

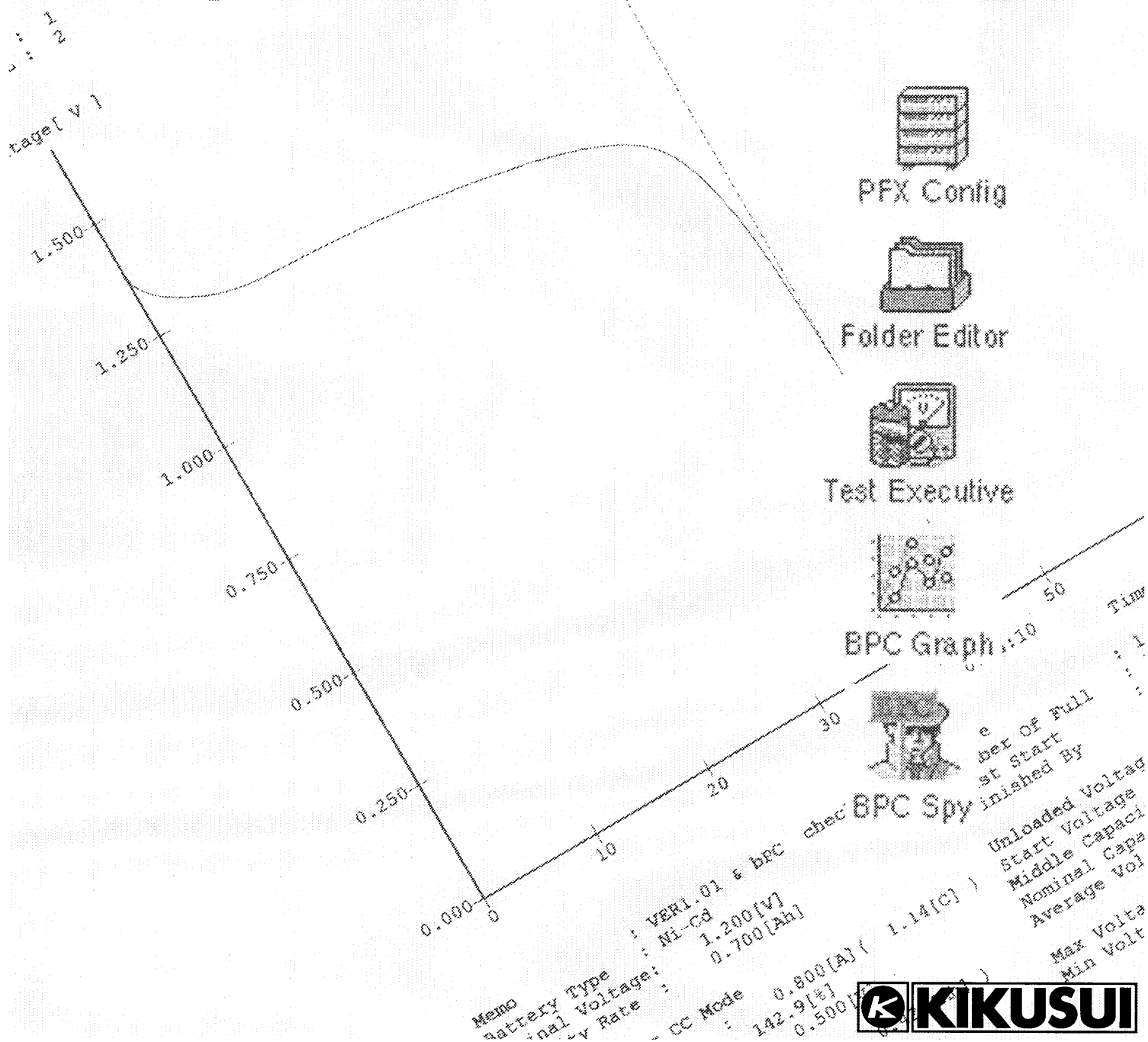


Battery Characteristics Testing System

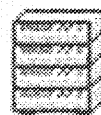
Battery Performance Checker 2.1

SD01-PFX

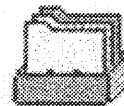
<< Voltage Transition
Full Discharge >>>



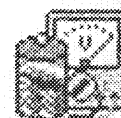
User's Manual



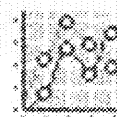
PFX Config



Folder Editor



Test Executive



BPC Graph



BPC Spy

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Symbolic Conventions

The meanings of symbols used in this manual are described below.

CAUTION

This indicates, if the caution ignored, the possibility of damaging the PFX itself or other connected equipment.

Always proceed by following listed operating procedures exactly.

Only proceed to the next step after fully understanding information in the caution and satisfying all listed conditions.

NOTE

This indicates supplementary information regarding operating procedures, etc.

Sequence →

Of the two operating modes of the BP checker, this symbol indicates matters only related to sequence mode.

Life cycle

Of the two operating modes of the BP checker, this symbol indicates matters only related to life cycle mode.

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1

CHAPTER 1

GENERAL DESCRIPTION

This chapter gives an overview of the Battery Performance Checker and describes the environment necessary to run it.

Sections in Chapter 1

- 1.1 Introduction
- 1.2 Environmental Requirements

1.1 Introduction

The Battery Performance Checker (hereafter referred to in the user's manual as the "BP checker") conducts performance tests on batteries by controlling the PFX40W-08 charge/discharge tester via an external personal computer. The battery performance test system stores the results of the test.

Using the BP checker, a single personal computer can control battery testing for up to six PFX40W-08's, or a maximum of 48 channels.

There are two operation modes of the BP checker: life cycle mode and sequence mode. The checker can be used in either mode. Life cycle mode is used to test battery life characteristics according to separate conditions (worksheets) for each channel. Test results are recorded in folders (which allow information managed using worksheets to be managed in up to 99 worksheet files) and worksheets (scenarios used to conduct tests). By conducting tests according to these conditions, life test data for an extended period can be saved automatically. Sequence mode is used to test initial battery characteristics which cannot be set for the PFX40W-08. Batteries are tested by varying test conditions (stored in worksheets). Tests in which conditions are varied according to folders created by assembling various worksheets for each test scenario are automatically conducted, and separately measured data is automatically stored.

The BP checker consists of the following five executable programs:

1. PFX Config

This executable is used to set the overall system environment and set common items shared by a PFX unit.

2. Folder Editor

This executable is used to edit the contents of worksheets and folders organizing up to 99 of these worksheets. Multiple worksheets can be saved in a folder. In life cycle mode, tests are conducted by selecting one of these worksheets. In sequence mode, tests are conducted by varying test conditions according worksheets sequence.

3. Test Executive

This executable starts and stops tests, and monitors test status for each channel individually. It also automatically creates graphs and reports from test results and saves them as files.

4. BPC Graph

This executable processes result files. It can create graphs, convert ranges for graphs, overlay graphs, make tables for each file and provide other manipulations based on result files. These results can be displayed on the screen or printed out. This executable can also convert result files to a text format.

5. BPC Spy

Test Executive includes DDE server functions which allow it to communicate with other programs. BPC Spy is an application that utilizes this function to intercept (obtain) data monitored by Test Executive.

In addition, user applications having DDE client functions can be created in a language such as Visual Basic, allowing to send commands to other GPIB equipment according to status change from the BP checker.

In this way, you can use the BP checker application software to implement a diverse test system for checking battery performance which cannot be supported by the PFX40W-08 alone.

1.2 Environmental Requirements

The following environment is required for BP checker to run smoothly.

■ Personal computer

- An IBM PC/AT or compatible machines running Windows 3.1 or Windows for Workgroups 3.11.
- An i486DX/33MHz CPU or better is recommended.
- 8MB of RAM or more is recommended.
- 20MB of available disk space or more.
- A high resolution (SVGA 1024 x 768 or more) video subsystem is recommended. The more windows to be opened at once, the larger the screen required.
- A 17-inch or 20-inch display monitor is recommended.

■ Communications environment

- GPIB board
National Instruments NI-488.2 or compatible GPIB board
- GPIB cable
A 24-pin connector cable conforming to IEEE-488 GPIB standards is required for each PFX unit being used.

Using the GPIB Board

When using a National Instruments GPIB board, it is necessary to install a Windows device driver for the GPIB board. This device driver is contained on a diskette included with the GPIB board. Refer to the documentation included with the GPIB board for details on installation procedure. Also, be aware that data retrieval is not always performed correctly when DMA mode is on. If this occurs, be sure to turn DMA mode off.

Windows Operations

BP checker runs under Windows 3.1 or Windows 95. The basic operations of windows, menus, buttons, etc. are the same as for other Windows applications. For details on common basic Windows operations, please refer to your Windows documentation.

What to do Next

Continue on to Chapter 2, and make all necessary preparations (setup) for running BP checker.

2

CHAPTER 2 SETUP

This chapter describes program installation and setting GPIB addresses of PFX units which must be performed before actually using the BP checker.

Sections in Chapter 2

- 2.1 Package Contents
- 2.2 Installation
- 2.3 GPIB Settings for PFX Units
- 2.4 Connecting GPIB Cables

2.1 Package Contents

The following items are included in the BP checker package.

| | | |
|--------------------------|-------------------------|---|
| <input type="checkbox"/> | Program diskettes | 1 |
| <input type="checkbox"/> | User's manual | 1 |
| <input type="checkbox"/> | Performance limitations | 1 |

2.2 Installation

Before using BP checker, first you have to install all programs into your hard disk. Installation is performed using the setup program contained in the program diskette. The following is a description of installation procedures.

===== NOTE =====

- To novice users of Windows

BP checker runs under Windows 3.1 or Windows 95. The basic operations of windows, menus, buttons, etc. are the same as for other Windows applications. If you are new to using Windows and are unsure of basic operations, please refer to your Windows documentation.

About BPC Screen Blanker

BPC Screen Blanker which has a same function of Screen Saver "Scrolling Marquee" is packed in the BP checker 2.1. We prepare this utility software as a replacement for "Scrolling Marquee", that's why we found some computers had troubled using the BPC Test Executive with Screen Savers. Refer to the help for BPC Screen Blanker for more information about BPC Screen Blanker.

There is a check box "Screen Blanker Auto-Run" on the BP checker 2.1 install display.

Installing BP checker

- ① Start up Windows
- ② Insert the program diskette into Drive A.
- ③ Select "File" from the Program Manager menu bar and then "Run...".
For Windows 95, click on the "Start" button and then select "Run...".
- ④ Type "A:SETUP".

NOTE

- Use the appropriate drive specification if the floppy is in a drive other than Drive A.

- ⑤ Click on the "OK" button.
- ⑥ After a short time, the screen shown in Figure 2-1 will appear.

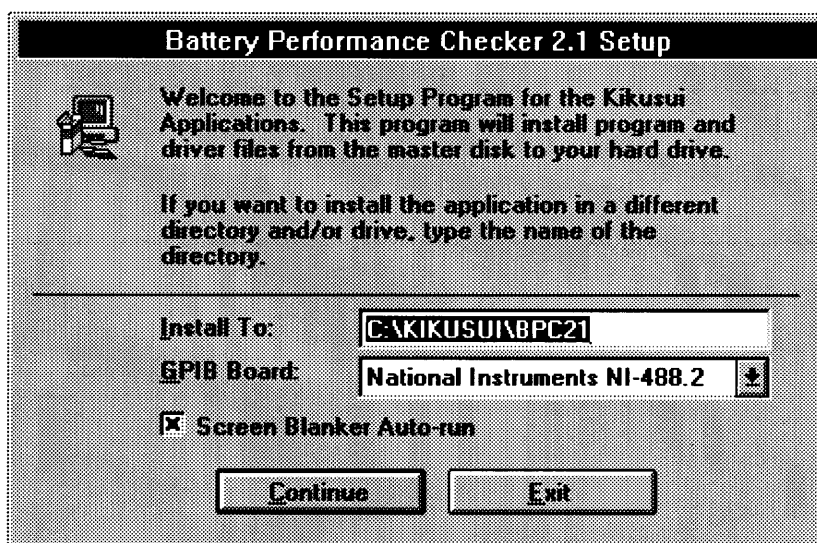


Figure 2-1 Installation Screen

■ Install To

This field specifies the directory in which to install BP checker. The default directory is C:\KIKUSUNBPC21, but you can install BP checker on any other drive or directory.

■ GPIB Board

Selectable GPIB board is National Instruments NI-488.2 only.

■ Screen Blanker Auto-Run

When "Screen Blanker Auto-Run" is checked (default)

In this case, Screen Savers is automatically disabled. Your computer will restart after BP checker 2.1 install, and BPC Screen Blanker will be launched automatically.

When "Screen Blanker Auto-Run" is unchecked

We don't change setting of Screen Savers in your computer. However, note that if you have set the screen saver, that will not run correctly during the BPC Test Executive execution.

- ⑦ Click on the "Continue" button to start installation.
- ⑧ After installation is complete, the group "Battery Performance Checker" will be created within Program Manager.

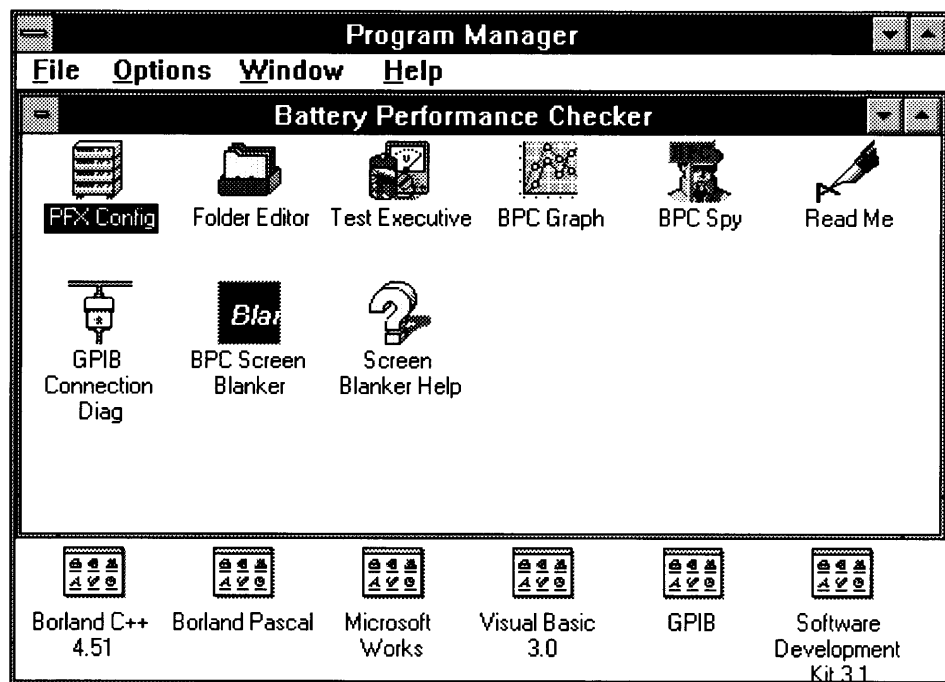


Figure 2-2 BP checker group

2.3 GPIB Settings for PFX Units

The GPIB address of a PFX40W-08 is set at the factory to "1".

NOTE

- GPIB addresses are assigned in order beginning from the first PFX unit. For example, if there are four PFX units, they must be assigned addresses "1", "2", "3" and "4", respectively. See Figure 2-3.

Changing the GPIB address of PFX unit

- ① Bring up the display "PFX40W-08" on the panel of the PFX unit.
- ② Press **【SHIFT】** + **【1(ADDRESS)】** .
- ③ Set an appropriate address using the number keys.
- ④ Press **【enter】** to confirm the new address.
- ⑤ Pressing **【ESC】** will return to the "PFX40W-08" display.
- ⑥ The address will change after the PFX unit is restarted.

2.4 Connecting GPIB Cables

CAUTION

- Be absolutely sure that the power switch of both the PFX unit and the computer are off before connecting GPIB cables.

Connect the PFX units and the computer by following the steps given below.

- ① Turn off the power switch of both the PFX unit and the computer.
- ② Connect one end of the GPIB cable connector to the GPIB board in the computer, and tighten with fastening screws.
- ③ Check that an "IB11 (interface board)" has been installed in the option slot on the rear panel of the PFX unit. If one has not been installed, install one.
- ④ Connect the other end of the cable referred to in Step ② to the "IB11", and tighten with fastening screws.
- ⑤ When using multiple PFX units, connect PFX units in series using GPIB cables. See Figure 2-3.

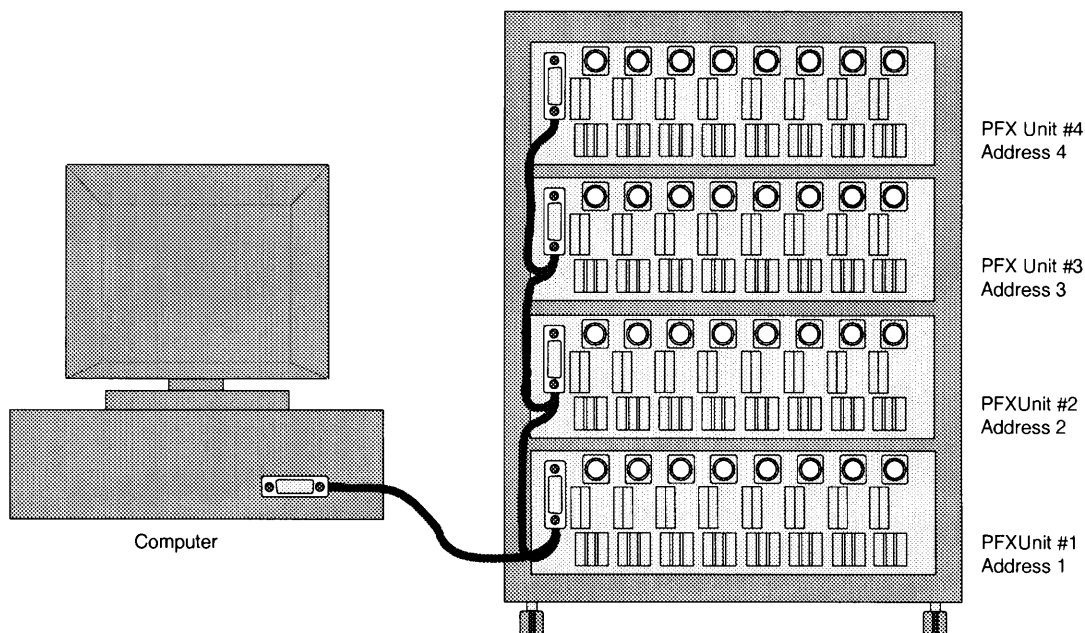


Figure 2-3 Four-Unit PFX System

What to do Next

Continue on to Chapter 3, and make all necessary system environment settings and test condition settings.

3

CHAPTER 3 CONFIGURING THE SYSTEM - PFX Config

This chapter describes environment settings for the entire system rack and how to set common items for each unit. After these descriptions, it explains how to create management files and how to transfer data to the PFX40W-08 units.

Sections in Chapter 3

- 3.1 Starting PFX Config
- 3.2 System Configuration
- 3.3 Unit Configuration
- 3.4 Sending Set Data
- 3.5 Quitting PFX Config

3.1 Starting PFX Config

To execute PFX Config, double-click on the "PFX Config" icon.

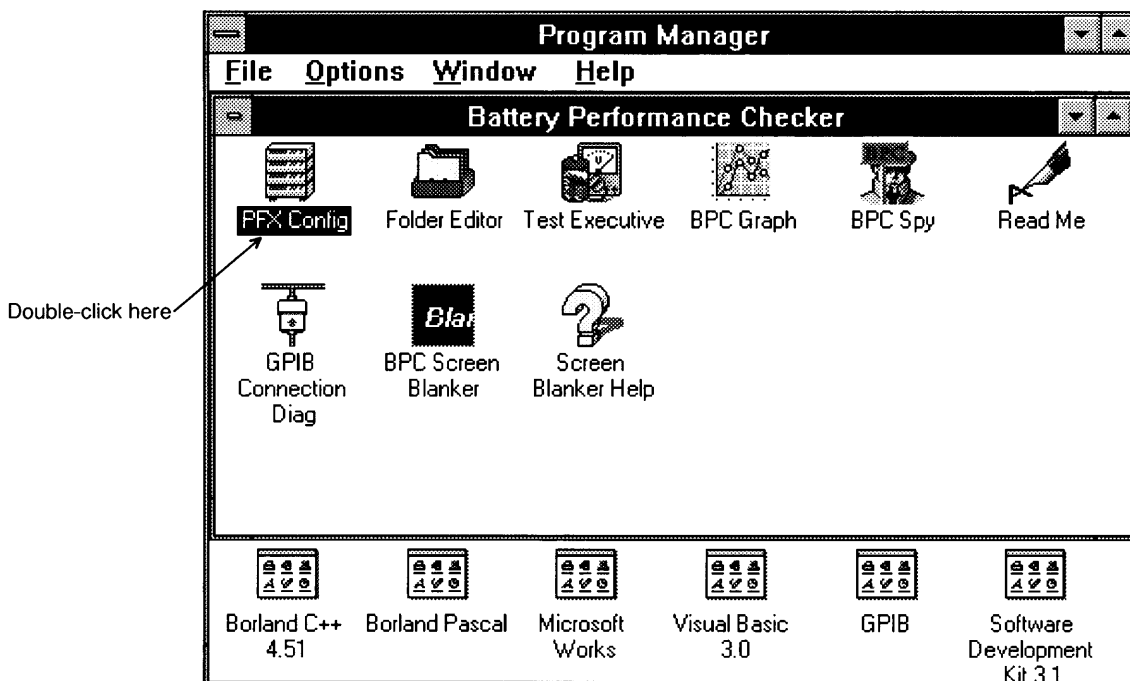


Figure 3-1 Starting PFX Config

The PFX Config screen will appear, and the current setting status for each unit will be visible.

