stop due to tripping of OAH (overcharge capacity protection) Connection Error: Stop due to DUT connection error PS/B: Stop due to PS board error OHP: Stop due to tripping of OHP of CD board CD/B: Stop due to CD board error UVP: Stop due to tripping of UVP OVP: Stop due to tripping of OVP Stop: Stop due to selection of Stop or Emergency Stop Communication Error: Stop due to a GPIB error or power failure CPU error: Stop due to CPU error AC Line: Stop due to sudden AC power line failure ---: Test not carried out ?: Other causes
Charge Capacity	Capacity value
Charge Time	Charge time
CC time	Elapsed time during shift from constant current (CC) to constant voltage (CV)
Unloaded voltage	Terminal voltage at no-load conditions about 2 seconds before start
Starting voltage	Terminal voltage about 500 ms after start
Max Voltage	Maximum voltage attained during test
Finished Voltage	Terminal voltage at the end of testing

6.4.3 [Discharge] property

This property displays test conditions and test results for discharge.

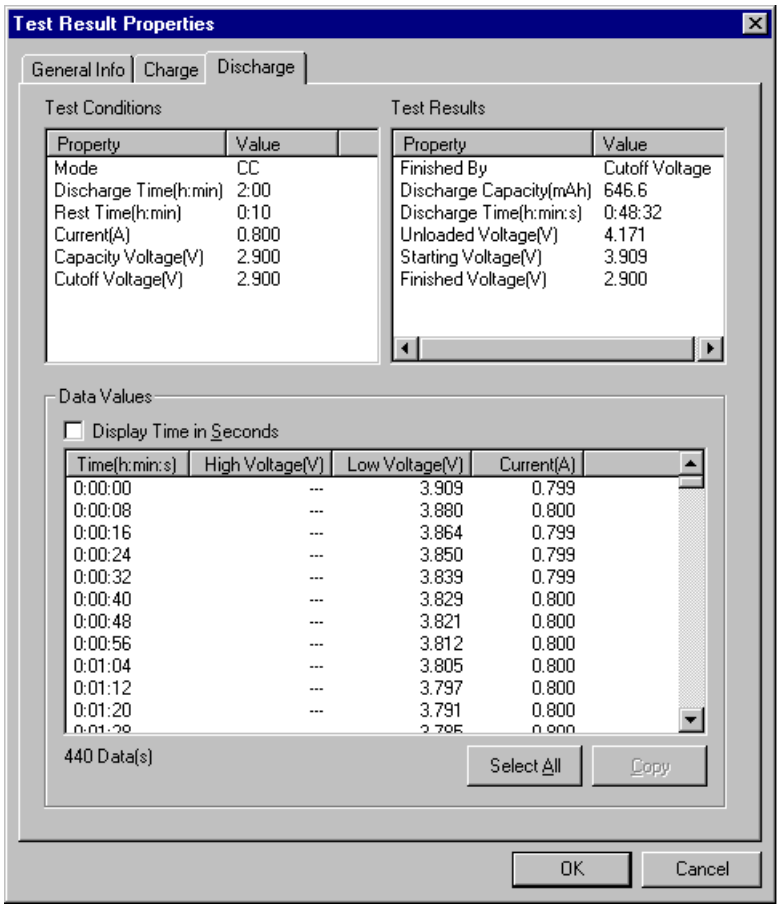


Fig. 51 Test Results of Discharge

■ Test Results

This section displays the results of discharge testing.

Test result item	Description
Finished By	Cutoff voltage: Discharge ends at the cutoff voltage of test conditions. Discharge time: Discharge ends at discharge time of test conditions. Connection Error: Stop due to DUT connection error PS/B: Stop due to PS board error OHP: Stop due to tripping of OHP of CD board CD/B: Stop due to CD board error UVP: Stop due to tripping of UVP OVP: Stop due to tripping of OVP Stop: Stop due to selection of Stop or Emergency Stop Communication Error: Stop due to GPIB error or power failure CPU error: Stop due to CPU error AC Line: Stop due to sudden AC power line failure ---: Test not carried out
Discharge Capacity	Capacity value
Discharge Time	Discharge time
Unloaded voltage	Terminal voltage under no-load conditions about 2 seconds before start
Starting voltage	Terminal voltage about 500 ms after start
Starting low voltage	Low voltage at terminals about 500 ms after start
Starting high voltage	High voltage at terminals about 500 ms after start
Finished voltage	Terminal voltage at completion of discharge
Finished low voltage	Low voltage at terminals at completion of discharge
Finished high voltage	High voltage at terminals at completion of discharge

NOTE

- Low and High voltages are not recorded for any discharge other than pulse discharge.

6.5 Pasting Data into Spreadsheet Applications

You can paste charge and discharge data displayed in the Test Result properties to spreadsheet application via the clipboard. Press the [Select All] button in the Test Result properties to select the entire area, then press the [Copy] button to copy the data to the clipboard.

Then select [Paste] from your spreadsheet's [Edit] menu.

6.6 Print

CD Data Graph can print graphs as well as the items displayed in the Test Result properties.

You may print a selected graph (normal printing) or continuously print all graphs displayed in the CD Data Graph screen.

To perform normal printing, select [Print] from the [File] menu.

To perform continuous printing, select [Print Continuous] from the [File] menu. Selecting continuous printing displays the following dialog box.

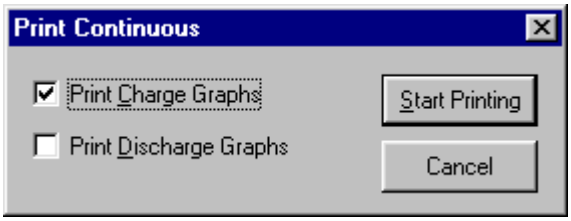


Fig. 52 Selecting Graphs for Continuous Printing

CD Data Graph prints charge-discharge data graphs continuously in all windows according to the graph type checked in this dialog box.

6.6.1 Color Print

CD Data Graph switches between black and white and color printing. To print in color, check [Color Print] in the [File] menu.

When you print in color, voltage and current lines are printed in green and red, respectively, to match the screen display.

6.7 Saving Data in Text Format

All data (in the General Info, Charge, and Discharge pages) observable in the Test Result properties may be saved in text format. Files saved in text format may be opened by word processor or spreadsheet applications.

To save data as text, select [Save As Text] from the [File] menu.

The default file name is a charge-discharge data file name with the ".txt" file extension.