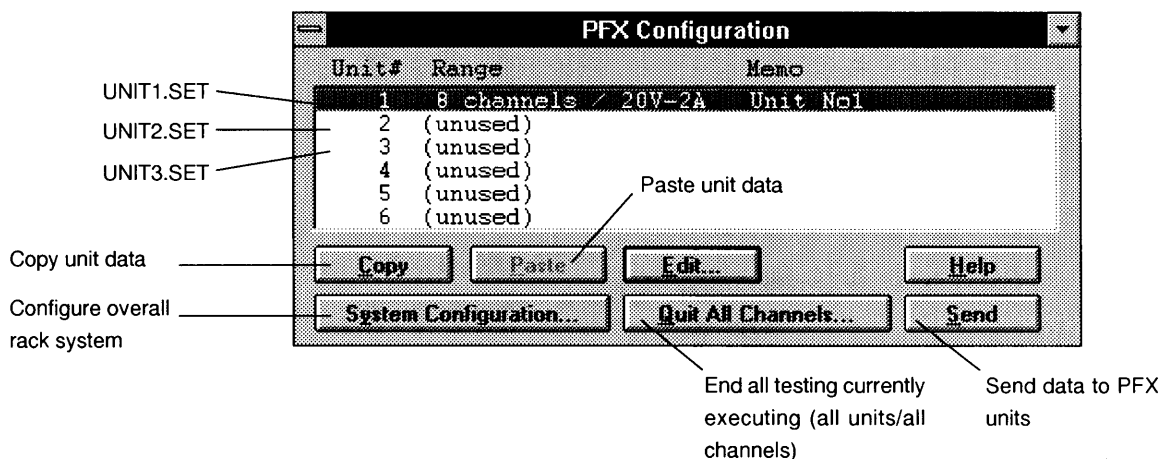


Figure 3-2 PFX Config Screen

Note that the screen shown here is for unit settings managed by BP checker. Since data set here has not yet been sent to PFX units, it does not reflect the actual current status of units.

[Unit#] represents a serial number assigned according to the number of units connected.

"(unused)" is displayed for unused units (Unit 2 and beyond in this example).

NOTE

- To ensure that tests are always conducted under proper conditions, we recommend that PFX Config be executed to send setting values to PFX units and then terminated every time the system is started (at power on) even if no settings have been changed. This procedure allows confirmation of system configuration and checking of communications status, and allows BP checker management files to be matched to PFX40W-08 units.

3.2 System Configuration

Double-clicking on "System Configuration" will cause a system configuration screen such as the following to appear.

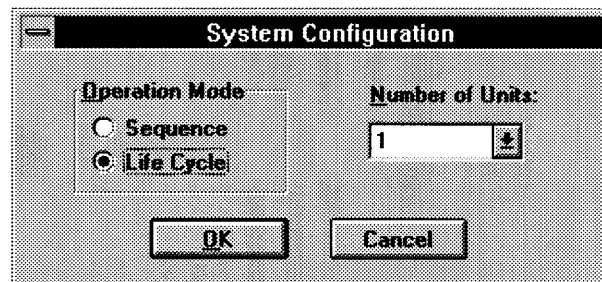


Figure 3-3 System Configuration Screen

The operation mode and the number of PFX units in the system can be changed from this screen.

System configuration items

■ Selecting the operation mode

BP checker includes two operating modes: sequence mode and life cycle mode. You can use the "Operation Mode" select switch to select either mode. Each of these operation modes is described below.

Sequence →

Sequence Mode

Select this mode when you wish to test the initial characteristics of your batteries. Tests are conducted by changing charge and discharge settings every time (or every set number of times). Graph data files (including voltage, current, and temperature transition) can be created for each charge and discharge.



Life Cycle Mode

Select this mode when you wish to test the life characteristics of your batteries. Tests are conducted for items which can be set for the PFX40W-08. Result files can be created for each full charge and full discharge. Result files regarding life characteristics can also be created when all tests are completed.

■ Selecting the number of units

Select the number of PFX units being controlled from the "Number of Units" list. 1 to 6 units can be selected.

When settings are complete

Click on the "OK" button to confirm current settings.

3.3 Unit Configuration

Select the desired unit number from the list box and click on the "Edit" button when you wish to check or change detailed settings for each PFX unit. Then, a "Unit Configuration" screen will appear.

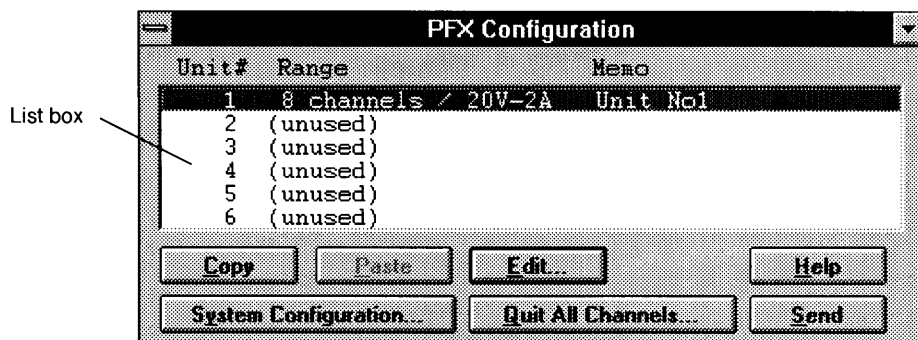


Figure 3-4 PFX Configuration Screen

NOTE

- The items "Cycle Format" and "Synchronous Operation" found on this screen are disabled (grayed out) when sequence mode is selected.

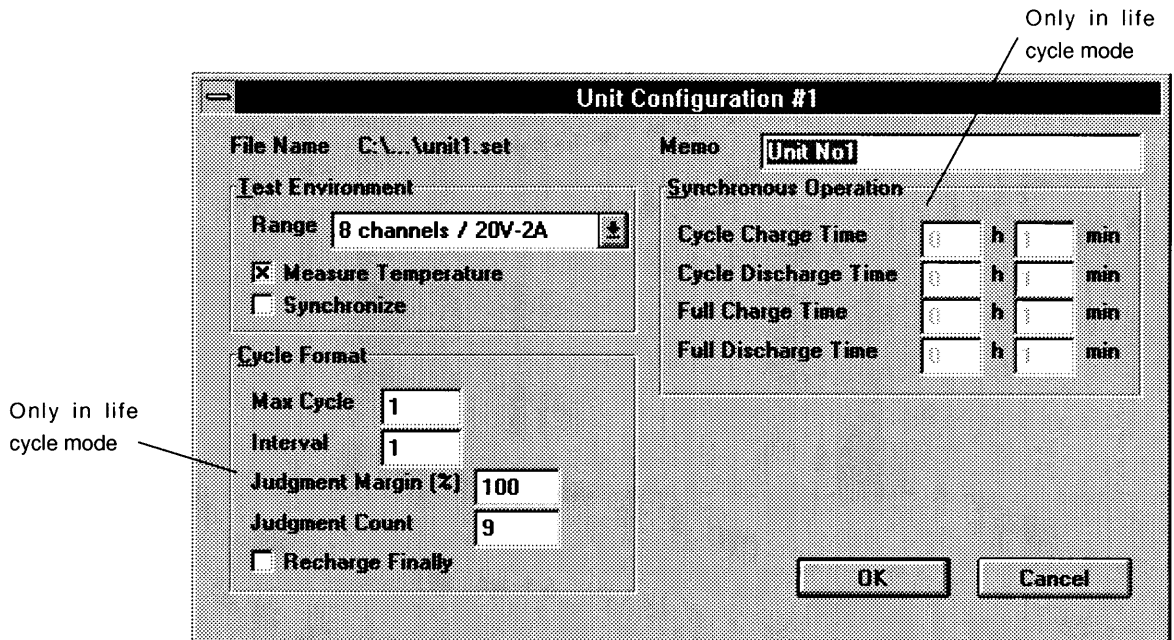


Figure 3-5 Unit Configuration Screen

This screen represents when Unit #1 has been selected.

These are some of the testing conditions which can be set. You can set these items separately for each unit. These items must be set before tests are actually conducted. For details on each setting item, see the operation manual for the PFX40W-08. A brief description of these items is given here.

Unit setting items

■ Test Environment

Range

This indicates the voltage/current range and the number of channels connected in parallel. The default number of channels is 8, but when connections are in parallel, select 4, 2 or 1 depending on the combinations used. Current range is determined based on the voltage range and number of channels. Select any of the following from the 8 settings shown below.

| | |
|----------------------|---------------------|
| 1 channel / 10V-32A | 1 channel / 20V-16A |
| 2 channels / 10V-16A | 2 channels / 20V-8A |
| 4 channels / 10V-8A | 4 channels / 20V-4A |
| 8 channels / 10V-4A | 8 channels / 20V-2A |

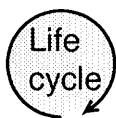
Measure Temperature

This specifies whether or not to measure battery temperature. This can only be selected when a thermistor is actually connected to a battery.

Synchronize

Select this item when synchronizing test cycles between channels. Synchronous Operation, described later, must also be set when this item has been selected.

■ Cycle Format



- This setting is disabled (grayed out) in sequence mode.

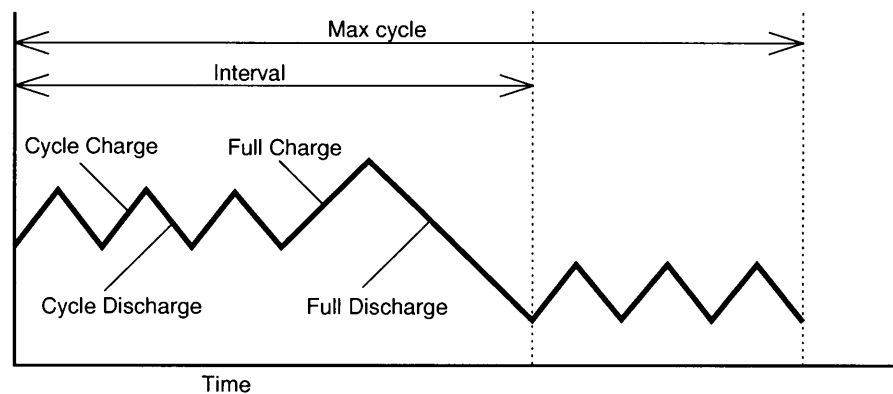


Figure 3-6 Number of Cycles and Interval

Max Cycle

One charge and discharge is counted as one cycle. This item sets the maximum number of cycles, including cycle charge/discharge and full charge/discharge, for the entire test. The Max Cycle setting in the figure above is 7.

Interval

This is the interval between cycle charge/discharge and full charge/discharge. The Interval setting in the figure above is 3 cycle charge/discharges and one full charge/discharge for an Interval of 4.

Judgment Margin

This is the margin value for judging if a battery passes or fails. In other words, it is the upper limit of the capacity rate factor (%) used to determine a pass. The actual capacity value is judged as okay or no good in relation to the capacity rate set under testing conditions.

Judgment Count

This setting is used to terminate charge/discharge cycle testing once the measured capacity of a battery has tested as no good a certain number of times thus indicating that its life has expired. Under this condition, testing may end before Max Cycle is reached.

Recharge Finally

Select this item when you wish to recharge your batteries after all testings are complete.

■ Synchronous Operation



NOTE

- This setting is disabled (grayed out) in sequence mode.

Be sure to set various synchronization times when you have selected Synchronize under Test Environment. If Synchronize has not been selected, synchronization times are disabled (grayed out).

■ Memo

A memo of up to 20 characters in length can be input to each unit.

When settings are complete

Click on the "OK" button to confirm current settings. The contents of the table will be updated to reflect current settings.

"Copy" and "Paste"

Use these functions when you wish to use the same settings for multiple units. These functions are available when more than one PFX unit is being used.

3.4 Sending Set Data

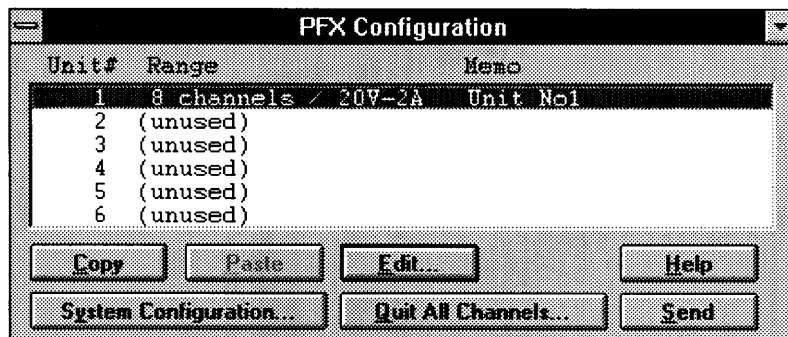


Figure 3-7 PFX Configuration Screen

You can send configuration settings to each PFX unit when the PFX Config is complete. If you wish to send data without quitting, click on the "Send" button on this screen. All settings up to this point will be sent to each PFX unit. Data transfer has failed if any of the following error messages appear. If this happens, follow the given instructions.

■ ERR-220

Cannot open GPIB device. Please check GPIB adapter and driver configuration.

This error message appears when the device driver set under the system configuration differs from the actual GPIB board being used, or when the driver for the GPIB board has not been loaded properly. Send data again after correcting settings for the driver.

■ ERR-230

GPIB write error in Unit x - Address x. Please check GPIB addresses and cables.

This abnormal communications error message appears when there are units among those displayed which are not GPIB connected. Check connections and Retry.

■ ERR-301

Cannot change the PFX operation mode to SETUP mode.

This warning message appears when there is an executing channel (including HOLD and END status) among those units displayed. Execute "Quit All Channels", described next, if this happens.

Quit all channels

If the error message ERR-301 appears, and you wish to quit all currently executing tests (abandon testing, STOP & QUIT) but still wish to send data, close this warning message and select "Quit All Channels" on the PFX Configuration screen.

Click on the "Yes" button when the confirmation message box appears. Note that if you select this accidentally, important testings may be abandoned before they are finished.

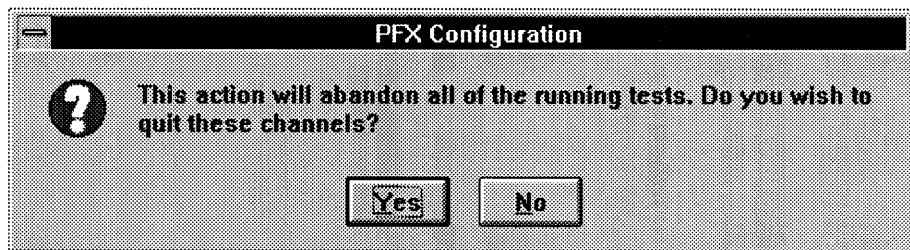


Figure 3-8 Confirmation Message

3.5 Quitting PFX Config

You can quit PFX Config by selecting "Close" from the control menu box in the upper left of the screen. A message box will appear asking if set data should be sent to each unit. If testing is to be conducted, select "Yes" to send the data.

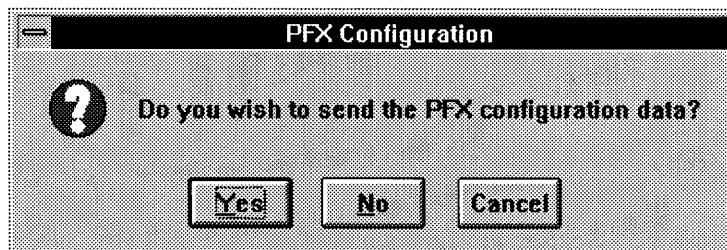


Figure 3-9 Send Message

NOTE

- Normally data is sent when quitting PFX Config. Avoid sending data before quitting. Note that data is not sent when PFX Config is iconized.

If the transfer is failed, an error message will appear. If this happens, follow the instructions given in the previous section "Sending Set Data". Do not conduct testing when there are errors sending data or without quitting PFX Config (without sending data). There is no way to send system configuration data and unit configuration data to PFX units except using PFX Config.

When you quit PFX Config, the configuration data will be overwritten to PFX configuration files.

Unit Configuration

```
C:\KIKUSUI\BPC21\UNIT1.SET  
C:\KIKUSUI\BPC21\UNIT2.SET  
:  
:  
C:\KIKUSUI\BPC21\UNIT6.SET
```

(Six files are created corresponding to the serial number of each unit.)

If BP checker has been installed in another drive and/or directory, you can find these configuration files there.

These files are written whenever you exit PFX Config regardless of whether or not data was sent at that time. These files are always required when executing BP checker. If any of these files do not exist, operations will be conducted using all default values. Normal operations are impossible if you execute tests when PFX units do not match associated file contents.

To ensure that tests are always conducted under proper conditions, we recommend that you execute PFX Config and then send setting values to PFX units when every time you start the system (at power on) even if no settings have been changed. This procedure allows confirmation of system configuration and checking of communications status, and allows BP checker management files to be matched to PFX40W-08 units.

What to do Next

Continue on to Chapter 4, and create all folders and worksheets necessary for actual testing.

4

CHAPTER 4 CREATING AND MANAGING TEST CONDITIONS - Folder Editor

This chapter describes the Folder Editor and then explains how to create folders and worksheets.

Sections in Chapter 4

- 4.1 Folder Editor
- 4.2 Starting the Folder Editor
- 4.3 Creating Folders
- 4.4 Creating Worksheets
- 4.5 Saving Folders

4.1 Folder Editor

The Folder Editor is a program for editing folders and multiple worksheets contained within folders.

A folder is a collection of worksheets which describe how tests are to be conducted. A worksheet represents a test scenario including charge current, discharge current, time, and other factors. Battery information shared by all worksheets and header information for managing the entire collection of worksheets is included in a folder.

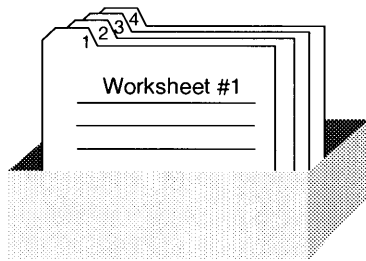


Figure 4-1 Folder

Each PFX40W-08 unit can have up to 8 worksheets at once. Under BP checker, this means each folder can handle up to 99 worksheets.

How worksheets are handled differs slightly depending on the operation mode of BP checker. In life cycle mode, worksheets for battery life characteristics are used to conduct separate tests numerous times based on given test conditions. In sequence mode, it is necessary to investigate a battery's initial charge characteristics. It is therefore necessary to keep on successively changing to different test conditions (worksheets). In this case, worksheets must be properly ordered in order for successive testing.

It is useful to think of a folder as a heading, and worksheets as separate elements. Note however that all worksheets in a folder have been created for the same battery. This means the three items of information, battery type, nominal voltage, and nominal current, represent "battery information" shared throughout the folder. Each of these items can only be set once within a given folder.

For details on the concept and contents of worksheets, please refer to your PFX40W-08 operation manual.