6.8 CD Data Graph Menus

Menu		Function
File	Open	Opens a charge-discharge data file (files having the extension *.dcd).
	Find File	Finds a charge-discharge data file.
	Open Previous Cycle	Opens the file for a cycle preceding the currently loaded file, if one exists. When the 11A0005Tcedt.dcd file is loaded, for example, this command opens the 11A0004Tcedt.dcd.
	Open Next Cycle	Opens the file for a cycle next to the currently loaded file, if one exists. When the 11A0006Tcedt.dcd file is loaded, for example, this command opens the 11A0007Tcedt.dcd.
	Close	Closes the charge-discharge data file.
	Save As Text	Saves charge-discharge data in text format. The text file extension is (*.txt). The command also allows you to specify a name for the charge-discharge data file.
	Print	Prints a charge-discharge data graph.
	Print Continuous	Prints the charge-discharge data graphs in all windows continuously, allowing selection between the data (charge or discharge) to be printed.
	Print Preview	Provides an on-screen preview of print output. - About print preview: Some printer drivers may not correctly reflect the character width of some font types (such as TrueType font). Lines in the print preview screen may flow past the right-hand margin. The actual printout will have correct character widths.
	Printer Setup	Allows you to select a printer and set the printing method. The items to be set depend on the selected printer.
	Color Print	Switches between black and white and color printing. Prints in color when checked.
	Exit	Exits CD Data Graph.
Edit	Copy	Allows you to copy and save charge-discharge data to the clipboard.
View	Charge Graph	Displays voltage and current graphs for charge data (charge + rest).
	Discharge Graph	Displays voltage and current graphs for discharge data (discharge + rest).
	Charge setting Values	On charge graphs, this command displays the set maximum voltage for CC charge, or the set CV voltage for CC-CV charge.
	Toolbar	Displays or hides the toolbar.
	Statusbar	Displays or hides the state bar.
	Graph Scale	Allows you to set scale, grids, and pens for graphs.
Test Results	Properties	Displays test results.
Window	Cascade	Displays overlapping windows, with title bars visible. This display mode allows quick selection of a particular window.
	Tile Horizontally	Displays all windows, tiled horizontally and without overlap.
	Tile Vertically	Displays all windows, tiled vertically and without overlap.
	Arrange Icons	Arranges icons at an equal intervals both horizontally and vertically.
	Close All	Closes all windows.

Chapter 7 Graphing the Life Results

Life Data Graph

This chapter describes how to graph the life data (extension: *.lif) created by the Test Executive, either for on-screen display or for printouts.

7.1 Opening a Life File

To display graphs, you may either directly specify the appropriate folder and file names, or find the file by using certain conditions.

7.1.1 Graphing by specifying a file name

To display graphs by specifying a file name directly, select [Open] from the [File] menu.

In the dialog box, specify the name of the folder containing the charge-discharge data files created by the Test Executive and select a desired life file.

Graphs for the specified file are displayed.

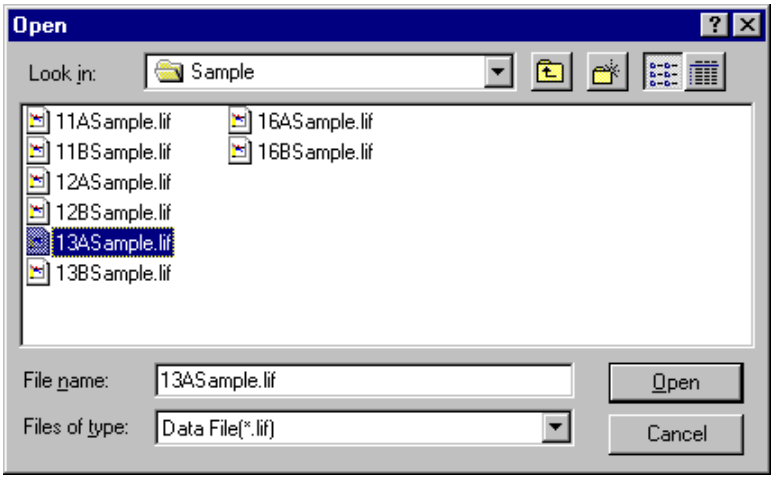


Fig. 53 Opening a Life File

7.1.2 Graphing by retrieving a file

To display graphs by finding a charge-discharge data file using file retrieval conditions, select [Find File] from the [File] menu. The following Find File dialog box appears.

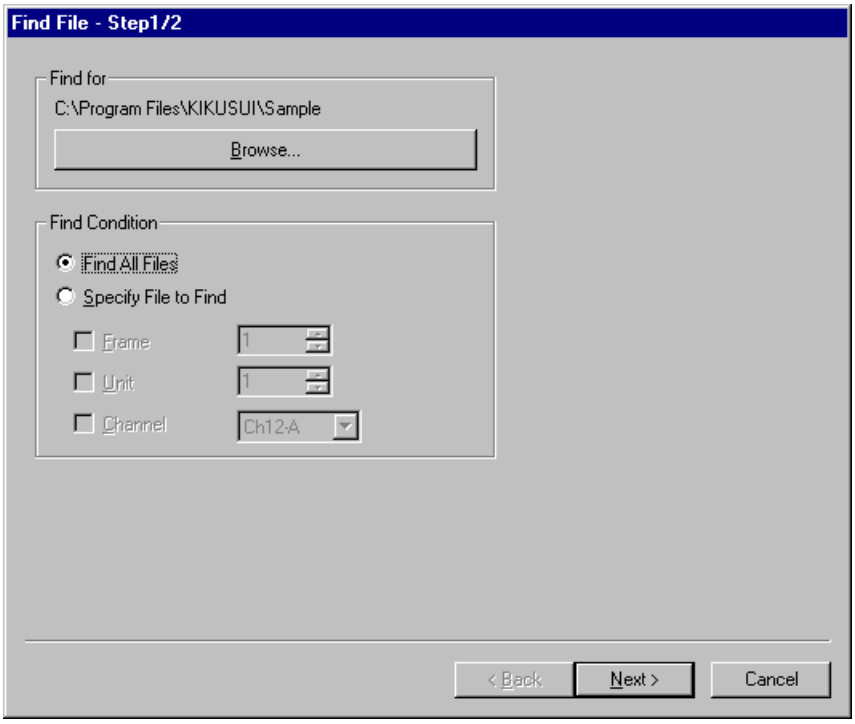


Fig. 54 Finding a Life File 1/2

Click the [Browse...] button at “Find for” to specify the folder name of the charge-discharge data files created by the Test Executive.

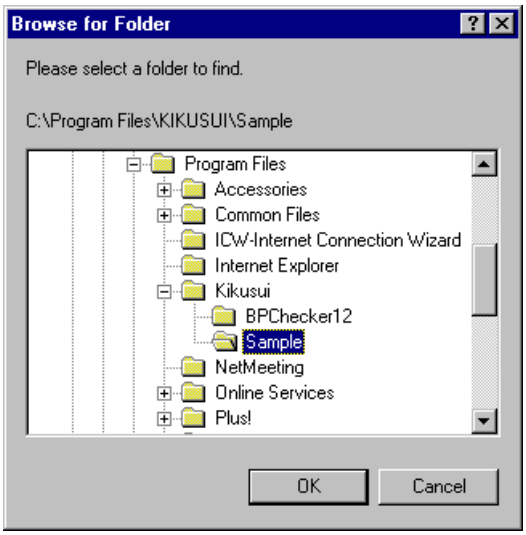


Fig. 55 Specifying the Folder

Specify the folder and click the [OK] button. This returns you to the preceding dialog box.

After specifying the folder, set the retrieval conditions. There are two retrieval conditions: one for “Find All Files” and another for “Specify File To Find.”

When you select “Specify File To Find,” the Find File dialog box allows you to specify a frame, unit, and channel. The Life Data Graph executes retrieval by OR of the condition specified here.

After specifying the retrieval conditions, click the [Next] button. The following dialog box appears, listing all the files that satisfy the retrieval conditions.

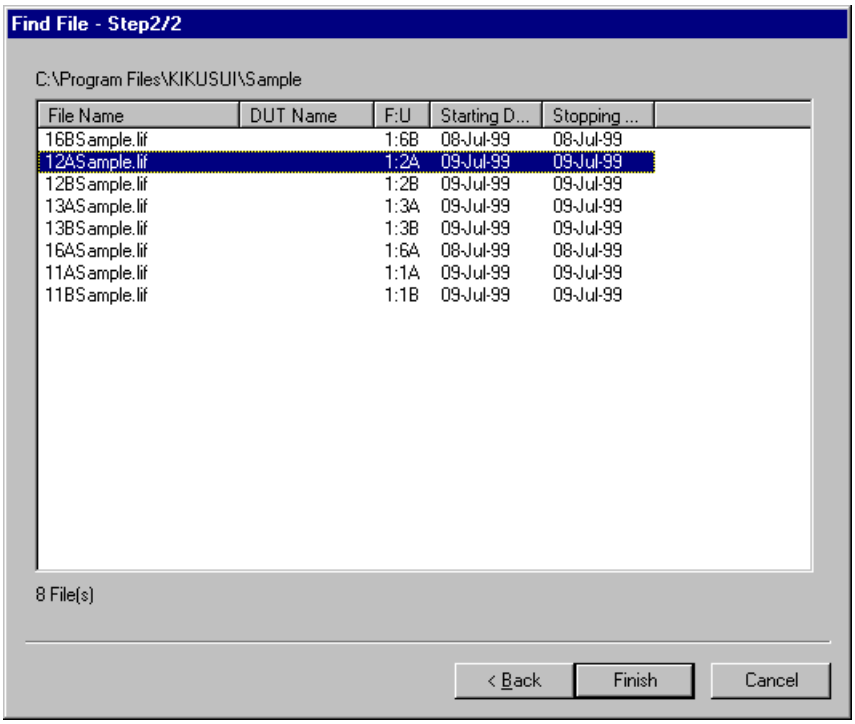


Fig. 56 Finding a Life File 2/2

From the list, select a life data file you wish to graph and click the [Finish] button. Graphs for the selected file are displayed.

NOTE

- The maximum number of files that may be retrieved is 2000.

7.2 Displaying Graphs

Graphs display capacity data for charge and discharge together.

You can select [Capacity Rate 100%]/[Capacity True Value] from the [View] menu to switch the vertical axis (Y axis) between "%" and "Ah" display.

You can also select [Linear]/[Logarithmic] from the [View] menu to switch the horizontal axis (X axis) between "linear" and "logarithmic" display.

Graph types are identified by color, as shown below:

Charge capacity graph → red

Discharge capacity graph → green

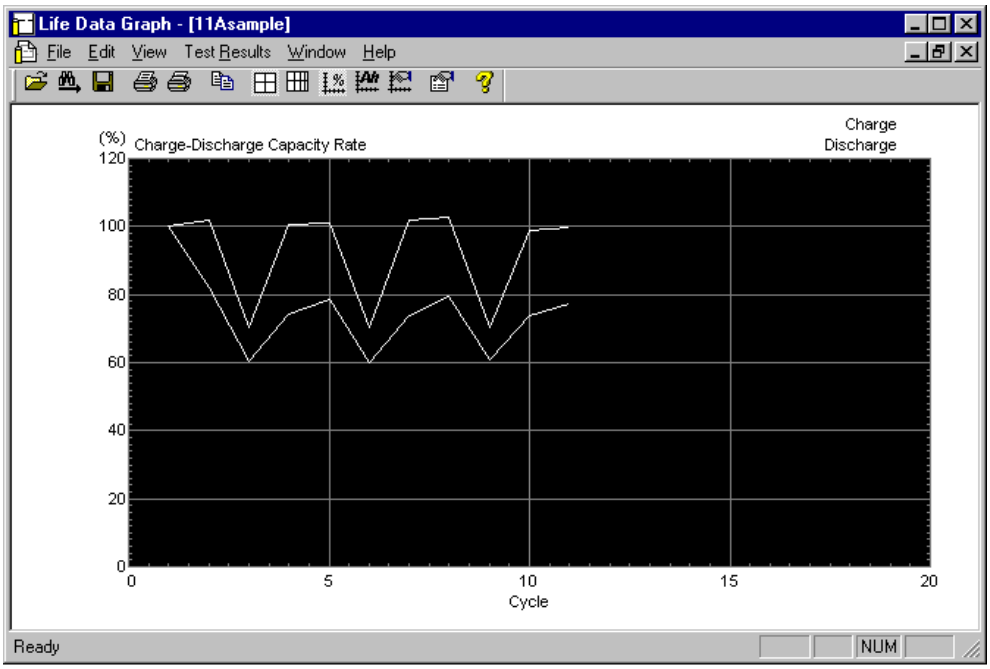


Fig. 57 Graph Display

7.3 Setting Graph Axes

You can select [Graph Scale] from the [View] menu to change the formats of the vertical (Y) and horizontal (X) axes of graphs.

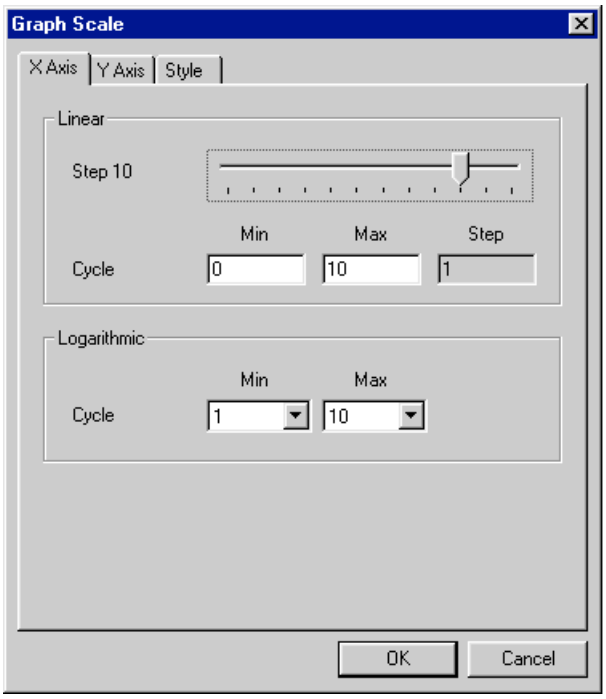


Fig. 58 Screen for Changing Graph Axes

The Graph Scale properties sheet consists of the “X axis”, “Y axis”, and “Style” pages.

7.3.1 Setting items in the [X axis] and [Y axis] properties

Set the following items.

[Step] slider

Adjust the slide knob to set the number of divisions of the axis, from 1 to 12.

[Min], [Max] and [Step] boxes

In the X-axis property page, enter the minimum and maximum values for graphs in linear display and logarithmic display.

In the Y-axis property page, enter the minimum and maximum values for the graphs in capacity rate display and measured capacity values.

The present value per division is displyed at the [Step] box.

7.3.2 Setting items in the [Style] property

Set the following items.

[Grid] check box

Check this check box to superimpose grids upon graphs.

[Step] slider

Adjust the slider knob to set the size of the grid squares to one of 2, 4, or 5.

[Pen Width]

Sets the width of the pen of the data.

[Back Color, Axis Color, Axis Width]

Sets the Back Color, Axis Color and Axis Width of Graph.

7.4 Displaying the Test Results

You can browse the capacity data for the test conditions and test results of the graphs displayed. To display test results, select [Properties] from the [Test Results] menu.

The Test Result properties sheet consists of the following four pages.