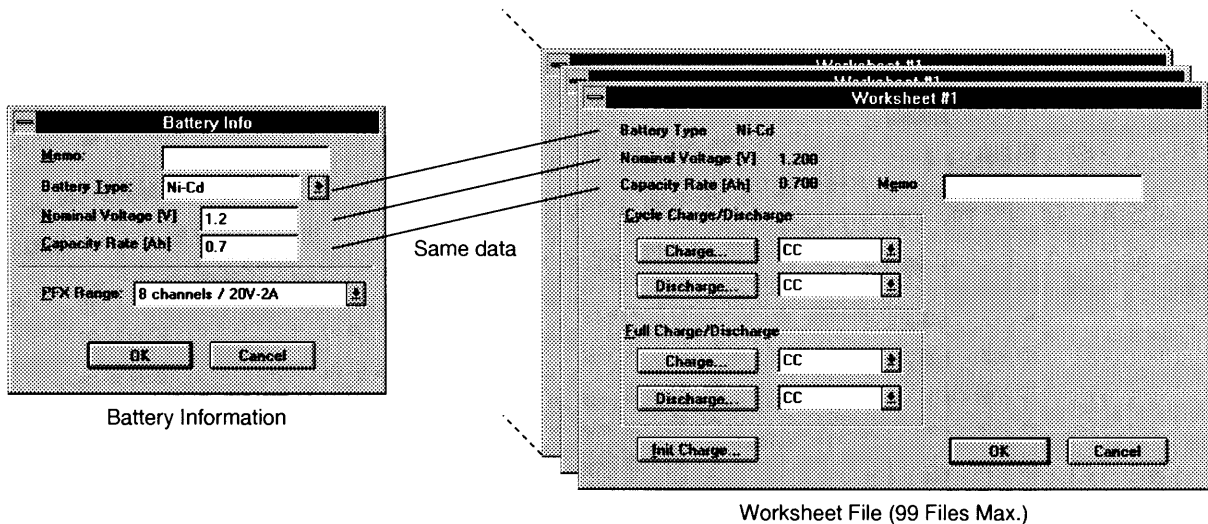


Figure 4-2 Battery Information and Worksheet Files

4.2 Starting Folder Editor

To start the Folder Editor, double-click on the "Folder Editor" icon.

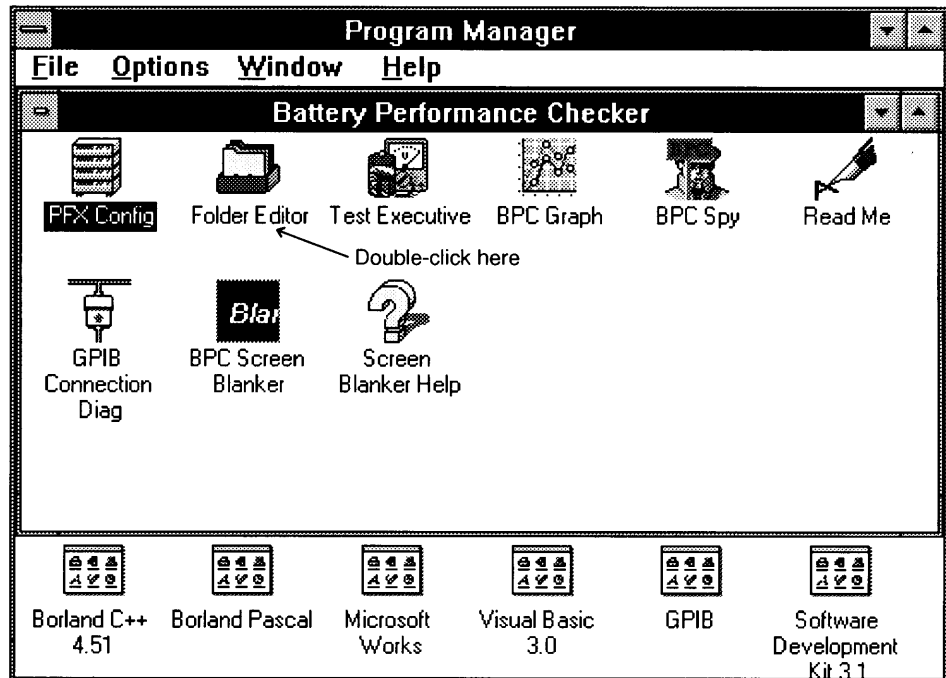


Figure 4-3 Starting the Folder Editor

If you are going to actually conduct tests, assign any folder to a given channel, select the desired worksheets from within the folder, and execute.

The Folder Editor is used for editing the test contents of worksheets and creating folders in which to save those worksheets.

4.3 Creating Folders

There are two ways to create a folder: create a new one, or change an existing one. The Folder Editor allows you to create a new folder immediately after it has been started. You can create a new folder from scratch, or you can select "Open" from the "File" menu and load an existing folder.

The file name of a folder must follow MS-DOS conventions. It may consist of up to 8 letters. The extension must be "FLD" when in life cycle mode or "FSQ" when in sequence mode.

Setting battery information

The first thing you must do when setting test conditions (writing conditions to a worksheet) is set battery information. Battery information is shared throughout a folder by all worksheets. Once these settings have been made, you can begin inserting several worksheets, but you should first secure a place (a drive and directory) in which to save your folder. A folder containing one worksheet requires approximately 3 KB of disk space to save.

A dialog box for setting battery information will appear when you select "Battery Info..." from "Edit" on the menu bar.

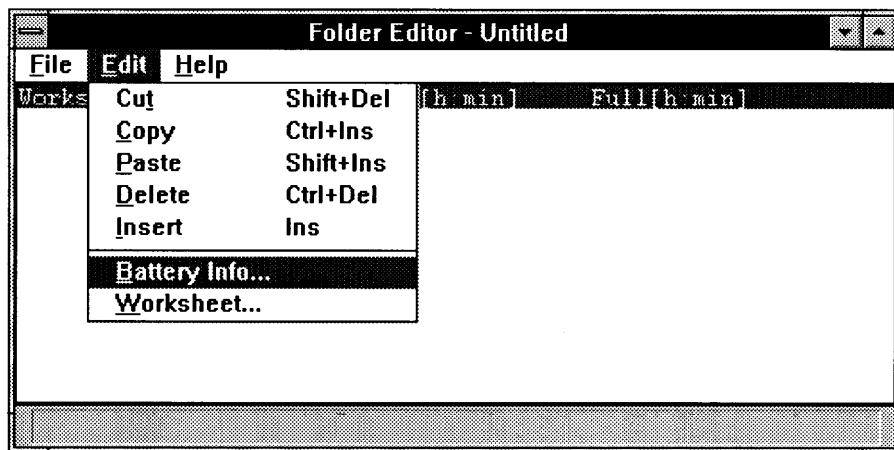


Figure 4-4 Setting Battery Information

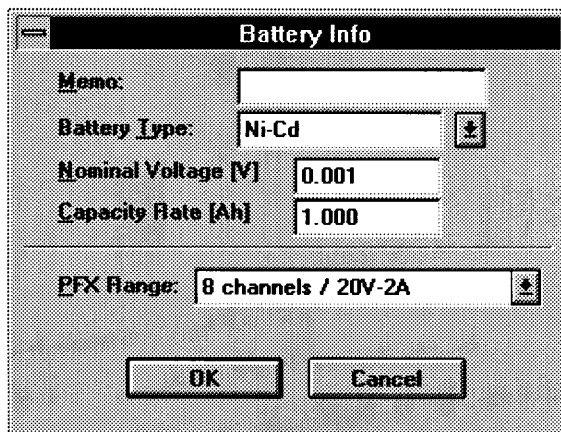


Figure 4-5 Battery Information Dialog Box

■ Memo

This is a memo for this folder. You can freely enter up to 20 characters.

■ Battery Type

This data is treated as a comment. Information entered here does not effect testing, but is sent to the PFX unit. Choose a battery type from the list or enter a descriptive name (up to 10 characters). The default is Ni-Cd.

NOTE

- When reading folders created under BP checker Ver 1.0, battery type is displayed as a number from 1 to 4. These numbers represent battery type as indicated below. Although using these numbers for the battery type represents no problem whatsoever in terms of actual testing, you can change them by selecting from the list if you want battery type represented by a descriptive name.

1 : Ni-Cd 3 : Pb
2 : Ni-MH 4 : Li

■ Nominal Voltage, Capacity Rate

These values directly effect testing conditions. Valid values must be input.

■ Range

This setting is used to check the range for voltage and current when creating worksheets. The range data actually sent to the PFX units is that set for the system configuration using PFX Config. If the folder used for testing has a range other than that set under PFX Config, a warning message will be displayed, but testing will still be possible. The reason for this is that it is conceivable that testing may be performed on a battery with different unit settings such as when a single folder is used for multiple channels. This means that when testing is being conducted using a folder for which a warning message is displayed, you must manage condition setting values yourself. Also, since a range check is performed only when the window for each worksheet is closed, no range check is performed right when the value under the folder heading "Range" is changed when writing worksheets. If you want the range to be checked, try opening/closing all setting windows active for the worksheet in question. If an inappropriate range has been specified, the associated window will not close.

Folder settings are complete when you select "OK" setting these items. Be sure to save settings before you forget. To save, select "Save" or "Save As" from "File" on the menu bar. The file name extension will be set by default to "FLD" (life cycle mode) or "FSQ" (sequence mode). Although you may freely select the directory and file name, do not change the extension. The file name of the folder just created appears on the title bar of the associated window.

4.4 Creating Worksheets

Setting battery information is not enough to conduct testing. You must also create a worksheet and set necessary test conditions there too. This section describes how to create a worksheet and make necessary settings within.

Creating a worksheet

To create a worksheet, select "Insert" from "Edit" on the menu bar. Then a single line including numbers appears on the Folder Editor. This is a worksheet. Try repeating the same operation one more time. The display now shows two lines. Each line represents a worksheet. Next, click on one of the two lines on the Folder Editor. The line selected will highlight and indicate that the worksheet is selected. Now let's explain how to make settings in a worksheet.

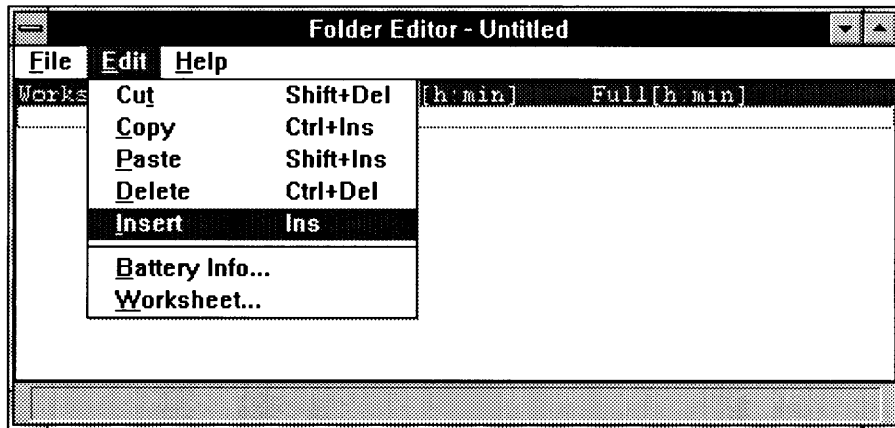


Figure 4-6 Creating a Worksheet

Select either of the two worksheets you just created. Now select "Worksheet..." from "Edit" on the menu bar or double click on the worksheet in question.

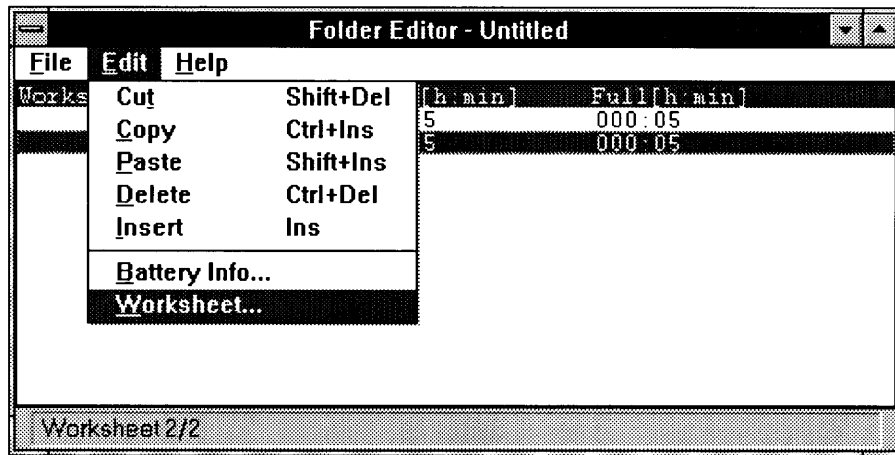


Figure 4-7 Editing a Worksheet

A dialog box entitled Worksheet #x (where x is the worksheet number) will appear as the worksheet setting screen. This screen differs depending on the operation mode.

Sequence →

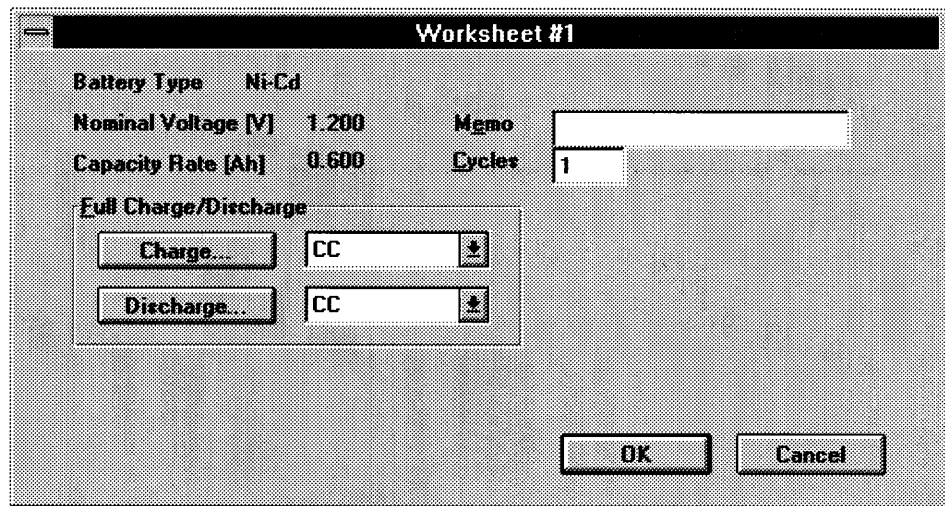


Figure 4-8a Worksheet Setting Screen in Sequence Mode

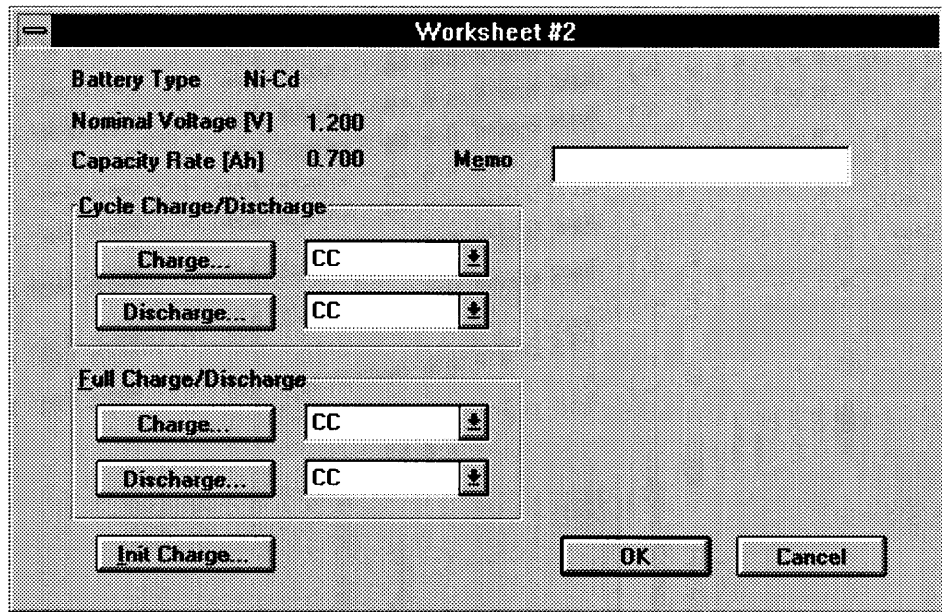


Figure 4-8b Worksheet Setting Screen in Life Cycle Mode

■ Battery Type, Nominal Voltage, Capacity Rate

Battery information which has already been set (battery type, nominal voltage, and capacity rate) is shown here for confirmation purposes.

■ Memo

A user-defined comment of up to 20 characters can be entered here.

■ Cycles

Sequence →

_____ NOTE _____

- This setting is not available in life cycle mode.

This setting specifies how many times this worksheet is to be repeated when tests are conducted in sequence mode.

■ Cycle Charge/Discharge

_____ NOTE _____

- The operation performed when the Charge or Discharge buttons are pressed differs depending on which item in the list to the immediate right (charge/discharge mode) is selected.

- If the "Cycle Format/Interval" of the unit configuration under PFX Config is set to "1", these settings are not needed since "Cycle Charge" and "Cycle Discharge" will not be executed. Similarly, the "Init Charge" setting is not required when initial charge is not performed.

Setting charge/discharge mode

Before setting charge/discharge parameters, it is necessary to select the charge/discharge mode. This is because parameter contents differ depending on the charge/discharge mode selected. Select the desired charge/discharge mode from the list immediately to the right of the Charge or Discharge buttons.



■ Cycle Charge/Discharge Mode

NOTE

- This setting is not available in sequence mode.

There are four modes which can be set for the charge mode: "CC", "CC-CV", "CC-Pattern", and "CC-CV-Pattern". There are four modes which can be set for the discharge mode: "CC", "CP", "CC-Pattern", and "CP-Pattern".

For details on these settings, please see your PFX40W-08 operation manual.

■ Full Charge/Discharge Mode

There are two modes which can be set for the charge mode: "CC" and "CC-CV". There are two modes which can be set for the discharge mode: "CC" and "CP".

For details on these settings, please see your PFX40W-08 operation manual.

Setting charge/discharge parameters

Once you have selected the charge/discharge mode, you can finally enter specific values for charge/discharge parameters. When you press the Charge or Discharge button arranged on the left, an edit screen for each parameter will appear. The edit screen which appears will depend on the charge/discharge mode you have selected.

NOTE

- For each of the dialog boxes shown from Figure 4-9 through 4-25, any value entered beyond the decimal point will be ignored for settings which are normally taken as integers.

■ Cycle Charge



NOTE

- This setting is not available in sequence mode.