1. The “General Info” property page, which displays nominal values for the battery being tested, conditions for life judgement, and other information
2. A “Sequence” property page displaying the sequence in which a charge-discharge test was conducted and the test conditions applied
3. A “Test Results” property page displaying cycle-basis capacity data for charge-discharge and test results
4. “Others” property page used to set the reference cycle for capacity rate (cycle regarded as 100%) displayed in the “Test Results” property page

7.4.1 [General Info] property

This property lists nominal values for the battery being tested and the conditions for life judgement, and others.

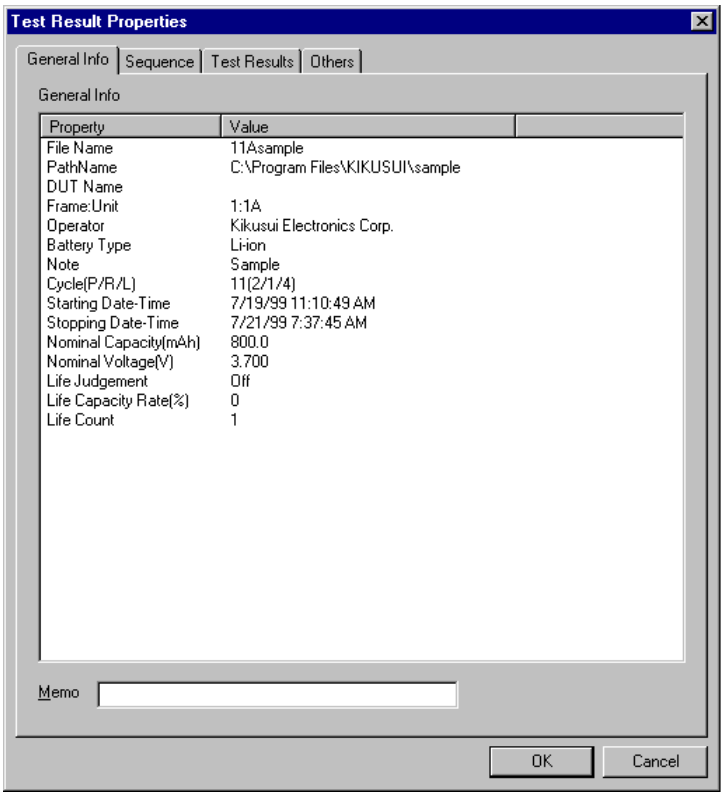


Fig. 59 Test Results of General Info

[Memo] box

Allows you to enter up to single-byte 30 characters of comments for the test results. When printed, a character string entered here is displayed in the memo item.

7.4.2 [Sequence] property

This property displays the sequence in which the charge-discharge test was conducted and the test conditions applied.

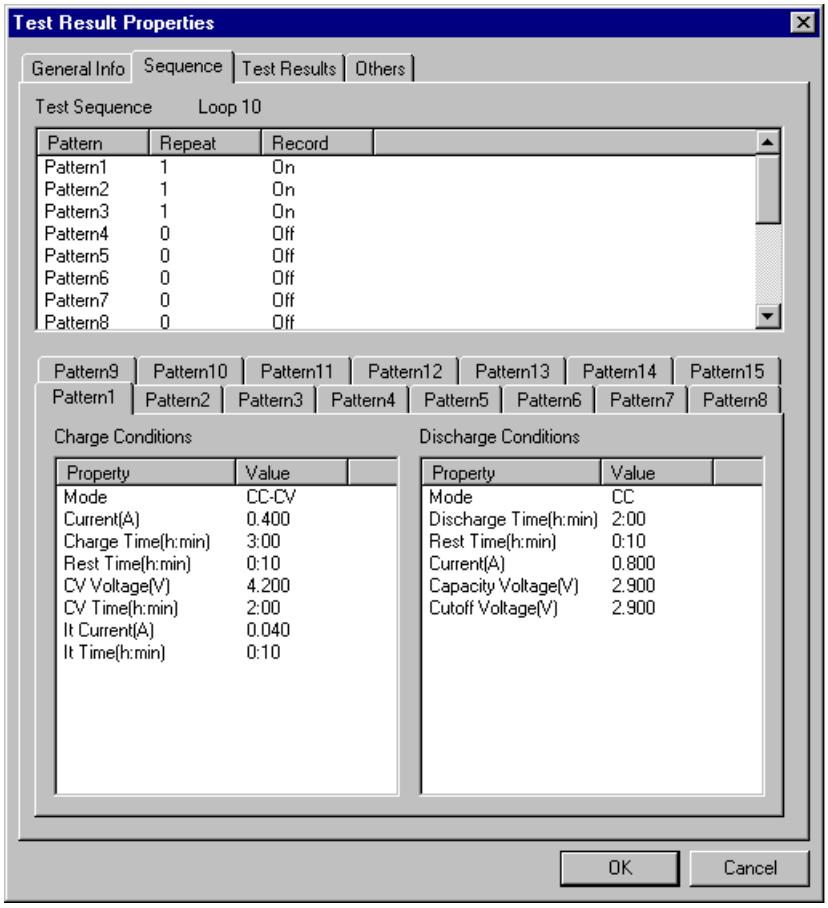


Fig. 60 Test Results of Sequence

7.4.3 [Test Results] property

This property displays the cycle-basis capacity data for charge-discharge and the test results.

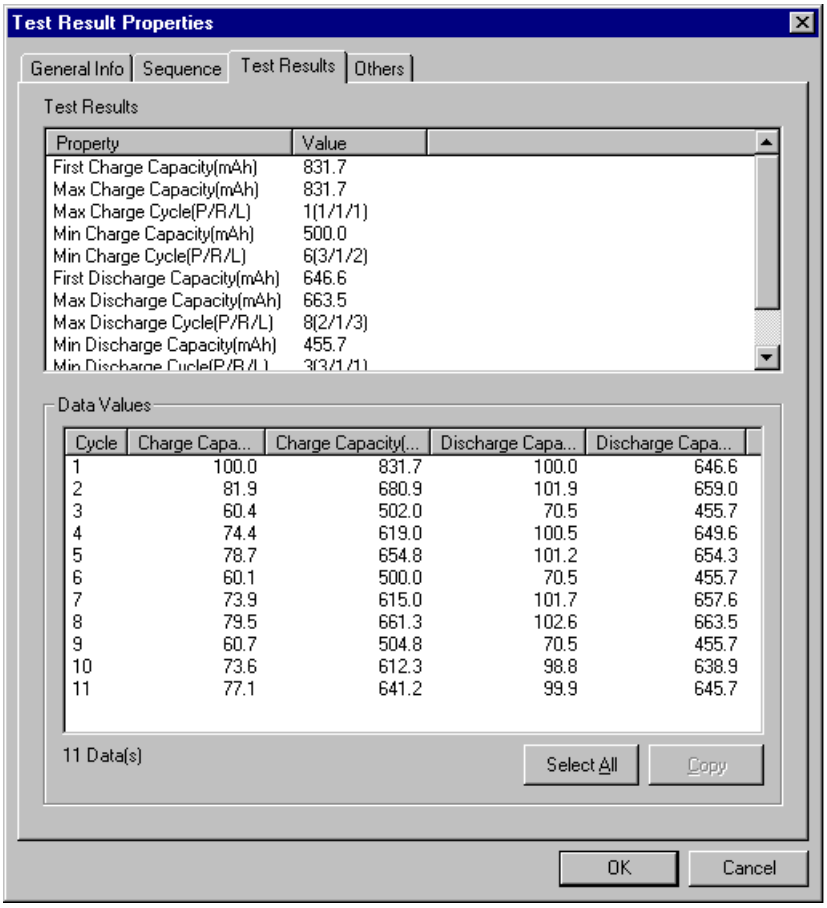


Fig. 61 Test Results of Test Results

■ Test Results

This section displays the results of charge-discharge testing.

Test result item	Description
First Charge Capacity(mAh)	Charge capacity of the first cycle
Max Charge Capacity(mAh)	Maximum charge capacity value in the test
Max Charge Cycle(P/R/L)	The number of cycles for the maximum charge capacity and the number of patterns/repeats/loops in the test
Min Charge Capacity(mAh)	Minimum charge capacity value in the test
Min Charge Cycle(P/R/L)	The number of cycles for the minimum charge capacity and the number of patterns/repeats/loops in the test
First Discharge Capacity(mAh)	Discharge capacity of the first cycle
Max Discharge Capacity(mAh)	Maximum discharge capacity value in the test
Max Discharge Cycle(P/R/L)	The number of cycles for the maximum discharge capacity and the number of patterns/repeats/loops in the test
Min Discharge Capacity(mAh)	Minimum discharge capacity value in the test
Min Discharge Cycle(P/R/L)	The number of cycles for the minimum discharge capacity and the number of patterns/repeats/loops in the test
Cycle	Total number of cycles since the start of a test sequence

7.4.4 [Others] property

This property allows you to set the reference cycle for the capacity rate (cycle regarded as 100%) that is displayed in the “Test Results” property page.

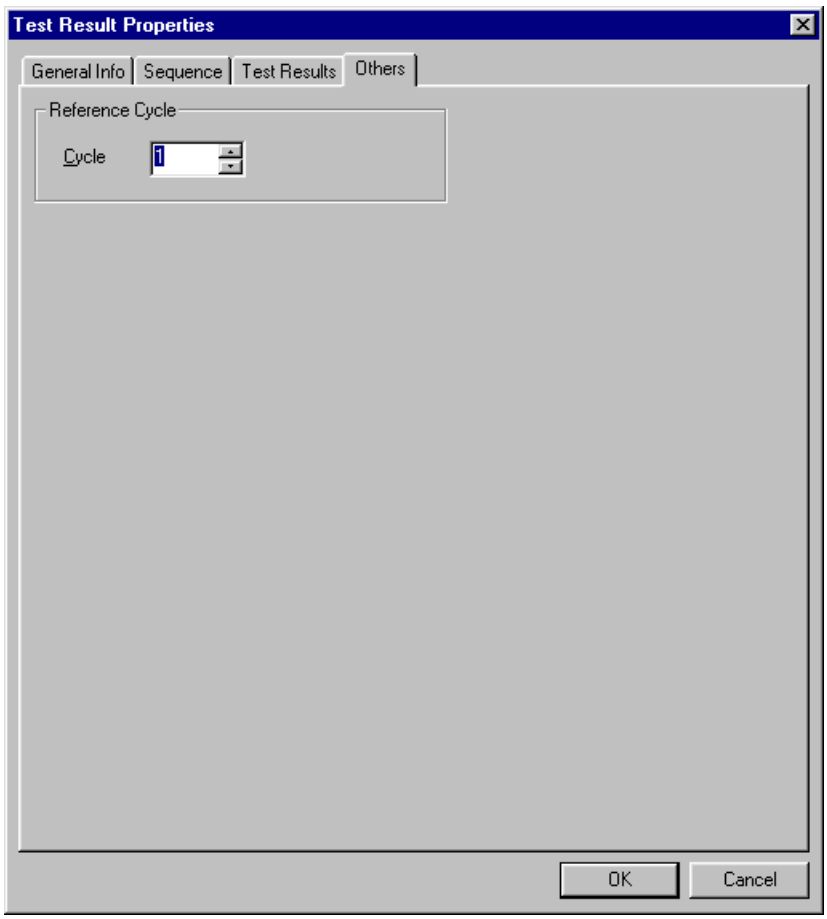


Fig. 62 Test Results of Others

7.5 Pasting Data into Spreadsheet Applications

You can paste the numeric data displayed in the “Test Results” page of the “Test Result” properties into spreadsheet application via the clipboard. Press the [Select All] button in the “Test Result” properties to select the entire area, then press the [Copy] button to copy the data to the clipboard.

Then select [Paste] from the [Edit] menu of spreadsheet application.

7.6 Printing

The Life Data Graph allows you to print the graphs displayed, as well as items displayed in Test Result properties.

You may print a selected graph (normal printing) or continuously print all graphs displayed in the Life Data Graph screen (continuous printing).

To perform normal printing, select [Print] from the [File] menu.

To perform continuos printing, select [Print Continuous] from the [File] menu. Selecting continuous printing displays the following dialog box.

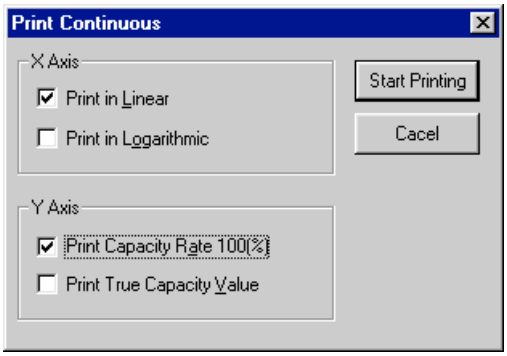


Fig. 63 Selecting Graphs for Print Continuous

The Life Data Graph prints graphs continuously in all windows according to the graph type checked in this dialog box.

7.6.1 Color Printing

The Life Data Graph switches between black and white and color printing. To print in color, check [Color Print] in the [File] menu.

When you print in color, charge capacity and discharge capacity are printed in red and green, respectively, to match the screen display.

7.7 Saving Data in Text Format

All data (in the General Info, Test Sequence, and Test Results pages) observable in the “Test Result” properties may be saved in text format. Files saved in text format may be opened by word processor or spreadsheet applications.

To save data as text, select [Save As Text] from the [File] menu.

The default file name is a life data file name with the “.txt” file extension.

7.8 Life Data Graph Menus

Menu		Function
File	Open	Opens a life data file (files having the extension *.lif).
	Find File	Finds life data files.
	Close	Closes a life data file.
	Save As Text	Saves life data in text format. The text file extension is (*.txt). The command also allows you to specify a name for the life data file.
	Print	Prints life data graph.
	Print Continuous	Prints life data graphs in all windows continuously, with options for selecting the data to be printed (X axis: linear or logarithmic; Y axis: capacity rate 100% or measured capacity values).
	Print Preview	Provides an on-screen preview of print output. - About print preview: Some printer drivers may not correctly reflect the character width of some font types (such as TrueType font). Lines in the print preview screen may flow past the right-hand margin. The actual printout will have correct character widths.
	Print Setup	Allows you to select a printer and set the printing method. Items to be set up depend on the selected printer.
	Color Print	Switches between black and white and color printing. Prints in color when checked.
	Exit	Exits the Life Data Graph.
Edit	Copy	Allows you to copy test data to the clipboard in text format.
View	Linear	Displays the cycle axis of life data graphs in linear form.
	Logarithmic	Displays the cycle axis of life data graphs in logarithmic form.
	Capacity Rate 100%	Displays the capacity axis of life data graphs, with the charge-discharge capacity of the reference cycle set as 100%. You can set the reference cycle on the [Others] sheet by selecting [Properties] from the [Test Results] menu.
	Capacity True Value	Displays the capacity axis of life data graph in measured capacity values.
	Toolbar	Displays or hides the toolbar.
	Status Bar	Displays or hides the state bar.
	Graph Scale	Allows you to set the scales, grids, and pens of graphs.
Test Results	Properties	Displays the test results.
Window	Cascade	Displays overlapping windows, with title bars visible. This display mode allows quick selection of a particular window.
	Tile Horizontally	Displays all windows, tiled horizontally and without overlap.
	Tile Vertically	Displays all windows, tiled vertically and without overlap.
	Arrange Icons	Arranges icons at an equal intervals both horizontally and vertically.
	Close All	Closes all windows.