There are six different setting screens possible depending on the charge mode. These are shown in Figures 4-9 through 4-14.

| Cycle Charge | |
|--------------------------|-----------|
| Mode CC | |
| Charge | |
| Current [A] | 0.001 |
| Time | 0 h 1 min |
| Aux Charge | |
| Current [A] | 0.001 |
| Time | 0 h 1 min |
| Finish At | |
| Max Voltage [V] | 0.001 |
| Max Temp [°C] | 100 |
| -dV [mV] | 999 |
| dT/dt [°C/min] | 99.0 |
| Rest After Charge | |
| Time | 0 h 1 min |
| OK | |
| Cancel | |

Figure 4-9 Cycle Charge Screen when CC Mode is Selected

| Cycle Charge | |
|--------------------------|-----------|
| Mode CC-CV | |
| Charge | |
| Current [A] | 0.001 |
| Voltage [V] | 0.001 |
| Time | 0 h 1 min |
| Finish At | |
| Max Temp [°C] | 100 |
| dT/dt [°C/min] | 99.0 |
| Rest After Charge | |
| Time | 0 h 1 min |
| OK | |
| Cancel | |

Figure 4-10 Cycle Charge Screen when CC-CV Mode is Selected

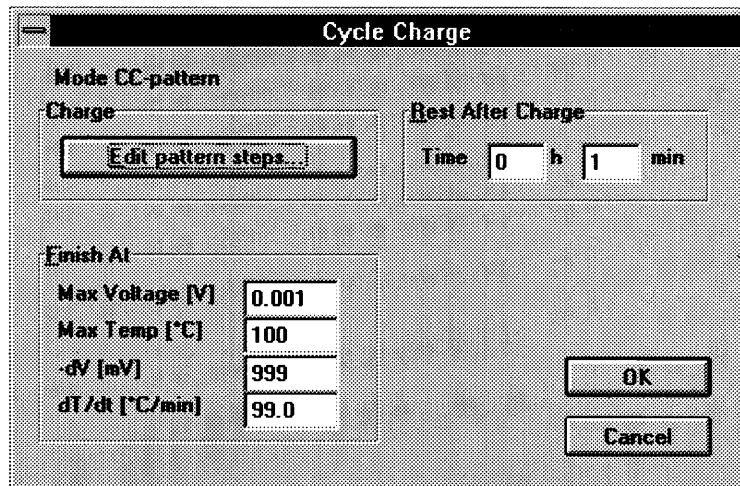


Figure 4-11 Cycle Charge Screen when CC-Pattern Mode is Selected

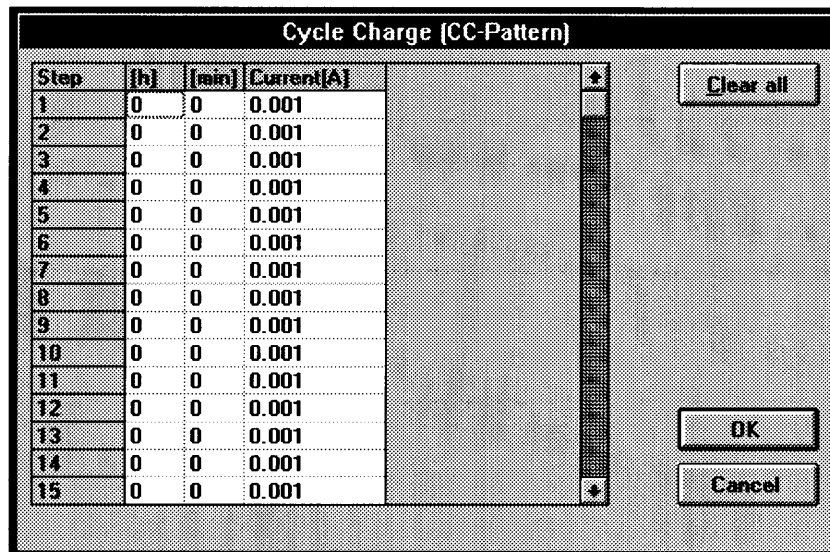


Figure 4-12 Step Setting Screen when CC-Pattern Mode is Selected

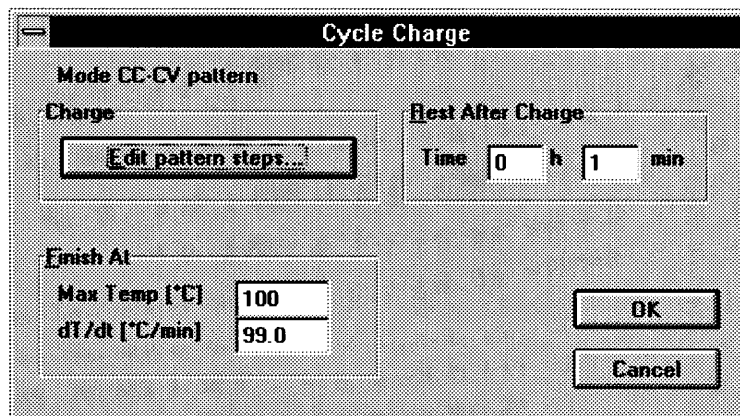


Figure 4-13 Cycle Charge Screen when CC-CV-Pattern Mode is Selected

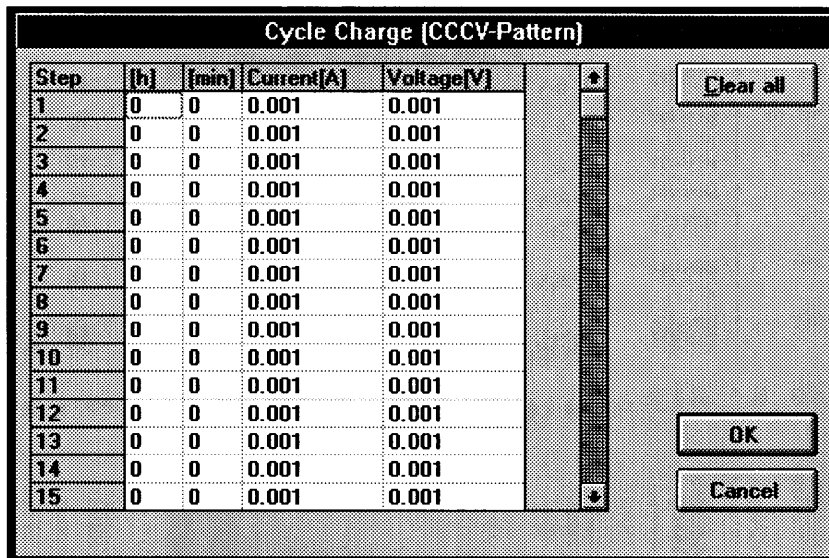
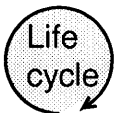


Figure 4-14 Step Setting Screen when CC-CV-Pattern Mode is Selected

■ Cycle Discharge



NOTE

- This setting is not available in sequence mode.

There are six different setting screens possible depending on the discharge mode. These are shown in Figures 4-15 through 4-20.

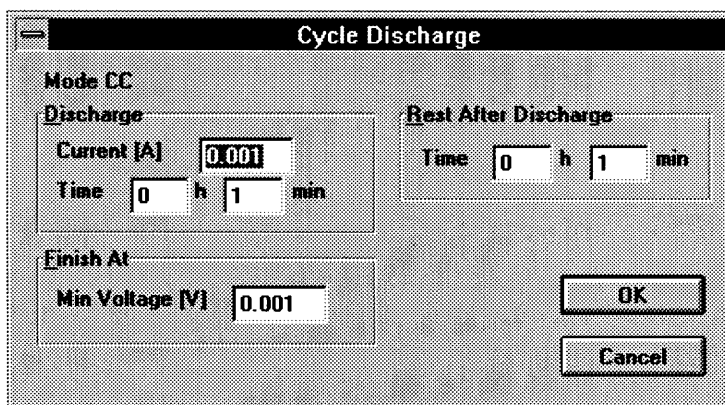


Figure 4-15 Cycle Discharge Screen when CC Mode is Selected

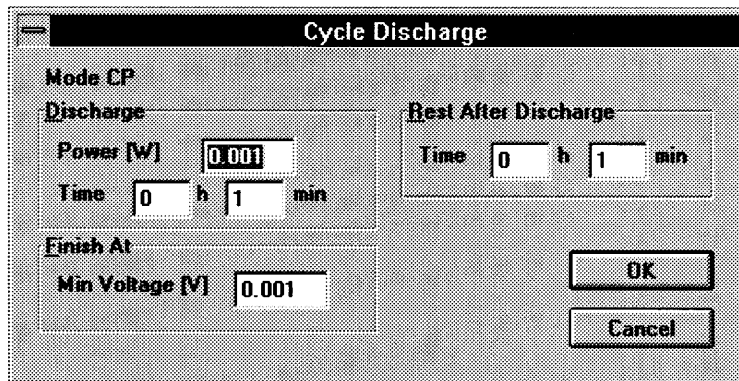


Figure 4-16 Cycle Discharge Screen when CP Mode is Selected

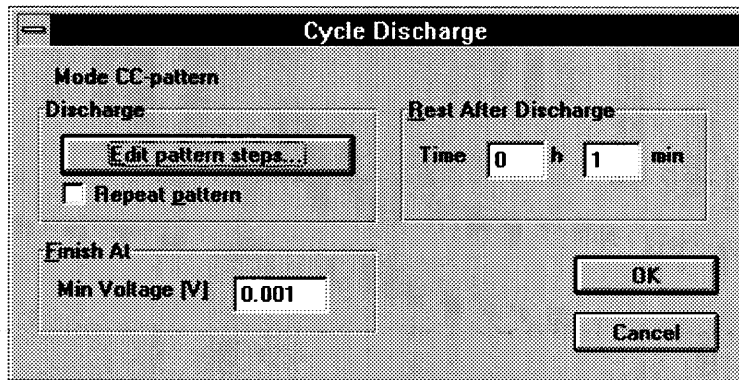


Figure 4-17 Cycle Discharge Screen when CC-Pattern Mode is Selected

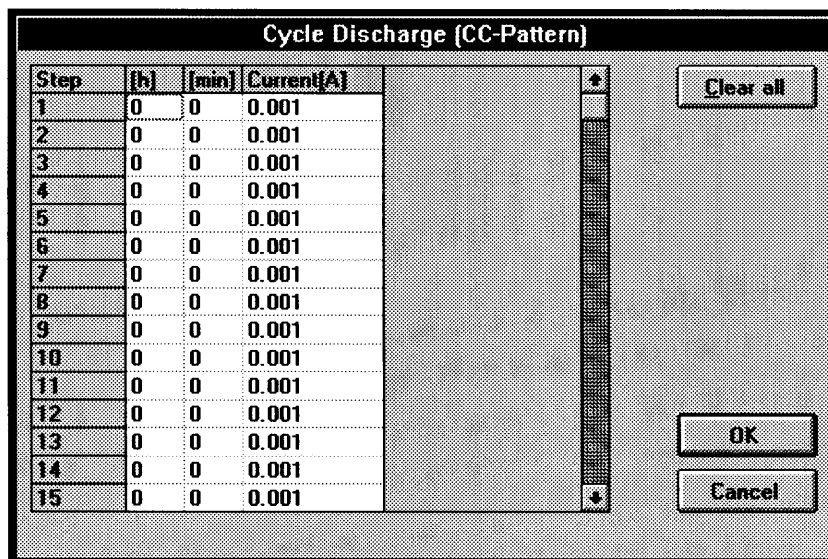


Figure 4-18 Step Setting Screen when CC-Pattern Mode is Selected

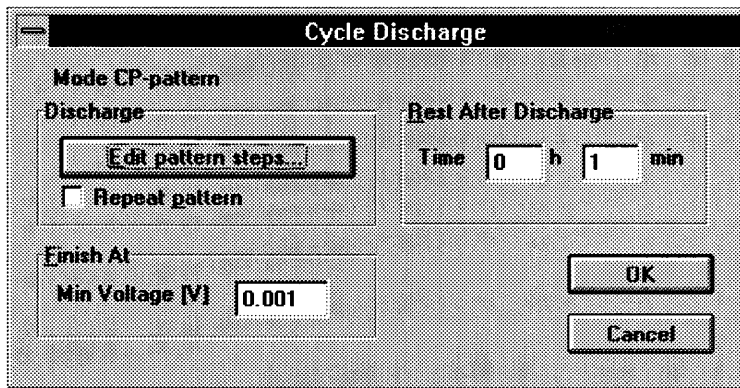


Figure 4-19 Cycle Discharge Screen when CP-Pattern Mode is Selected

| Step | [h] | [min] | Power[W] |
|------|-----|-------|----------|
| 1 | 0 | 0 | 0.001 |
| 2 | 0 | 0 | 0.001 |
| 3 | 0 | 0 | 0.001 |
| 4 | 0 | 0 | 0.001 |
| 5 | 0 | 0 | 0.001 |
| 6 | 0 | 0 | 0.001 |
| 7 | 0 | 0 | 0.001 |
| 8 | 0 | 0 | 0.001 |
| 9 | 0 | 0 | 0.001 |
| 10 | 0 | 0 | 0.001 |
| 11 | 0 | 0 | 0.001 |
| 12 | 0 | 0 | 0.001 |
| 13 | 0 | 0 | 0.001 |
| 14 | 0 | 0 | 0.001 |
| 15 | 0 | 0 | 0.001 |

Figure 4-20 Step Setting Screen when CP-Pattern Mode is Selected

■ Full Charge

There are two different setting screens possible depending on the charge mode. These are shown in Figures 4-21 and 4-22.

The screenshot shows a 'Full Charge' configuration window for 'Mode CC'. It is divided into several sections: 'Charge' with Current [A] at 0.001 and Time at 0 h 1 min; 'Pre-discharge' with Current [A] at 0.001, Time at 0 h 0 min, and Finish Min Voltage [V] at 0.001; 'Finish At' with Max Voltage [V] at 0.001, Max Temp [°C] at 100, -dV [mV] at 999, and dT/dt [°C/min] at 99.0; and 'Aux Charge' with Current [A] at 0.001 and Time at 0 h 1 min. A 'Rest After Charge' section has Time at 0 h 1 min. 'OK' and 'Cancel' buttons are at the bottom right.

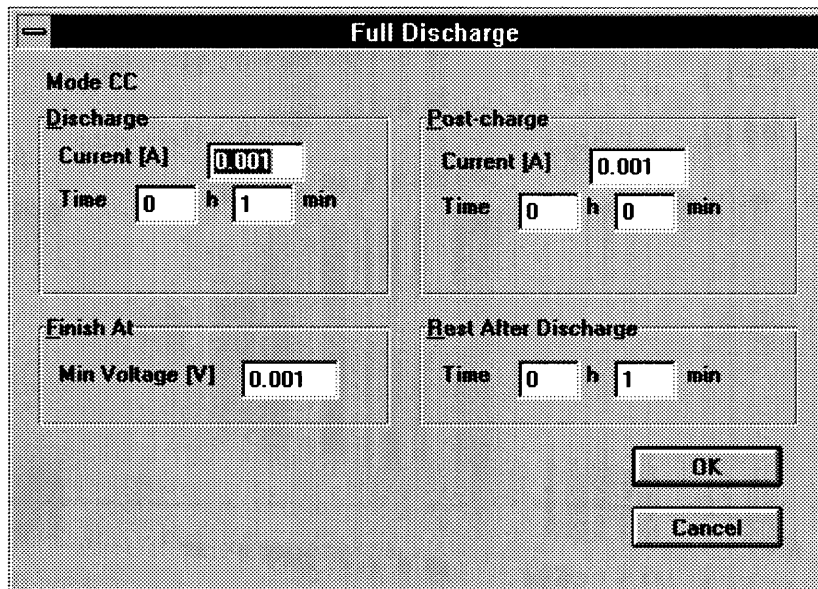
Figure 4-21 Full Charge Screen when CC Mode is Selected

The screenshot shows a 'Full Charge' configuration window for 'Mode CC-CV'. It is divided into several sections: 'Charge' with Current [A] at 0.001, Voltage [V] at 0.001, Max Time at 0 h 1 min, and CV Time at 0 h 0 min; 'Pre-discharge' with Current [A] at 0.001, Time at 0 h 0 min, and Finish Min Voltage [V] at 0.001; 'Finish At' with Max Temp [°C] at 100 and dT/dt [°C/min] at 99.0; and 'Rest After Charge' with Time at 0 h 1 min. 'OK' and 'Cancel' buttons are at the bottom right.

Figure 4-22 Full Charge Screen when CC-CV Mode is Selected

■ Full Discharge

There are two different setting screens possible depending on the discharge mode. These are shown in Figures 4-23 and 4-24.

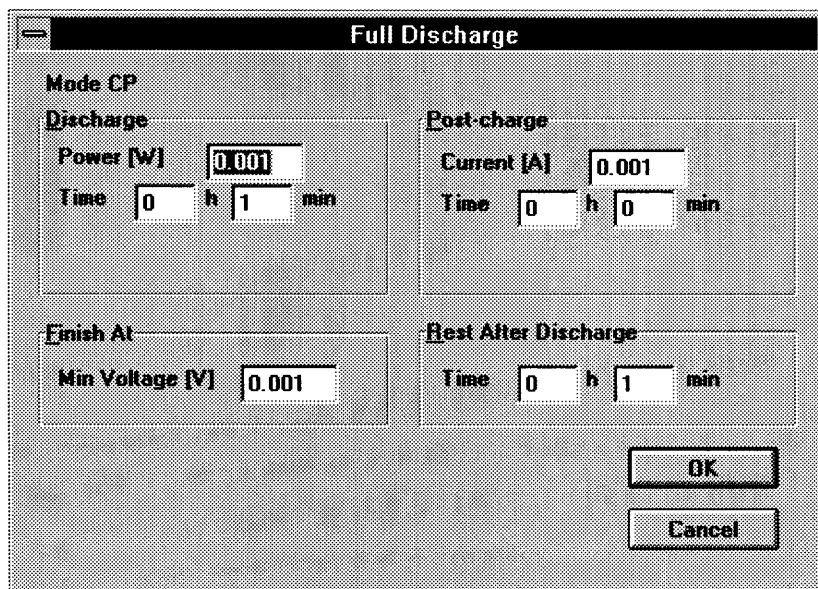


The screenshot shows a software interface titled "Full Discharge" with a back arrow on the top left. It is divided into four quadrants for setting parameters:

- Mode CC** (indicated at the top left of the screen)
- Discharge**: Current [A] is set to 0.001; Time is 0 h and 1 min.
- Post-charge**: Current [A] is set to 0.001; Time is 0 h and 0 min.
- Finish At**: Min Voltage [V] is set to 0.001.
- Rest After Discharge**: Time is 0 h and 1 min.

At the bottom right, there are two buttons: "OK" and "Cancel".

Figure 4-23 Full Discharge Screen when CC Mode is Selected



The screenshot shows a software interface titled "Full Discharge" with a back arrow on the top left. It is divided into four quadrants for setting parameters:

- Mode CP** (indicated at the top left of the screen)
- Discharge**: Power [W] is set to 0.001; Time is 0 h and 1 min.
- Post-charge**: Current [A] is set to 0.001; Time is 0 h and 0 min.
- Finish At**: Min Voltage [V] is set to 0.001.
- Rest After Discharge**: Time is 0 h and 1 min.

At the bottom right, there are two buttons: "OK" and "Cancel".

Figure 4-24 Full Discharge Screen when CP Mode is Selected

■ Init Charge



NOTE

- This setting is not available in sequence mode.

| Step | [h] | [min] | Current[A] |
|------|-----|-------|------------|
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 |
| 5 | 0 | 0 | 0 |
| 6 | 0 | 0 | 0 |
| 7 | 0 | 0 | 0 |
| 8 | 0 | 0 | 0 |
| 9 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 |
| 11 | 0 | 0 | 0 |
| 12 | 0 | 0 | 0 |
| 13 | 0 | 0 | 0 |
| 14 | 0 | 0 | 0 |
| 15 | 0 | 0 | 0 |

Figure 4-25 Initial Charge Setting Screen

Saving worksheets

Once each item has been set, click on "OK" on the worksheet dialog to confirm worksheet contents. The comment text entered in the Memo field will appear at the left of each worksheet entry.

Also, a reference value for the total time for cycle charge/discharge (shallow charge/discharge) and full charge/discharge (deep charge/discharge) during normal operations will be displayed. (For "Cycle" and "Full" entries.)

| Worksheet | Cycle[h:min] | Full[h:min] |
|------------------|--------------|-------------|
| BPChecker Test-1 | 000:05 | 000:05 |
| BPChecker Test-2 | 000:05 | 000:05 |

Figure 4-26 List of Worksheets

Editing worksheets

You can do various operations from "Edit" on the menu bar of the Folder Editor for use inside worksheets. These operations include: Cut, Copy, Paste, Delete, and Insert. Cut & Paste and Copy & Paste can be used within the same folder or between worksheets of different folders when creating a new folder or opening existing folder.

4.5 Saving Folders

To save a folder, select "Save" or "Save As" from "File" on the menu bar. The file name extension will be set by default to "FLD" (life cycle mode) or "FSQ" (sequence mode). Although the you may freely select the directory and file name, do not change the extension. The file name of the folder just created appears on the title bar of the associated window.

Worksheets are saved in their own files once the folder is saved. The file name of each worksheet in a folder is the same as the associated folder, but with an extension from W01 to W99.

NOTE

- Although the extension used in the file name of a folder differs depending on whether it is intended for sequence mode or life cycle mode, the extensions of worksheet files underneath a given folder are always the same. To avoid conflicts in file names in sequence mode and life cycle mode, be sure to save folders for different modes in different directories. The directories LIFE and SEQ are already created for you underneath C:\BPCHKR.

What to do Next

Continue on to Chapter 5, and conduct actual tests using folders and worksheets created in this chapter.

5

CHAPTER 5 CONDUCTING TESTS - Test Executive

This chapter will describe how to conduct tests and interpret the test screen.

Sections in Chapter 5

- 5.1 Starting Test Executive
- 5.2 Conducting Tests Using Different Worksheets for Each Channel
- 5.3 Conducting Tests on More than One Channel Using One Worksheet
- 5.4 Functions Related to the On-Screen Display
- 5.5 Options
- 5.6 Processing During Power Failures

5.1 Starting Test Executive

Test Executive is the kernel program for the BP checker and manages actual testing. It executes for each channel, monitors test status, and automatically creates results files. The main feature of Test Executive is communication with PFX units.

NOTE

- Although it depends on the number of units connected, in terms of time required for communications, there is an adverse effect on the speed of other applications run while tests are being executed by this program. Avoid running or using other applications as much as possible while this program is conducting tests. This is necessary so that important data is not missed.

To execute Test Executive, double-click on the "Test Executive" icon.