Chapter 8 Appendix

8.1 Hard Disk Space Required

The size of a cycle-basis charge-discharge data file (extension: .dcd) created by the Test Executive varies with test time or the particular recording method for test conditions (such as delta voltage and delta current), changing according to the following equation.

File size = 548 bytes (header) + (24 bytes x number of charge data points) + (24 bytes x number of discharge data points)

Because the maximum number of points is 1024 for both charge and discharge, the file size reached when all 1024 points are saved is about 48.6 KB.

When a data file of this maximum number of points is saved for each cycle, the following disk space is required per channel.

Considerable disk space is required, depending on the number of channels and cycles. Thus, ways to eliminate unnecessary data efficiently should be considered.

Capacity data files (extension: .lif) use the following space per channel.

File size = 2122 bytes (header) + (8 bytes x number of cycles)

The Windows cluster allocation system reserves an entire separate cluster for all files up to the size of a single cluster. Particular cluster sizes are given in the table below.

You must consider in advance the number of files to be created, based on the type of the hard disk format in use and hard disk space.

8.2 Printer Output of Test Conditions 1/2

Test Condition Editor

KIKUSUI SD03-PFX(E) Version 1.30

Battery Performance Checker 12 SD03-PFX(E) C:\Program Files\Kikusui\Sample\Sample.tst

Date	Monday, July 19, 1999					
Operator	Kikusui Electronics Corp.					
Battery type	Li-ion					
Note	Sample					
Channel Structure	12Channels/Frame					
Battery Nominal Value	Capacity(mAh)	800.0				
	Voltage(V)	3.700				
Fixed-Time Operation	Off					
DUT Protection	V/Cap Protect.	On				
	OVP(V)	4.300				
	UVP(V)	2.500				
	OAH(%)	150				
	Confirm Combine	On				
Recording Method	T/1024					
	Delta Voltage(mV)	20,On				
	Delta Current(mA)	20,On				
	Delta Time(s)	3600,On				
Life Judgement	Judgement	Off				
	Capacity Rate(%)	0				
	Count	1				
Test Sequence	Pattern:Repeat,Record					
	1: 1, On	2: 1, On	3: 1, On	4: 0,Off	5: 0,Off	
	6: 0,Off	7: 0,Off	8: 0,Off	9: 0,Off	10: 0,Off	
	11: 0,Off	12: 0,Off	13: 0,Off	14: 0,Off	15: 0,Off	
	Loop(s)	10				

*Predischarge	
Mode	CC
Disch. Time(h:min)	3:00
Rest Time(h:min)	0:10
Current(A)	0.400
Wattage(W)	0.00
Limit Current(A)	0.000
Pulse Current1(A)	0.010
Pulse Time1(ms)	0.50
Pulse Current2(A)	0.010
Pulse Time2(ms)	0.50
Pulse Current3(A)	0.010
Pulse Time3(ms)	0.50
Pulse Current4(A)	0.010
Pulse Time4(ms)	0.50
Capacity Voltage(V)	2.900
Cutoff Voltage(V)	2.900

*Charge	Pattern1	Pattern2	Pattern3	Pattern4	Pattern5
Mode	CC-CV	CC-CV	CC-CV	CC-CV	CC-CV
Current(A)	0.400	0.400	0.600	0.000	0.000
Charge Time(h:min)	3:00	3:00	3:00	0:00	0:00
Rest Time(h:min)	0:10	0:10	0:10	0:01	0:01
CV Voltage(V)	4.200	4.200	4.100	0.000	0.000
CV Time(h:min)	2:00	2:00	2:00	0:00	0:00
It Current(A)	0.040	0.040	0.100	0.000	0.000
It Time(h:min)	0:10	0:10	0:00	0:00	0:00
Max Voltage(V)	0.000	0.000	0.000	0.000	0.000
-dV(V)	0.001	0.001	0.001	0.001	0.001
-dV Mask Time(min)	1	1	1	1	1

*Discharge	Pattern1	Pattern2	Pattern3	Pattern4	Pattern5
Mode	CC	CP	Pulse2	CC	CC
Disch. Time(h:min)	2:00	2:00	2:00	0:00	0:00
Rest Time(h:min)	0:10	0:10	0:10	0:01	0:01
Current(A)	0.800	0.800	0.800	0.000	0.000
Wattage(W)	0.00	2.50	0.00	0.00	0.00
Limit Current(A)	0.000	0.800	0.000	0.000	0.000
Pulse Current1(A)	0.010	0.010	2.000	0.010	0.010
Pulse Time1(ms)	0.50	0.50	0.58	0.50	0.50
Pulse Current2(A)	0.010	2.000	0.010	0.010	0.010
Pulse Time2(ms)	0.50	0.50	4.70	0.50	0.50
Pulse Current3(A)	0.010	0.010	0.010	0.010	0.010
Pulse Time3(ms)	0.50	0.50	0.50	0.50	0.50
Pulse Current4(A)	0.010	0.010	0.010	0.010	0.010
Pulse Time4(ms)	0.50	0.50	0.50	0.50	0.50
Capacity Voltage(V)	2.900	2.900	2.850	0.000	0.000
Cutoff Voltage(V)	2.900	2.900	2.850	0.000	0.000

1/2

8.3 Printer Output of Test Conditions 2/2

Test Condition Editor

KIKUSUI SD03-PFX(E) Version 1.30

Battery Performance Checker 12 SD03-PFX(E)

C:\Program Files\Kikusui\Sample\Sample.tst

*Charge	Pattern6	Pattern7	Pattern8	Pattern9	Pattern10
Mode	CC-CV	CC-CV	CC-CV	CC-CV	CC-CV
Current(A)	0.000	0.000	0.000	0.000	0.000
Charge Time(h:min)	0:00	0:00	0:00	0:00	0:00
Rest Time(h:min)	0:01	0:01	0:01	0:01	0:01
CV Voltage(V)	0.000	0.000	0.000	0.000	0.000
CV Time(h:min)	0:00	0:00	0:00	0:00	0:00
It Current(A)	0.000	0.000	0.000	0.000	0.000
It Time(h:min)	0:00	0:00	0:00	0:00	0:00
Max Voltage(V)	0.000	0.000	0.000	0.000	0.000
-dV(V)	0.001	0.001	0.001	0.001	0.001
-dV Mask Time(min)	1	1	1	1	1