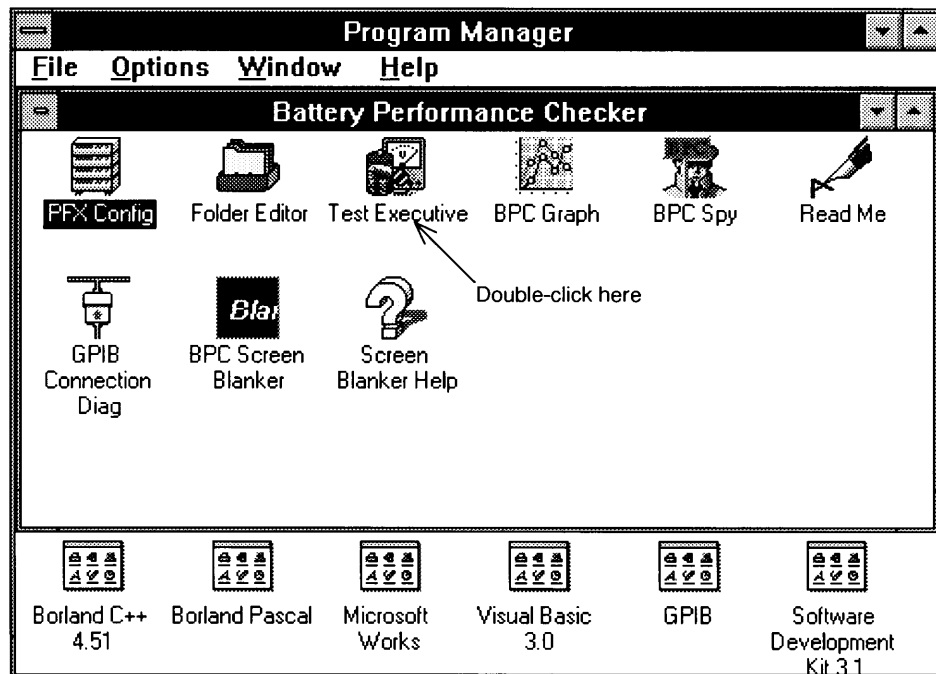


Figure 5-1 Starting Test Executive

When Test Executive is started, the entire system environment is read in from PFX configuration files. The data is read in from files, not from PFX units. Normal operations are not possible if there are any differences between PFX units and contents of configuration files. If you think that there are any differences quit Test Executive, start PFX Config and then restart Test Executive after checking PFX unit settings. For details, see Chapter 3, "Configuring the System - PFX Config".

■ Channels

The execution unit of this program is a channel. Channels have a one-to-one correspondence with individual batteries being tested. For example, if there are eight batteries to be tested, then there are also eight channels. Each channel has a corresponding "channel window" during testing.

It is necessary to first open a channel when starting testing. A folder must be assigned to that channel at this time. Usually this is done when a channel is newly opened. However, sometimes you may want to test several same type batteries under the same conditions. In such cases, it is possible to assign a single folder to more than one channel.

5.2 Conducting Tests Using Different Worksheets for Each Channel

Opening a channel

Let's open a channel. You can open the "Channel Open" dialog box by either selecting "Open" from "Channel" on the menu bar, or by pressing the "Open" button on the toolbar. Here, we will select the channel on which we want to conduct testing.

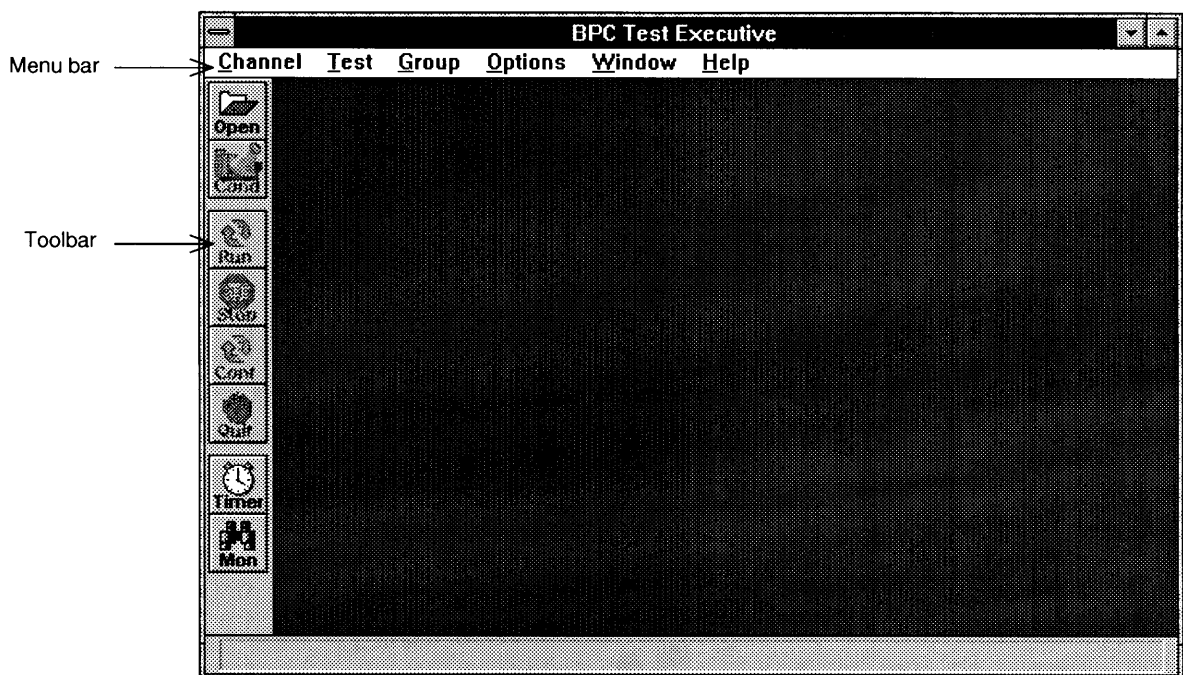


Figure 5-2 Opening a Channel

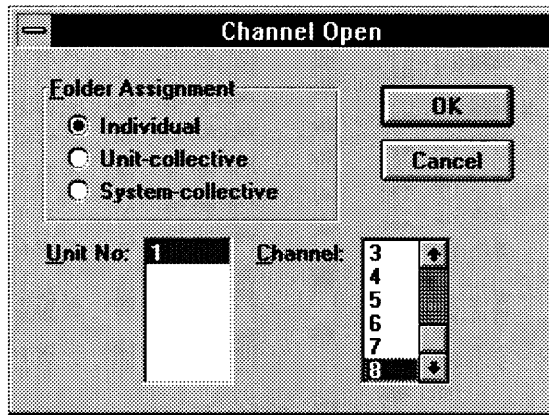


Figure 5-3 Channel Open Screen

Since we are going to conduct testing by assigning a different worksheet to each channel, select "Individual" from the list under "Folder Assignment". (This is selected by default.) Afterwards, select a unit number and a channel to be tested, and confirm by pressing "OK". This will cause the "Run Condition" dialog box of the target channel to open.

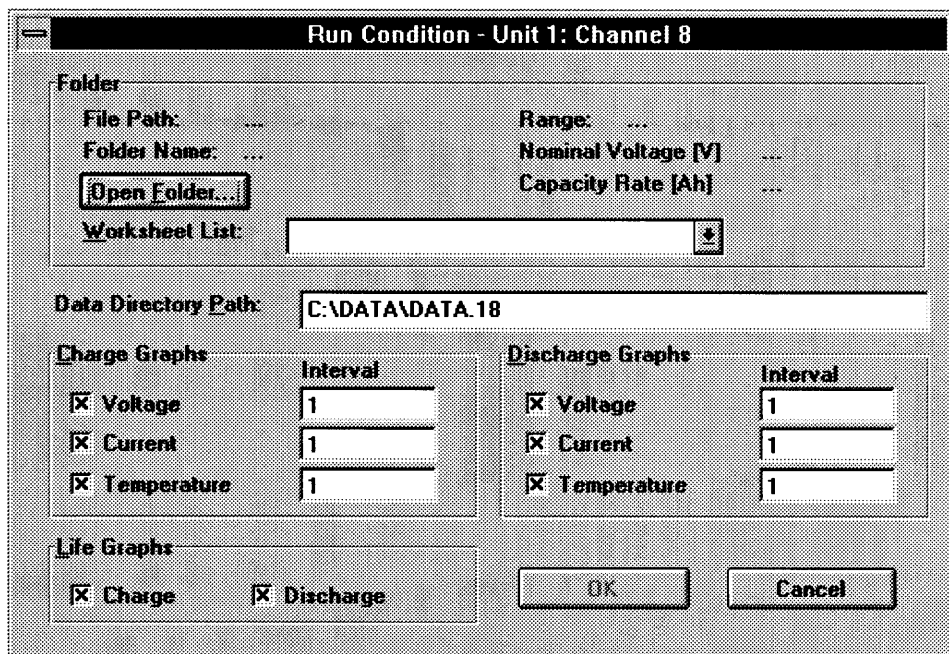


Figure 5-4 Setting Run Conditions

Setting run conditions

This dialog box is used to set necessary conditions before conducting testing. Items are roughly divided into the following two sorts:

- Reading folders
- Settings related to the automatic creation of test results files

■ Reading folders

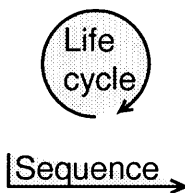
Here, a folder assigned to the channel has to be read in. Find the folder by its file name. In life cycle mode, the extension of the file will be "FLD", while in sequence mode it will be "FSQ". Also, in life cycle mode, you also have to select a desired worksheet that will be used as test conditions. Since worksheets are sequentially used from the first when in sequence mode, you don't have to select any worksheet.

To read a folder, first press the "Open Folder" button to open a folder created with the Folder Editor. If the folder read in does not include even one worksheet, it will not be possible to open a channel. In this case, the "OK" button will be grayed out and cannot be selected. You can close the channel window by pressing the "Cancel" button. Next, stop working in Test Executive (or iconize it) and start the Folder Editor. Try opening a channel window again after you have created a folder and associated worksheets. You can quit Test Executive since testing will not be conducted at this time anyway. (Of course you can close it too.)

The "Folder" portion at the top of the screen is determined by opening a folder.

In life cycle mode, you have to select the desired worksheet from the folder. A list of worksheets will appear in the "Worksheet List". Select one of the worksheets shown.

In sequence mode, since worksheets in a folder will be sequentially used from the first, you cannot select a worksheet from the list.



■ Settings related to automatic creation of test results files

Here, you set the location in which to save test results files, whether or not to create them, and interval for them.

Settings directory in which results files are created

BP checker creates many test results files from the test results of a given channel. The names of these files are automatically determined by the BP checker system. However, since the same result file names will be assigned on each separate channel, it is necessary to assign different directories to different channels. In actual practice, this means you need 48 different directories for testing on 48 different channels.

These directories should all be located within the same base directory on the same hard disk drive. The base directory should be at the top of the directory tree, with subdirectories for saving data for each channel beneath it. For example, if the base directory is C:\DATA, and the subdirectory for Channel 1 is DATA.11, all test result files for Channel 1 will be placed in the directory C:\DATA\DATA.11.

The base directory is set to C:\DATA as default. And the subdirectory for each channel is DATA.XX, where XX stands for the corresponding unit number and channel number. For example, if testing is for Unit 1 on Channel 8, the corresponding subdirectory is DATA.18. There is no problem using default directories just by changing the base directory for each testing project. If you still want to change directory specifications, change it using the "Data Directory Path" item.

NOTE

- If there is old test data remaining in a data directory, it will be overwritten by new data. If you don't want to lose old test data, change the setting for the base directory. A confirmation message asking you to check the directory name will appear every time you start Test Executive or set the base directory.

To change the base directory at a later time, select "Data Directory" from the "Options" menu within Test Executive.

Whether or not to create results files

You can individually specify which types of graphs should be created using the check boxes showing the eight graph types available. After testing has completed, graphs and tables can be created and printed from within the BPC Graph program by opening those files which have been created.

Files created here are always in binary format so that the large amounts of data can be processed quickly. If you need text format files, use the "Save in text format" function of the BPC Graph program.

Charge Graphs, Discharge Graphs

Graph data files for each charge/discharge characteristic are created whenever a full charge or full discharge is completed. Graph data files for both charge and discharge include those for voltage, current, and temperature characteristics. The letters given in brackets below represent file name extensions used for each of these file types.

- [.GCV] Charge test voltage graph data file
- [.GCC] Charge test current graph data file
- [.GCT] Charge test temperature graph data file
- [.GDV] Discharge test voltage graph data file
- [.GDC] Discharge test current graph data file
- [.GDT] Discharge test temperature graph data file

Here, we will give a brief description about each of the types of files created. The names of files created consist of a 5-digit number representing the test cycle number.

Example: 00005.GDV (Discharge test voltage file for the 5th cycle)

Life Graphs

These files are for creating graphs related to life characteristics. The two files listed below are created for each test.

- LIFE.GCL (Charge life characteristics results file)
- LIFE.GDL (Discharge life characteristics results file)

Report files

Although not displayed on the dialog boxes listed in the Run Conditions screen, the two files listed below are also created for use of creation of charge/discharge characteristics lists.

RSLTCHG.REP (Charge life characteristics results report file)

RSLTDCHG.REP (Discharge life characteristics results report file)

These files can be used under BPC Graph to create reports relating to charge and discharge characteristics. These report files are always created and cannot be disabled.

Interval for results file creation

The text boxes found under the heading "Interval" under both "Charge Graphs" and "Discharge Graphs" are used to set the interval at which each file type is to be created. This is used when you do not need results files for every test cycle, but do want results files every given number of cycles. Regardless of the numeric value appearing here, files will be created for the first cycle and last cycle of a test if file creation has been selected.

Once a folder and worksheets have been selected and settings regarding results files have been made, clicking on the "OK" button will cause window for the associated channel to appear.

If you wish to re-display the Run Conditions dialog box for a channel which is already open, activate the channel's window, and select "Running Condition" from under "Channel" on the menu bar. Note that once testing has begun, this can only be used to check run conditions, not change them.



NOTE

- If the cycle format setting of the PFX unit associated with the channel for which testing is being conducted is not "Interval=1", in other words if cycle charge or discharge is being conducted, the graph interval will be fixed at 1 (create graphs every cycle) and this setting cannot be changed.

Executing tests (Run)

Now let's actually execute a test. If you have followed the steps described so far, executing a test should be simple. Please note however that testing will not execute properly if no battery is connected or if test condition settings are not appropriate for the battery type which is connected.

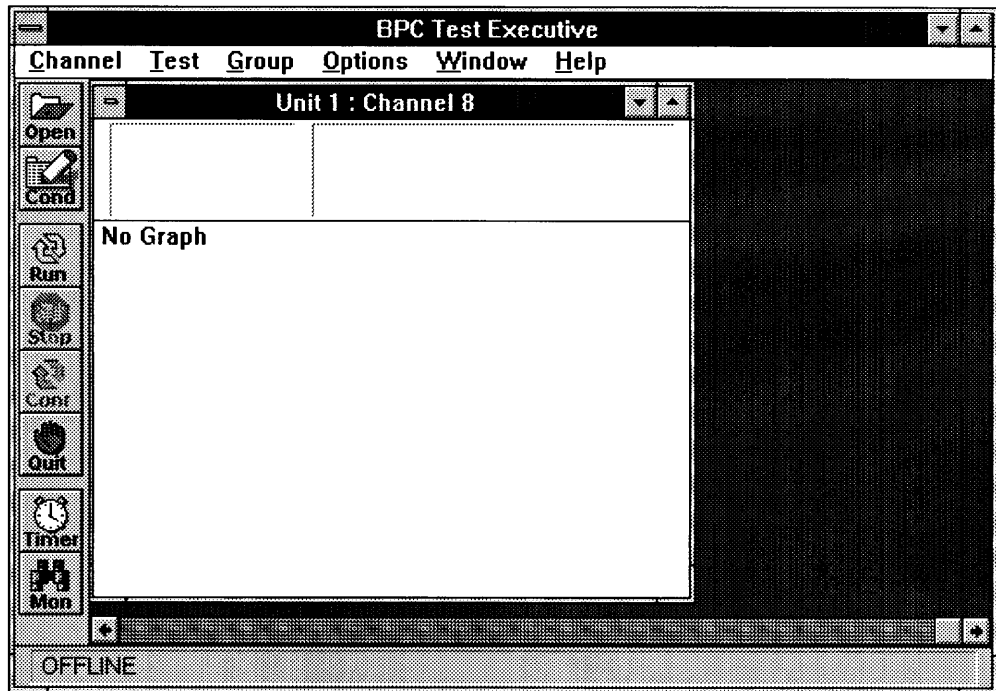


Figure 5-5 Executing Tests

Select the window of the channel for which you wish to conduct testing. The toolbar includes the channel open button and buttons for other frequently used test execution commands. Buttons which are not currently active are grayed out and cannot be selected. Active commands for the selected channel can also be found under "Test" on the menu bar. Selecting "Run" will cause test execution to start. Try executing a test. The display will not change until the status monitoring begins. But after a while, execution status monitoring will begin. The command button active at this time will change from "Run" to "Stop".

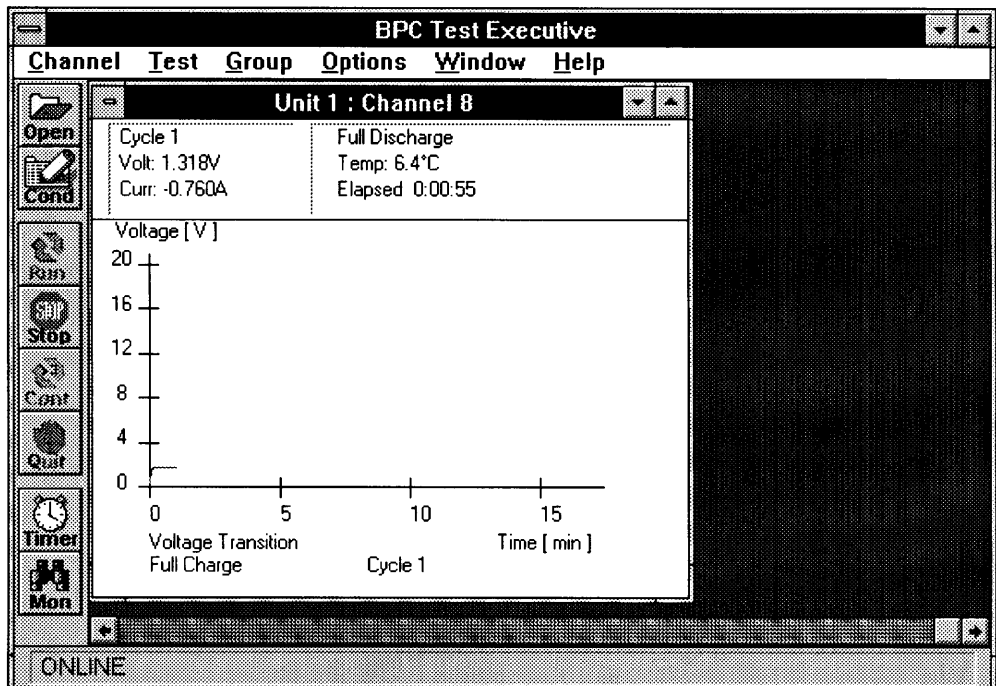


Figure 5-6 During Test Execution

A graph will be displayed in the window once a full charge has been completed. The graph type can be changed by clicking the right mouse button on the graph. However immediately after testing begins, this will result in "No Graph". If no graph data is found, "Graph Data Missing" will be displayed.

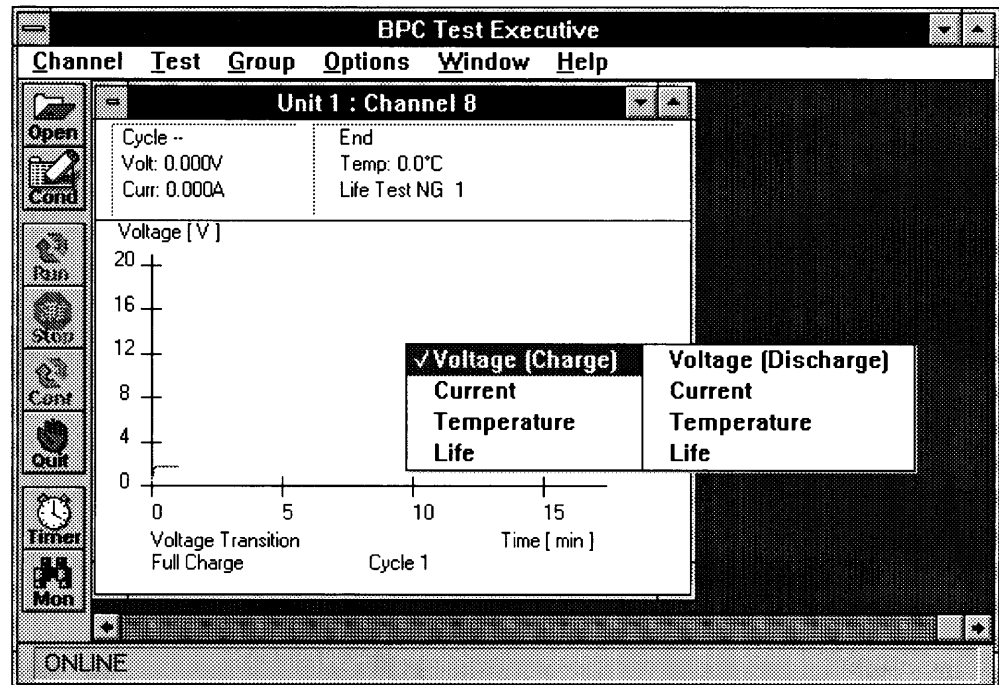


Figure 5-7 Changing Graphs

Using commands on the "Test" menu or buttons on the toolbar, you can execute, halt, restart and stop tests on separate channels. Operations are possible on any channels whose windows are currently active.