*Discharge	Pattern6	Pattern7	Pattern8	Pattern9	Pattern10
Mode	CC	CC	CC	CC	CC
Disch. Time(h:min)	0:00	0:00	0:00	0:00	0:00
Rest Time(h:min)	0:01	0:01	0:01	0:01	0:01
Current(A)	0.000	0.000	0.000	0.000	0.000
Wattage(W)	0.00	0.00	0.00	0.00	0.00
Limit Current(A)	0.000	0.000	0.000	0.000	0.000
Pulse Current1(A)	0.010	0.010	0.010	0.010	0.010
Pulse Time1(ms)	0.50	0.50	0.50	0.50	0.50
Pulse Current2(A)	0.010	0.010	0.010	0.010	0.010
Pulse Time2(ms)	0.50	0.50	0.50	0.50	0.50
Pulse Current3(A)	0.010	0.010	0.010	0.010	0.010
Pulse Time3(ms)	0.50	0.50	0.50	0.50	0.50
Pulse Current4(A)	0.010	0.010	0.010	0.010	0.010
Pulse Time4(ms)	0.50	0.50	0.50	0.50	0.50
Capacity Voltage(V)	0.000	0.000	0.000	0.000	0.000
Cutoff Voltage(V)	0.000	0.000	0.000	0.000	0.000

*Charge	Pattern11	Pattern12	Pattern13	Pattern14	Pattern15
Mode	CC-CV	CC-CV	CC-CV	CC-CV	CC-CV
Current(A)	0.000	0.000	0.000	0.000	0.000
Charge Time(h:min)	0:00	0:00	0:00	0:00	0:00
Rest Time(h:min)	0:01	0:01	0:01	0:01	0:01
CV Voltage(V)	0.000	0.000	0.000	0.000	0.000
CV Time(h:min)	0:00	0:00	0:00	0:00	0:00
It Current(A)	0.000	0.000	0.000	0.000	0.000
It Time(h:min)	0:00	0:00	0:00	0:00	0:00
Max Voltage(V)	0.000	0.000	0.000	0.000	0.000
-dV(V)	0.001	0.001	0.001	0.001	0.001
-dV Mask Time(min)	1	1	1	1	1

*Discharge	Pattern11	Pattern12	Pattern13	Pattern14	Pattern15
Mode	CC	CC	CC	CC	CC
Disch. Time(h:min)	0:00	0:00	0:00	0:00	0:00
Rest Time(h:min)	0:01	0:01	0:01	0:01	0:01
Current(A)	0.000	0.000	0.000	0.000	0.000
Wattage(W)	0.00	0.00	0.00	0.00	0.00
Limit Current(A)	0.000	0.000	0.000	0.000	0.000
Pulse Current1(A)	0.010	0.010	0.010	0.010	0.010
Pulse Time1(ms)	0.50	0.50	0.50	0.50	0.50
Pulse Current2(A)	0.010	0.010	0.010	0.010	0.010
Pulse Time2(ms)	0.50	0.50	0.50	0.50	0.50
Pulse Current3(A)	0.010	0.010	0.010	0.010	0.010
Pulse Time3(ms)	0.50	0.50	0.50	0.50	0.50
Pulse Current4(A)	0.010	0.010	0.010	0.010	0.010
Pulse Time4(ms)	0.50	0.50	0.50	0.50	0.50
Capacity Voltage(V)	0.000	0.000	0.000	0.000	0.000
Cutoff Voltage(V)	0.000	0.000	0.000	0.000	0.000

2/2

8.4 Printer Output of Charge Graphs

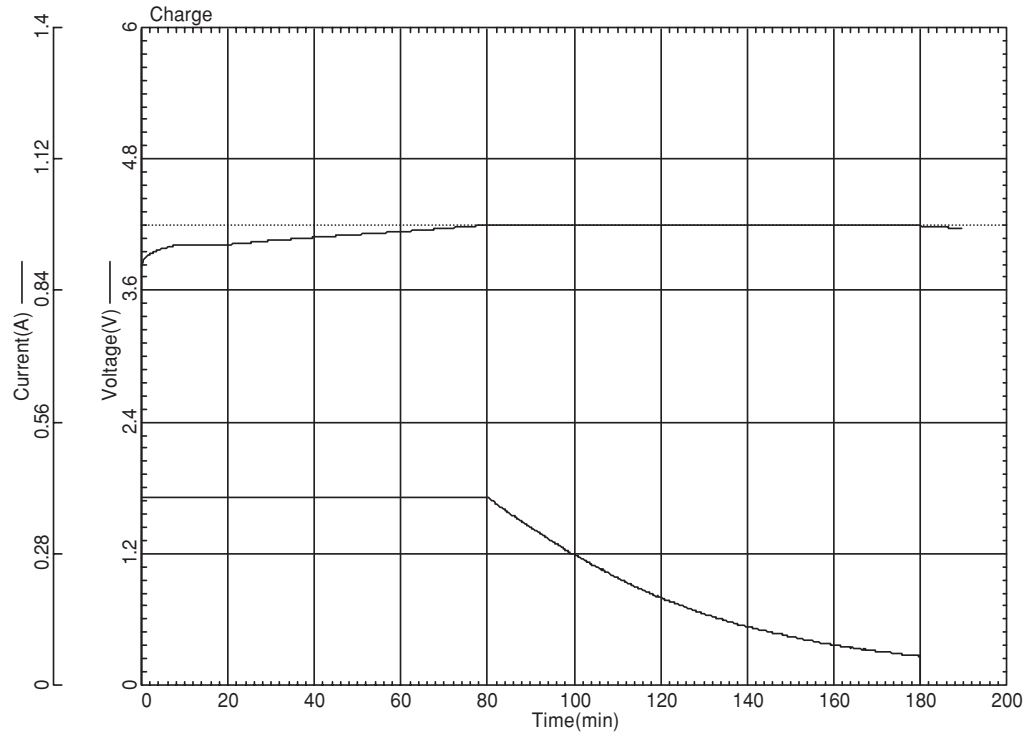
CD Data Graph

KIKUSUI SD03-PFX(E) Version 1.30

Battery Performance Checker 12 SD03-PFX(E) C:\Program Files\Kikusui\Sample\11A0001sample.dcd

DUT Name	
Frame:Unit	1:1A
Operator	Kikusui Electronics Corp.
Battery Type	Li-ion
Note	Sample
Cycle(P/R/L)	1(1/1/1)
Starting Date-Time	20/07/ 99 3:10:49
Stopping Date-Time	20/07/ 99 7:48:11
Memo	

Nominal Capacity(mAh)	800.0
Nominal Voltage(V)	3.700
V/Cap Protect.	On
OVP(V)	4.300
UVP(V)	2.500
OAH(%)	150
Recording method	T/1024
Delta Voltage(mV)	20,On
Delta Current(mA)	20,On
Delta Time(s)	3600,On



*Charge Condition

Mode	CC-CV
Current(A)	0.400
Charge Time(h:min)	3:00
Rest Time(h:min)	0:10
CV Voltage(V)	4.200
CV Time(h:min)	2:00
It Current(A)	0.040
It Time(h:min)	0:10

*Charge Result

Finished By	Charge Time
Charge Capacity(mAh)	831.7
Charge Time(h:min:s)	3:00:00
CC Time(h:min:s)	1:20:22
Unloaded Voltage(V)	3.490
Starting Voltage(V)	3.821
Max Voltage(V)	4.200
Finished Voltage(V)	4.200