The "Group" menu can be used to start/stop the execution of testing all at once for all channels in the system. Pay particular attention to four of these items: "Run/Continue", "InitRun/Continue", "Stop", and "Quit". Selecting "Stop" puts all channels for which testing is being conducted in HOLD status. "Run/Continue" issues a "Run" command to all channels currently in IDLE status, and issues a "Continue" command for all channels currently in HOLD status. "Quit" terminates all testing and puts all channels in IDLE status.

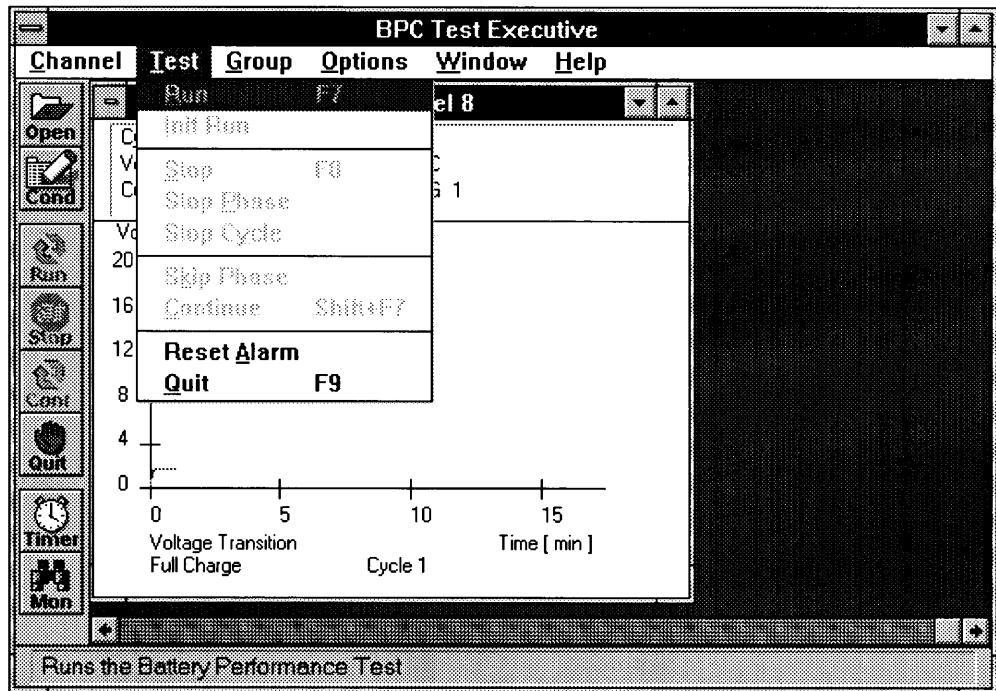


Figure 5-8 Test Menu

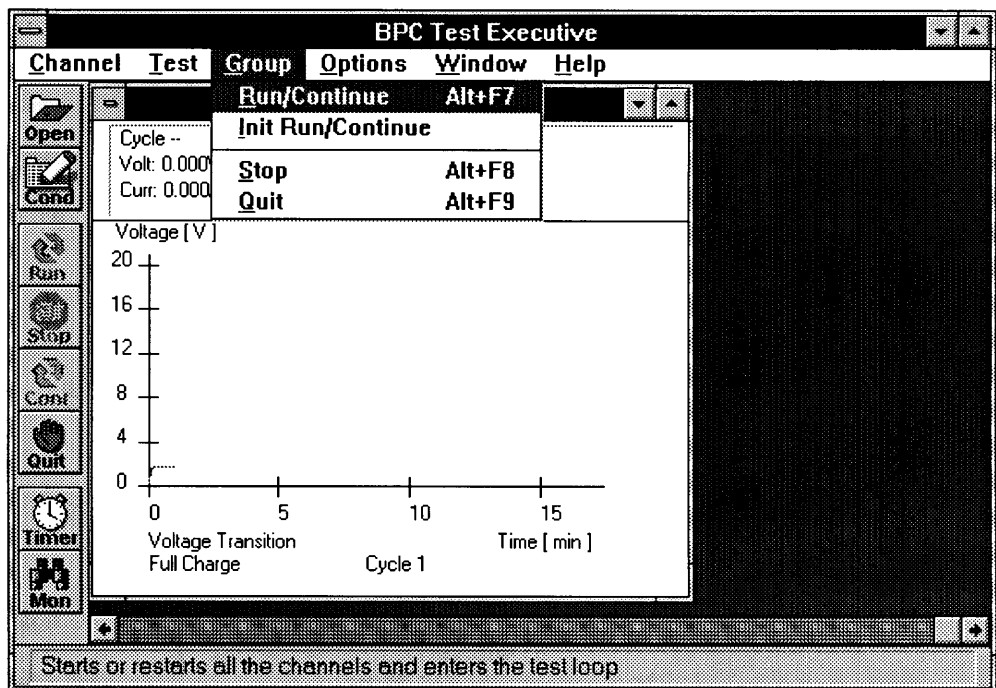


Figure 5-9 Group Menu

Setting the timer

During test execution, status is always monitored at a constant interval based on a timer. It is needed for that current status is displayed on the window. The system checks status change with status monitoring and performs any necessary processing. For example, if a full charge or full discharge has ended, graph data must be read from the PFX unit. This status monitoring is performed for every channel on which testing is being conducted (except those in IDLE status). Typically the response of other Windows operations slows down when there is a lot of this processing. It is therefore possible to set the timer speed slower if you wish to preserve quick response of operability even though timer interval is going to slower.

You can set the timer by selecting "Timer Tick Setup" from "Options" on the menu bar, or by clicking on the "Timer" button on the tool bar.

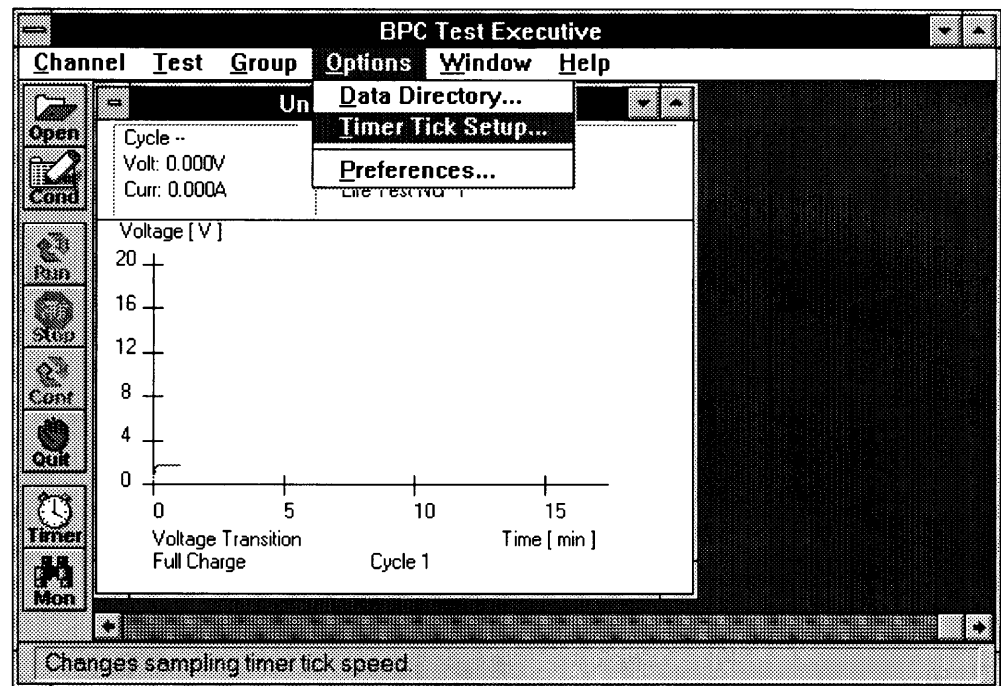


Figure 5-10 Changing Timer Speed

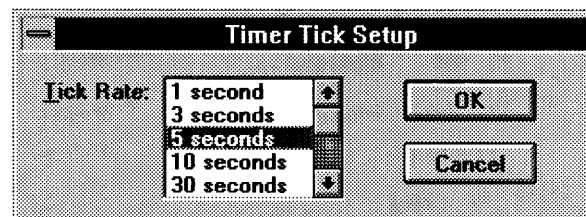


Figure 5-11 Timer Tick Setup Screen

Any of the following values can be selected as the timer speed: 1 second, 3 seconds, 5 seconds, 10 seconds, 30 seconds, or 60 seconds. However, even if you have selected a fast timer, data acquisition and status monitoring will take precedence when there are many channels on which testing is being performed. This means that sometimes the status monitoring interval will be longer than the set value. For example, although status monitoring can be done every second for four channels, the actual interval will be longer than one second for more channels. Use the timer speed setting to improve Windows response and operability even though the monitoring interval becomes longer.

■ Selecting timer tick and limitations on charge/discharge times

The timer tick setting is used to set the time interval for status monitoring on executing channels. It is necessary to set the optimum timer tick depending on the number of channels. If the timer tick is too short operability will worsen, but if it is too long, graph data may not be acquired properly.

The full charge/full discharge time is limited by whether or not graph data is being acquired and how many channels are executing. Note that graph data may not be acquired properly when a full charge/full discharge is performed in a shorter time than the limit.

For details on charge/discharge time settings and data acquisition failure, see the separate document "Performance Limitations".

NOTE

- Please consult Kikusui agent when you need to set a full charge/full discharge time even shorter than the minimum time.

5.3 Conducting Tests on More than One Channel Using One Worksheet

When you wish to test more than one battery of the same type under the same conditions, it is inefficient to assign one folder/worksheet separately for each channel. Test Executive allows you to assign the same folder to multiple channels for conducting tests. This is a useful method for executing tests since you do not need to set folders for each channel.

Opening channels

Let's open a channel. Either select "Open" from "Channel" on the menu bar, or press the open button on the toolbar to open the "Channel Open" dialog box.

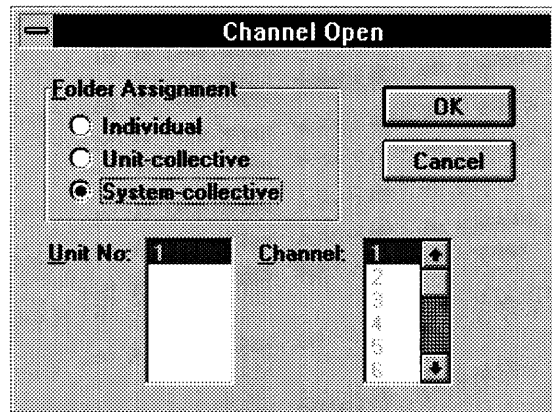


Figure 5-12 Channel Open Dialog Box

There are two ways to select multiple channels: unit-collective and system-collective. Select "Unit-collective" when you wish to use the same test conditions within a particular PFX unit. Select "System-collective" when you wish to use the same test conditions throughout the entire PFX rack system.

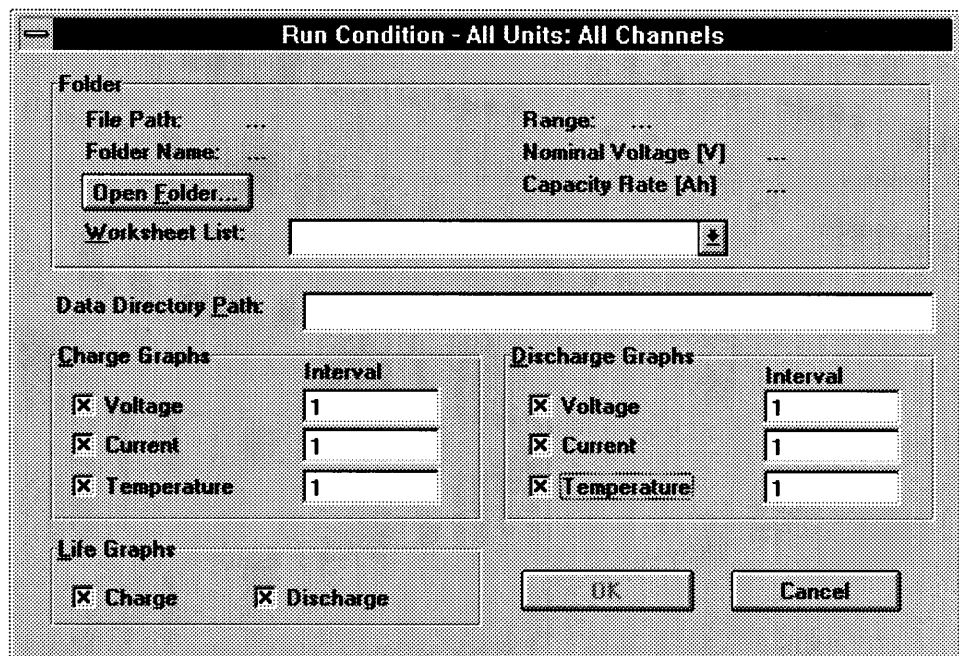


Figure 5-13 Setting Run Conditions (System-Collective)

Operations from this point until test execution are the same as those described in Section 5.2, "Conducting Tests Using Different Worksheets for Each Channel". Please refer to that section for details.

NOTE

- If more than one channel window is open, "System-collective" and "Unit-collective" for the PFX unit to which the channel belongs cannot be selected. Also, when collective execution is used the "Data Directory Path" setting cannot be made.

5.4 Functions Related to the On-Screen Display

■ Channel windows

Each PFX channel has a one-to-one correspondence to a window called a channel window. The unit number and channel number associated with each window is displayed on its title bar.

The channel windows don't have to be visible during testing. Iconizing a channel window has no effect on test execution. However, it is not possible to close a channel window during testing, because that would result in testing for that channel being abandoned. The only time a channel window can be closed is when that channel is offline (no communications). Any attempt to close a channel window while it is online will simply result in that window being iconized.

You can open the monitor window to identify which channels are online or offline. This is described next. The status line at the bottom of the screen always displays "ONLINE" when communication with one or more channels are being performed. Note that this indication cannot be used to identify which specific channels are currently online.

■ Monitor window

When the number of executing channels has become large, the monitor window is useful for overseeing all testing. This window can be displayed by selecting "Monitor" from the "Window" menu, or by clicking on the "Mon" button on the toolbar.

The status of each channel is summarized on the monitor window. Also, double-clicking on any of the channels on the monitor window will cause corresponding channel window to be brought to the top.

"OFFLINE" is displayed for channels for which no testing or monitoring is being conducted. When the channel window of a channel which is offline is closed, you will have to reassign a folder for the channel to reopen it.

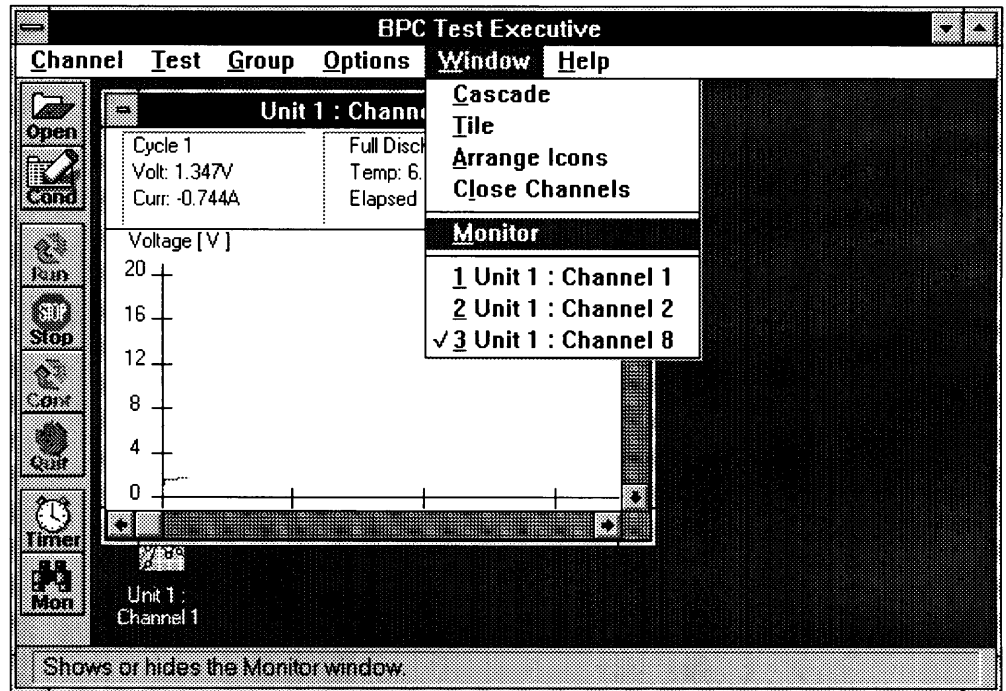


Figure 5-14 Selecting the Monitor Window

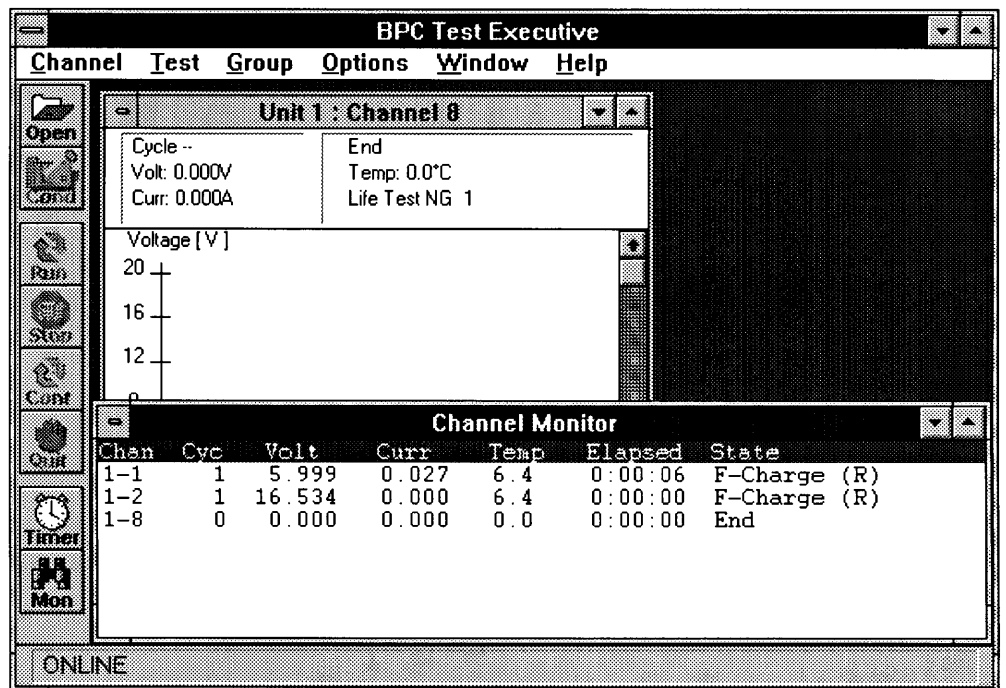


Figure 5-15 Monitor Window

■ Tile display and cascade display

When there are many windows or icons on the display, the "Window" menu can be useful in organizing them. Monitoring will be performed even for open channel windows which have been iconized.

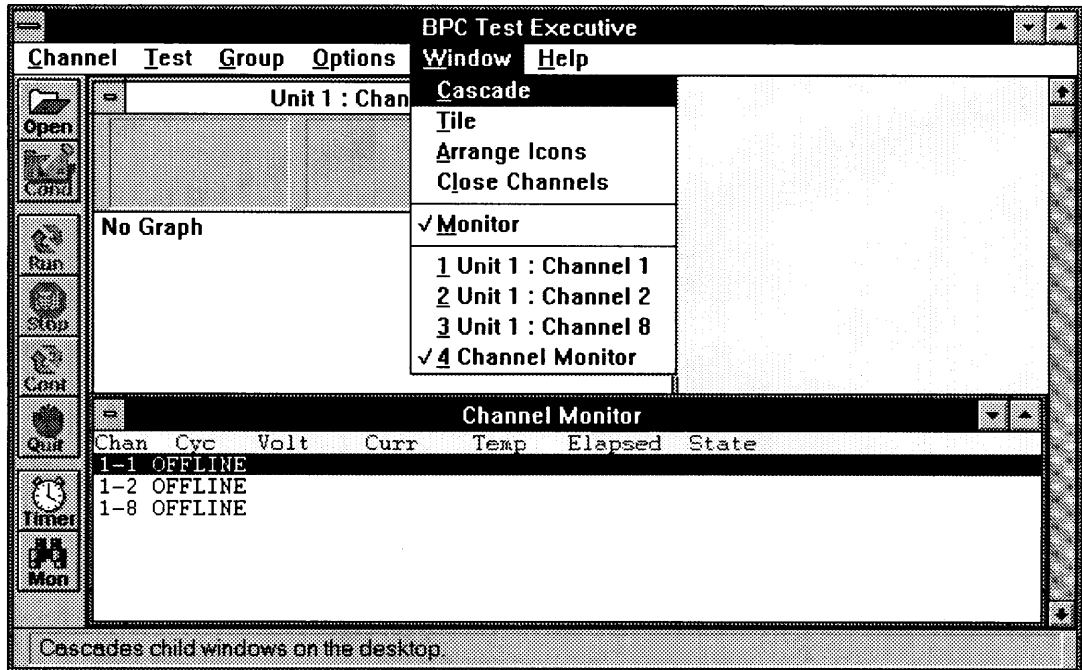


Figure 5-16 Selecting a Tile Display or Cascade Display

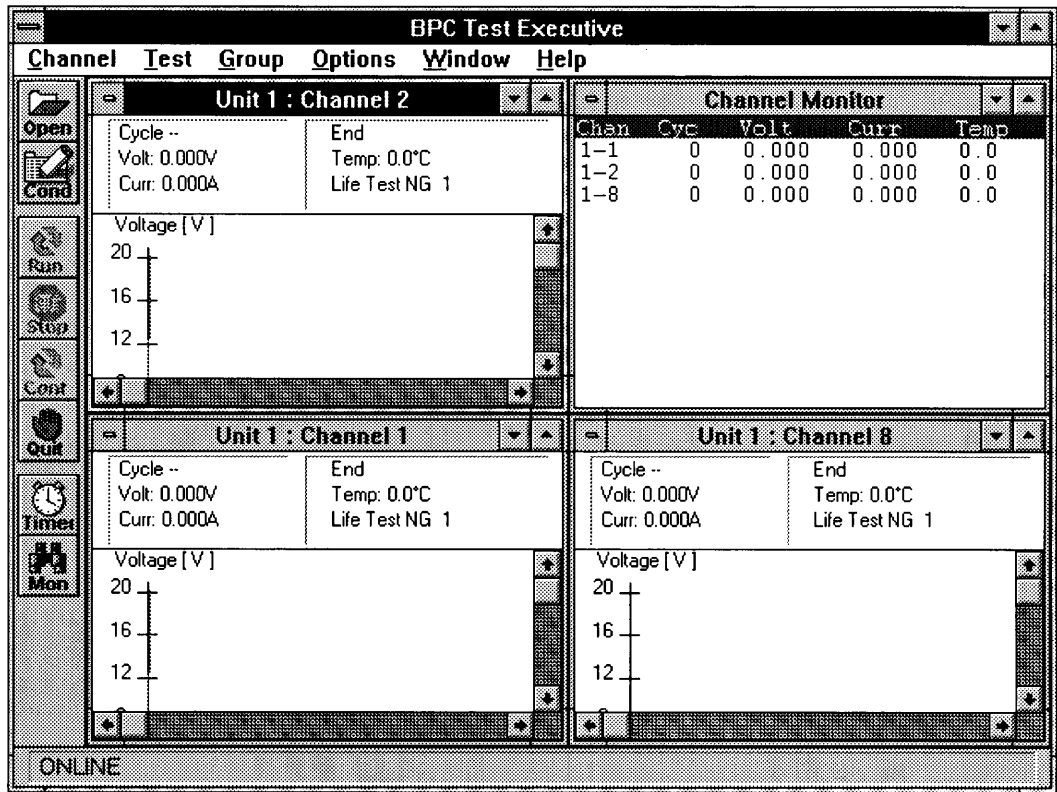


Figure 5-17 Tile Display

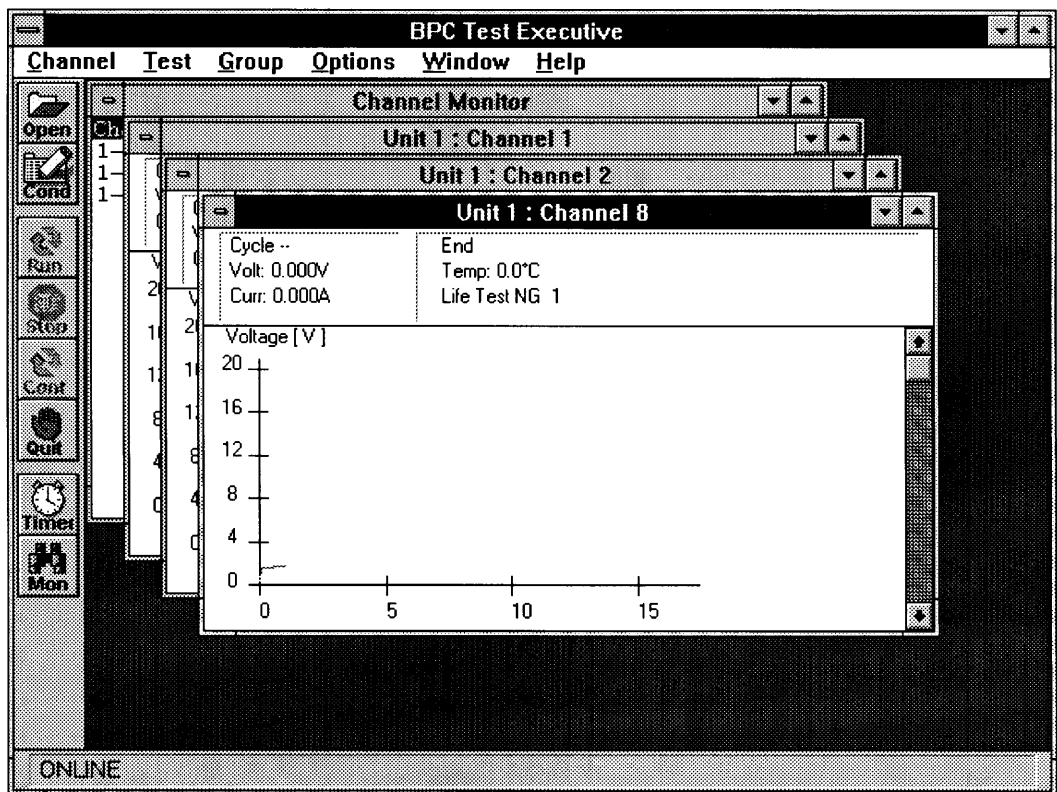


Figure 5-18 Cascade Display

5.5 Options

Test Executive includes other optional functions for setting the environment. To set optional functions, select "Preferences" from under "Options" on the menu bar. These preferences will be saved automatically when you exit BP checker.

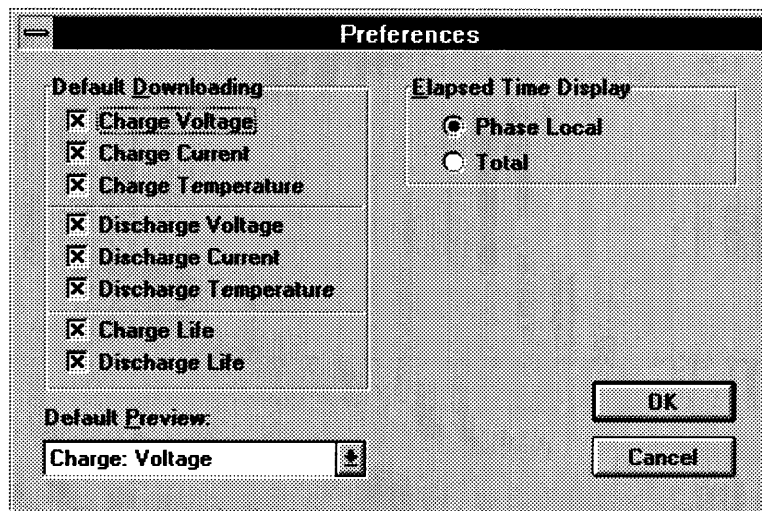


Figure 5-19 Setting Preferences

■ Default Downloading

This item sets default values for which graphs are to be generated as set on the Run Condition dialog box. All graphs are selected for generation by default immediately after BP checker is installed.

■ Default Preview

This item sets a default type of graphs to be displayed on the channel window. Charge Voltage is selected as the default immediately after BP checker is installed.

■ Elapsed Time Display

This item is used to set the elapsed time display shown in the ribbon display portion on each channel window and in the monitor window. "Phase Local" causes local elapsed time for each phase of the testing process to be displayed, while "Total" causes total elapsed time from the beginning of testing to be displayed.

5.6 Processing During Power Failures

This application does not perform power failure processing due to the large number of files which are handled. However, as for PFX unit itself, it is designed to continue testing even when there is a power failure. Test Executive can perform continuous testing using the Group Continue function even after system restoration as long as the personal computer has not been powered down by the resume function.

6

CHAPTER 6

MAKING GRAPHS FROM TEST RESULTS - BPC Graph

This chapter will describe how to make graphs from test results, and how to display these graphs on the screen and print them out.

Sections in Chapter 6

- 6.1 Starting BPC Graph
- 6.2 Displaying Graphs
- 6.3 Overlaying Graphs
- 6.4 Displaying Report Files
- 6.5 Displaying Settings
- 6.6 Printing
- 6.7 Options

6.1 Starting BPC Graph

BPC Graph is a program that generates graphs and lists from test results files, and displays them on the screen or prints them out. The results files are created during testing by Test Executive. Simple graph displays are even possible under Test Executive. However, Test Executive cannot make any reports from test results or overlaying multiple graphs. BPC Graph should be used for data processing of this type after testing has been completed.

BPC Graph does not communicate via GPIB with PFX units. And since it is too busy to operate GPIB by Test Executive during testing, it is better to execute BPC Graph after testing is completed.

To execute BPC Graph, double-click on the "BPC Graph" icon.

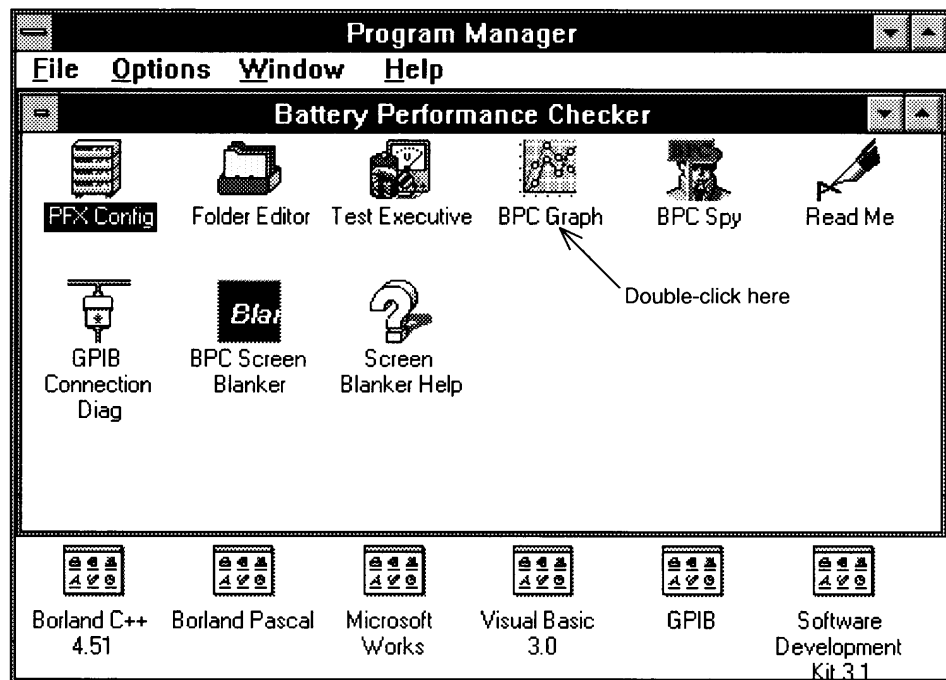


Figure 6-1 Starting BPC Graph

6.2 Displaying Graphs

There are two ways to display graphs. One way is to read test results files generated by Test Executive into a data window and then generate a graph window based on this data. The other way is to generate a graph window directly without displaying a data window. This can be done by selecting "How To Open Graph" from the "Options" menu. Here, we will explain the default graph display method in which a data window is used.

Displaying the data window

To display the data window, it is necessary to open test result files. Select "Open Graph" from the "File" menu.

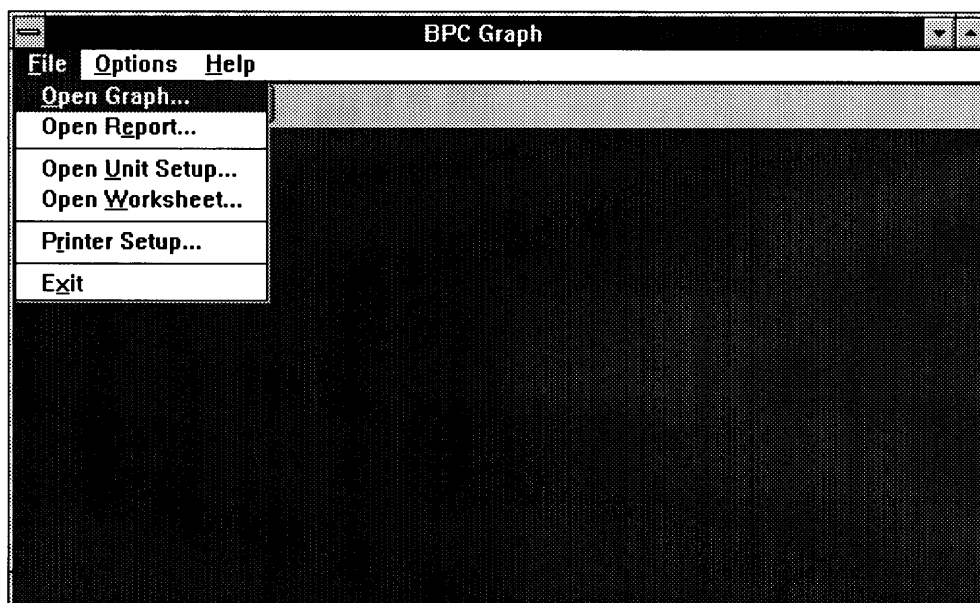


Figure 6-2 Opening a Graph File

Then, a dialog box for selecting a file name will appear. Move to the directory specified under Test Executive as the location to save test results files, and select the desired file type by its associated extension.

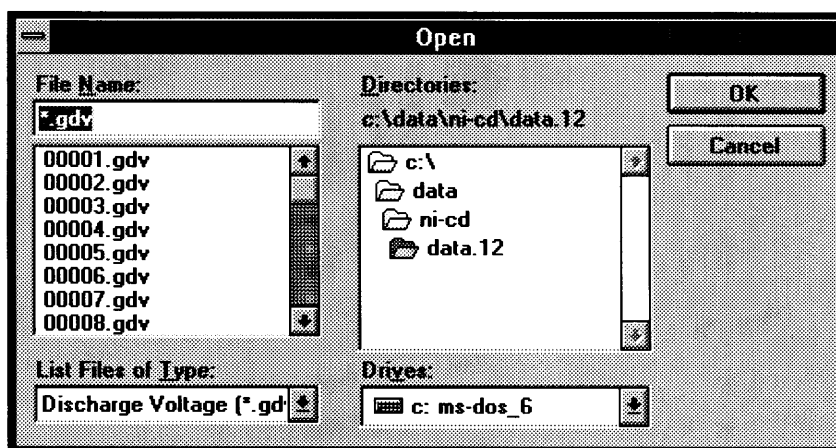


Figure 6-3 Selecting a Graph File

There are eight types of files which can be selected for making graphs at this time. Search for the desired file from these files. File names for charge/discharge characteristics represent their cycle numbers. Once you have selected a file, the data window for the file will appear.

Charge characteristics

Charge Voltage (*.GCV)
Charge Current (*.GCC)
Charge Temperature (*.GCT)

Discharge characteristics

Discharge Voltage (*.GDV)
Discharge Current (*.GDC)
Discharge Temperature (*.GDT)

Life characteristics

Charge Life (*.GCL)
Discharge Life (*.GDL)

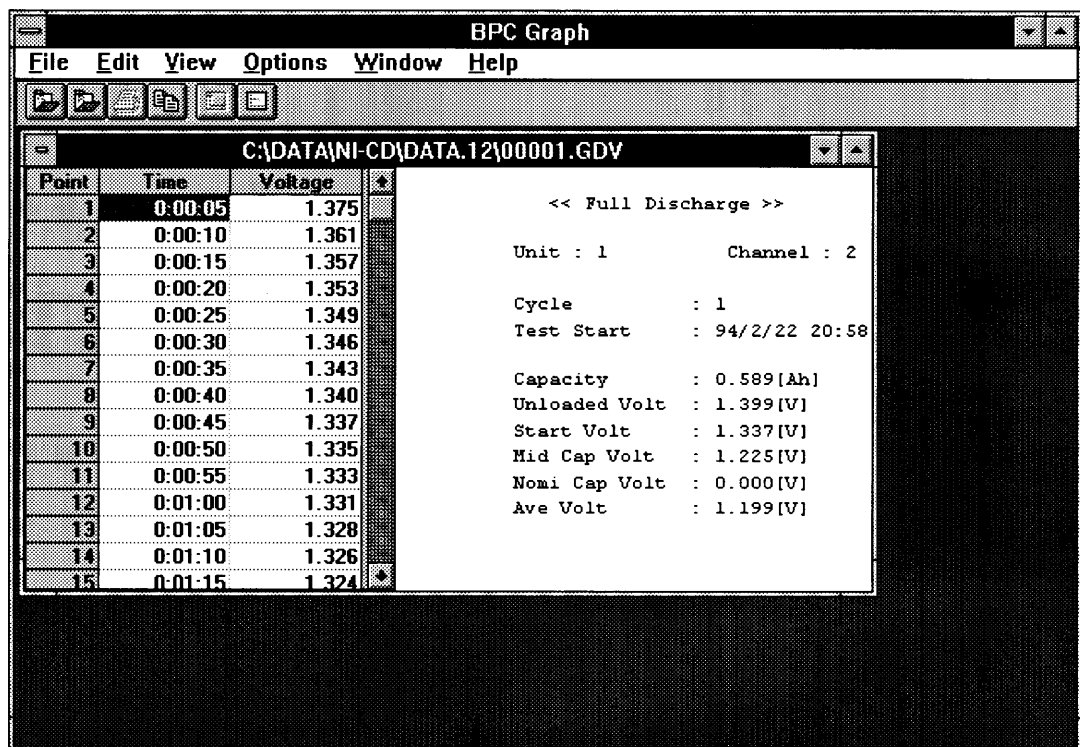


Figure 6-4 Data Window

The data window is a window in which graph file data is displayed in a table. This window appears immediately after a graph file is opened. This window is the starting point for displaying graphs. The operations described to follow can be performed from this window.

■ Pasting data to spreadsheet software

You can paste data to spreadsheet software such as "Microsoft Excel" or "Lotus 1-2-3" via the clipboard. To do this, click once on "Point" in the upper left of the table, and then select "Copy" from the "Edit" menu. This will cause data to be copied to the

clipboard. Next, bring the spreadsheet software to the top on the display, and select "Paste" from the "Edit" menu.

■ Saving data in text format

Data in the data window can be saved in text format. Files saved in this format can be read by standard text editors and word processors. To save data in text format, select "Save As Text" from the "File" menu.

The file name used when saving in text format, is the same as that of the graph file, but with a different extension. Naming conventions are outlined below.