8.5 Printer Output of Discharge Graphs

CD Data Graph

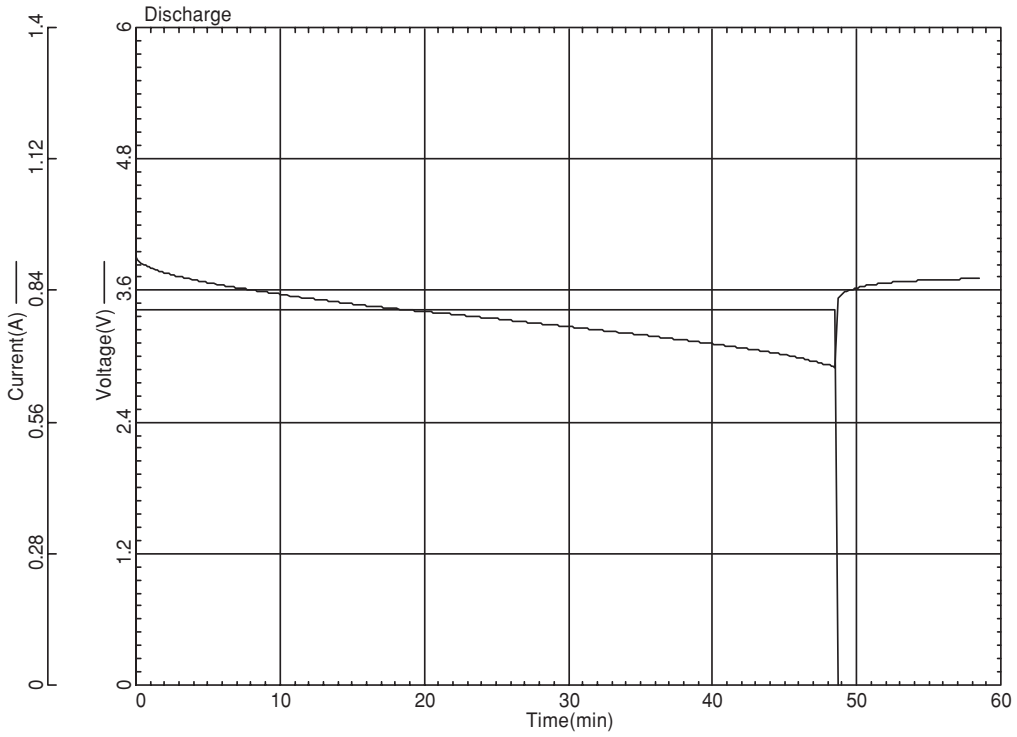
KIKUSUI SD03-PFX(E) Version 1.30

Battery Performance Checker 12 SD03-PFX(E)

C:\Program Files\Kikusui\Sample\11A0001sample.dcd

DUT Name	
Frame:Unit	1:1A
Operator	Kikusui Electronics Corp.
Battery Type	Li-ion
Note	Sample
Cycle(P/R/L)	1(1/1/1)
Starting Date-Time	20/07/ 99 3:10:49
Stopping Date-Time	20/07/ 99 7:48:11
Memo	

Nominal Capacity(mAh)	800.0
Nominal Voltage(V)	3.700
V/Cap Protect.	On
OVP(V)	4.300
UVP(V)	2.500
OAH(%)	150
Recording method	T/1024
Delta Voltage(mV)	20,On
Delta Current(mA)	20,On
Delta Time(s)	3600,On



*Discharge Condition

Mode	CC
Discharge Time(h:min)	2:00
Rest Time(h:min)	0:10
Current(A)	0.800
Capacity Voltage(V)	2.900
Cutoff Voltage(V)	2.900

*Discharge Result

Finished By	Cutoff Voltage
Discharge Capacity(mAh)	646.6
Discharge Time(h:min:s)	0:48:32
Unloaded Voltage(V)	4.171
Starting Voltage(V)	3.909
Finished Voltage(V)	2.900

8.6 Printer Output of Life Graphs

Life Data Graph

KIKUSUI SD03-PFX(E) Version 1.30

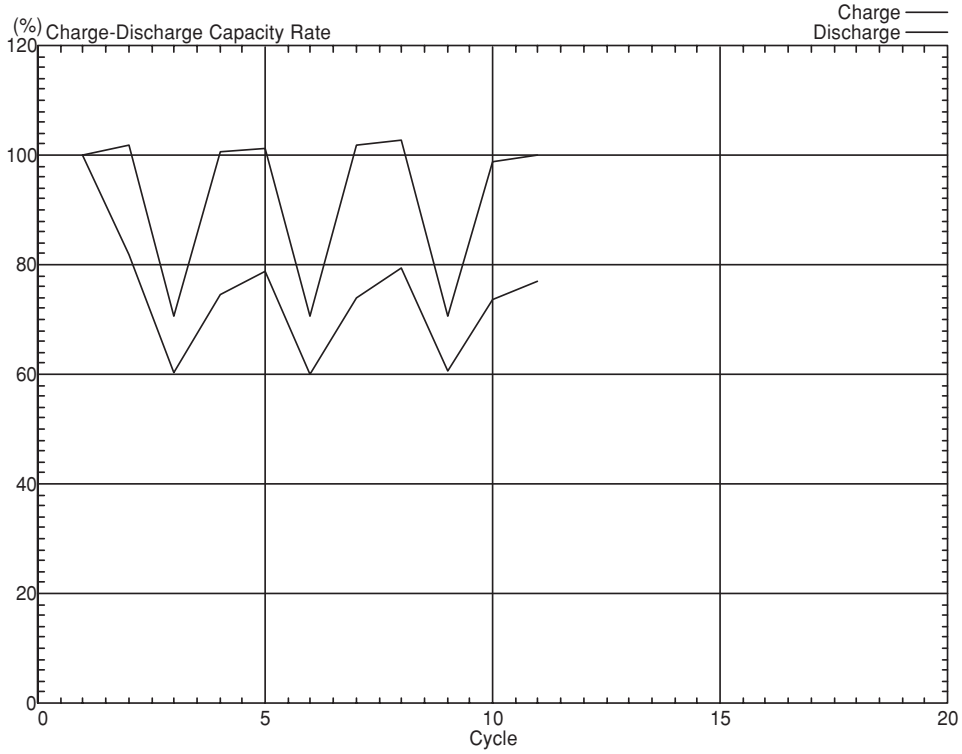
Battery Performance Checker 12 SD03-PFX(E)

C:\Program Files\Kikusui\Sample\11Asample.lif

DUT Name		Nominal Capacity(mAh)	800.0
Frame:Unit	1:1A	Nominal Voltage(V)	3.700
Operator	Kikusui Electronics Corp.	Life Judgement	Off
Battery Type	Li-ion	Life Capacity Rate(%)	0
Note	Sample	Life Count	1

Cycle(P/R/L)	11(2/1/4)
Starting Date-Tim e	20/07/ 99 3:10:49
Stopping Dtae-Time	21/07/ 99 23:37:45

Memo



*Charge-Discharge Result

First Charge Capacity(mAh)	831.7
Max Charge Capacity(mAh)	831.7
Max Charge Cycle(P/R/L)	1(1/1/1)
Min Charge Capacity(mAh)	500.0
Min Charge Cycle(P/R/L)	6(3/1/2)
First Discharge Capacity(mAh)	646.6
Max Discharge Capacity(mAh)	663.5
Max Discharge Cycle(P/R/L)	8(2/1/3)
Min Discharge Capacity(mAh)	455.7
Min Discharge Cycle(P/R/L)	3(3/1/1)
Cycle	11

Index

T

U

V

W