Charge characteristics

| | Generated file name ⇒ | Text format file name |
|-------------|-----------------------|-----------------------|
| Voltage | xxxxx.GCV | xxxxx.TCV |
| Current | xxxxx.GCC | xxxxx.TCC |
| Temperature | xxxxx.GCT | xxxxx.TCT |

Discharge characteristics

| | | | |
|-------------|-----------|---|-----------|
| Voltage | xxxxx.GDV | ⇒ | xxxxx.TDV |
| Current | xxxxx.GDC | ⇒ | xxxxx.TDC |
| Temperature | xxxxx.GDT | ⇒ | xxxxx.TDT |

Life characteristics

| | | | |
|-----------|----------|---|----------|
| Charge | LIFE.GCL | ⇒ | LIFE.TCL |
| Discharge | LIFE.GDL | ⇒ | LIFE.TDL |

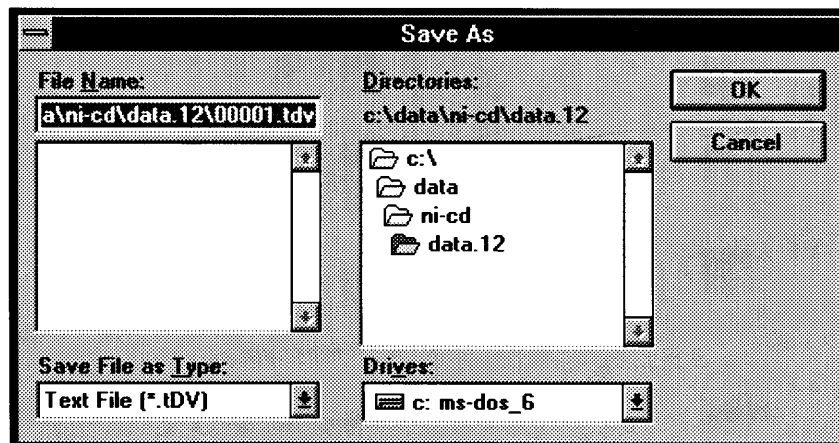


Figure 6-5 Saving Data in Text Format

Creating graphs

Graphs of characteristics data are displayed in a graph window. This graph window is generated by extracting data from the data window previously described. To

display a graph, select "Graph" from under "View" on the menu bar.

On the graph window, you can change axis settings, overlay graphs with other graphs already displayed, and print graphs.

Differing graph types are displayed in the following colors.

- Voltage Green
- Current Red
- Temperature Blue
- Charge capacity Red
- Discharge capacity Green

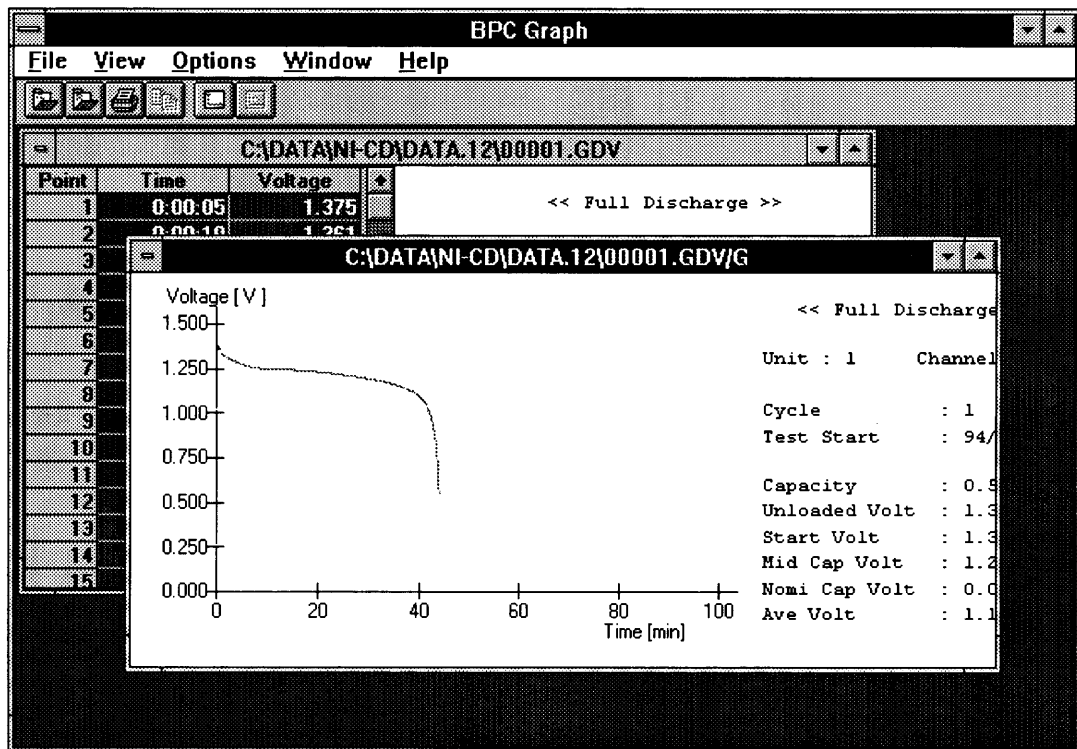


Figure 6-6 The Graph Window

Setting graph axes

Clicking with the right mouse button on graph window, or selecting "Axes" from the "View" menu, allows you to change the setting for the vertical axis (Y axis) and horizontal axis (X axis). In the case of life characteristics graphs, you can set the Y axis to represent either [Ah] or [%]. Refer to the allowable input ranges shown below, and input so that the minimum value does not exceed the maximum value.

An error message will appear if a value outside the range of data is input.

Charge and discharge characteristics

Y axis Max. 1 to 9999
 Min. 0 to 9998
X axis 0 hours, 1 minute to 999 hours, 59 minutes

Life characteristics

Y axis Max. 1 to 9999
 Min. 0 to 9998
Y axis units Can represent either [Ah] or [%]
X axis Max. 1 to 99999
 Min. 0 to 99998

NOTES

- The items which can be set for graphs of charge/discharge characteristics and life characteristics differ.
- Although data beyond the decimal point can be input for the Y axis, an error will result if the difference between Max and Min is less than 1.
- Sometimes the maximum value on the axis of a graph will differ from that input for Max due to some reasons of axis calculation.
- Be sure to set such that the Min value does not exceed the Max value.
- An error message will appear if a value out of the range of data is input.

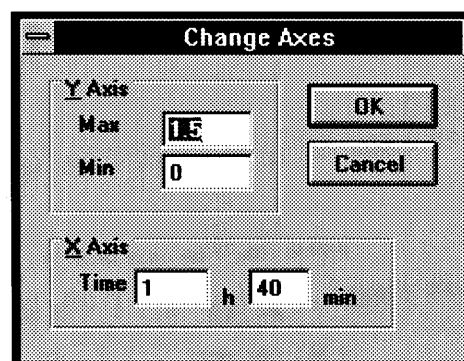


Figure 6-7 Setting Graph Axes

6.3 Overlaying Graphs

BPC Graph can display graphs overlaying on other graphs already displayed. Up to three graphs can be overlaid as long as one of the following conditions is met.

Conditions for overlaying graphs

- A combination of voltage, current and temperature graphs, from the same unit, same channel, and same cycle. However, charge graphs cannot be overlaid with discharge graphs.
- A combination of charge life characteristics and discharge life characteristics, from the same unit and same channel.
- A combination is of the same type of graph, from different units and different channels. In other words, graph files whose extensions match.

To overlay graphs, select "Overlay" from the "View" menu. Once this is done, a Graph Overlay dialog box shown below will appear. Use this dialog box to select the graphs you wish to overlay. (Multiple selections can be made by clicking while holding down Shift key or Ctrl key.)

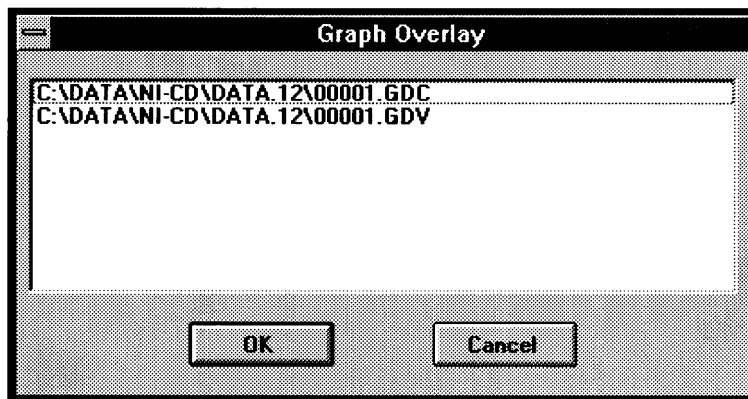


Figure 6-8 Selecting Graphs to Overlay

After selecting graphs, click on the "OK" button, and the result will appear in the overlay graph window.

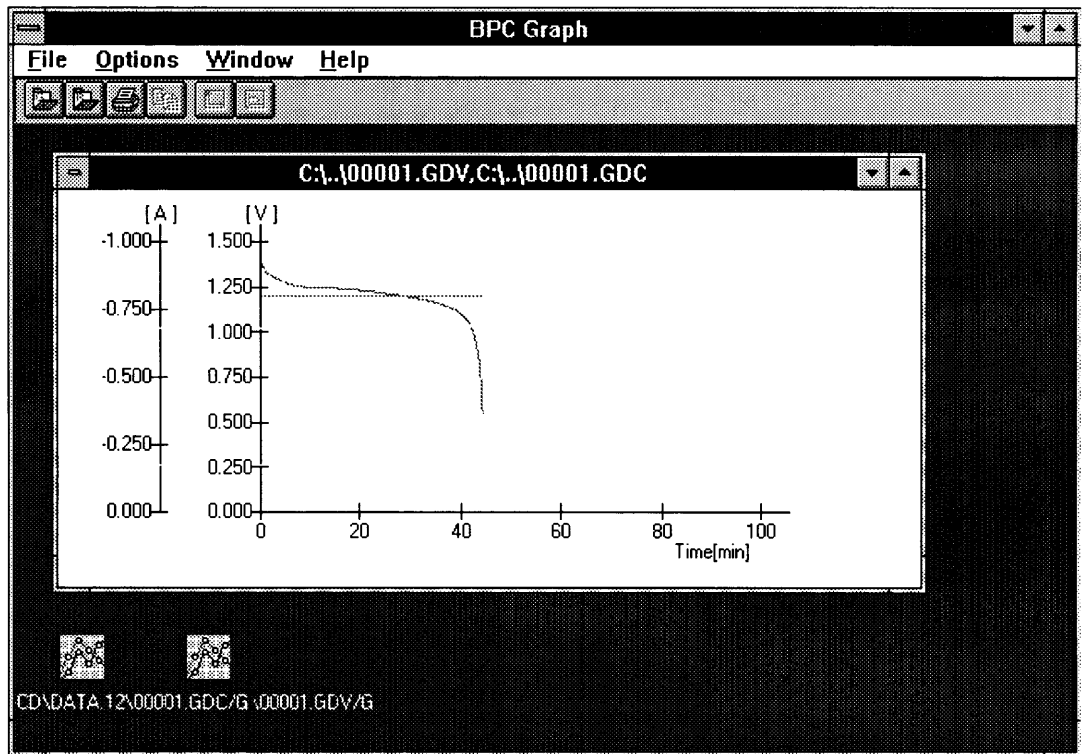


Figure 6-9 Overlay Graph Window

NOTE

- It is not possible to overlay life characteristics graphs which use their Y axis to represent a different unit. ([%] and [Ah] units cannot be mixed.) An error message will appear if you attempt to overlay such graphs. Be sure to combine life characteristics graphs only after unifying every unit for the Y axis matches.

6.4 Displaying Report Files

This function generates a table of test results from the test result report files. Select "Open Report" from the "File" menu. Then change to the directory specified under Test Executive in which test result files are saved.

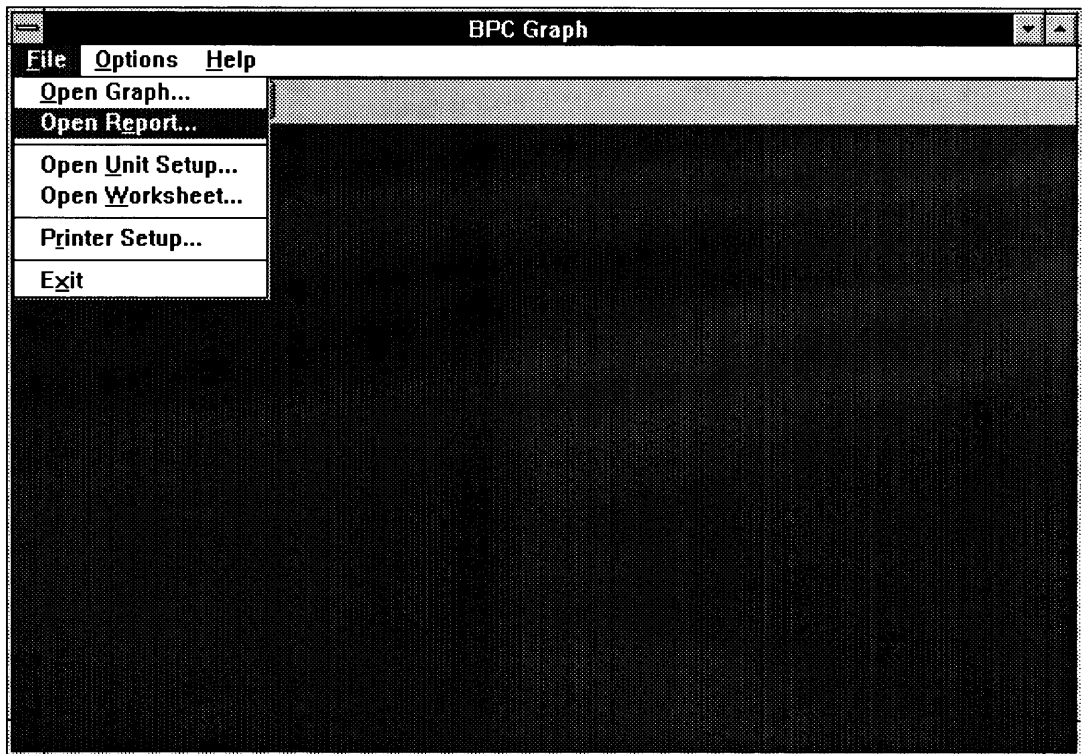


Figure 6-10 Opening a Report File

The table of test results will be created from the test result report files. This file has the extension ".REP" and two types of files described below can be displayed. Select the report file you want to view from these two.

Charge capacity results file RSTCHG.REP

Discharge capacity results file RSTDCHG.REP

Although there are two other files with the .REP extension (RSTLIFE.REP and WORKCOND.REP), these files are used internally by BP checker. They cannot be viewed using BPC Graph.

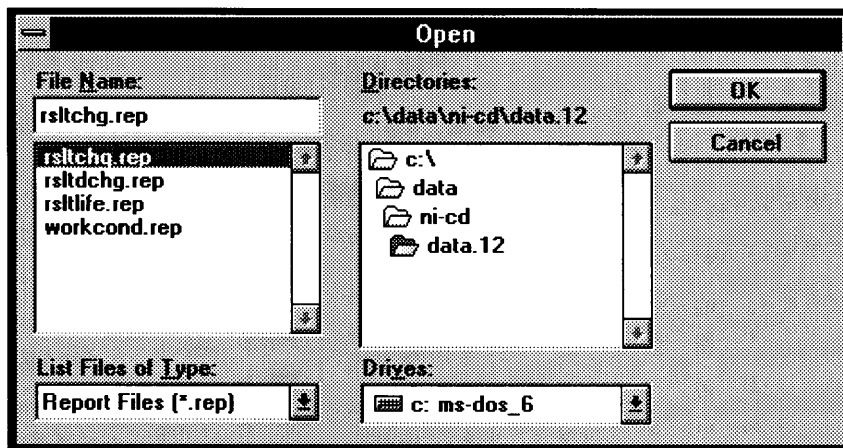


Figure 6-11 Selecting a Report File

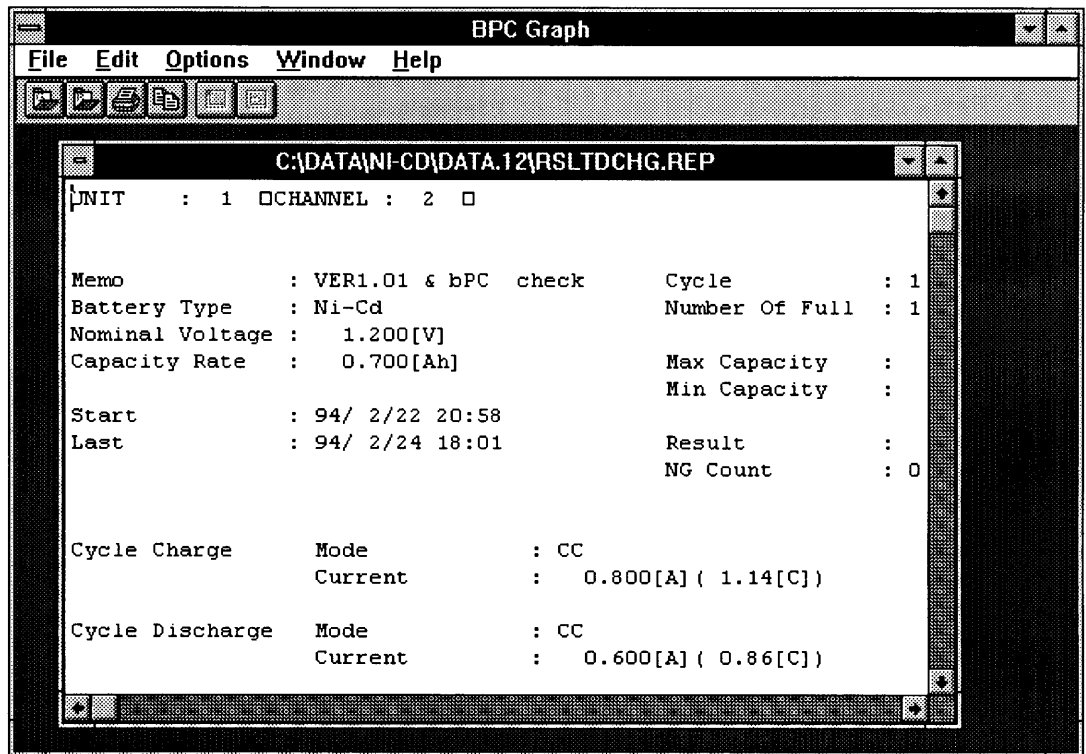


Figure 6-12 Report File

Saving reports in text format

BPC Graph can save the contents of displayed reports in text format. To save data in text format, select "Save As Text" from the "File" menu. The file extension used at this time will be changed as shown below.

Charge capacity results file RSLTCHG.REP ⇒ RSLTCHG.TXT

Discharge capacity results file RSLTDCHG.REP ⇒ RESLTCHG.TXT

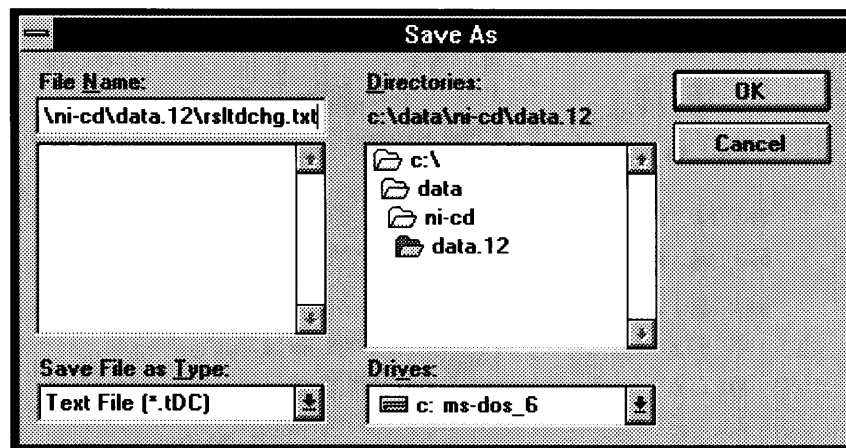


Figure 6-13 Saving Reports in Text Format

It is also possible to copy contents of the text window to the clipboard by selecting "Copy" (Ctrl+Ins) from under "Edit" on the menu bar. This feature can be used to paste data to other word processors and text editors such as "NotePad" which also run under Windows.

6.5 Displaying Settings

BPC Graph can display unit configuration settings and worksheet contents in a text window. When worksheet contents are displayed, information regarding the folder to which it belongs is also displayed.

To display unit configuration settings, select "Open Unit Setup" from the "File" menu, and change to the directory in which BP checker has been installed (C:\BPCHKR as default). To display worksheet contents, select "Open Worksheet" from the "File" menu, and change to the directory in which worksheets are saved by Folder Editor.

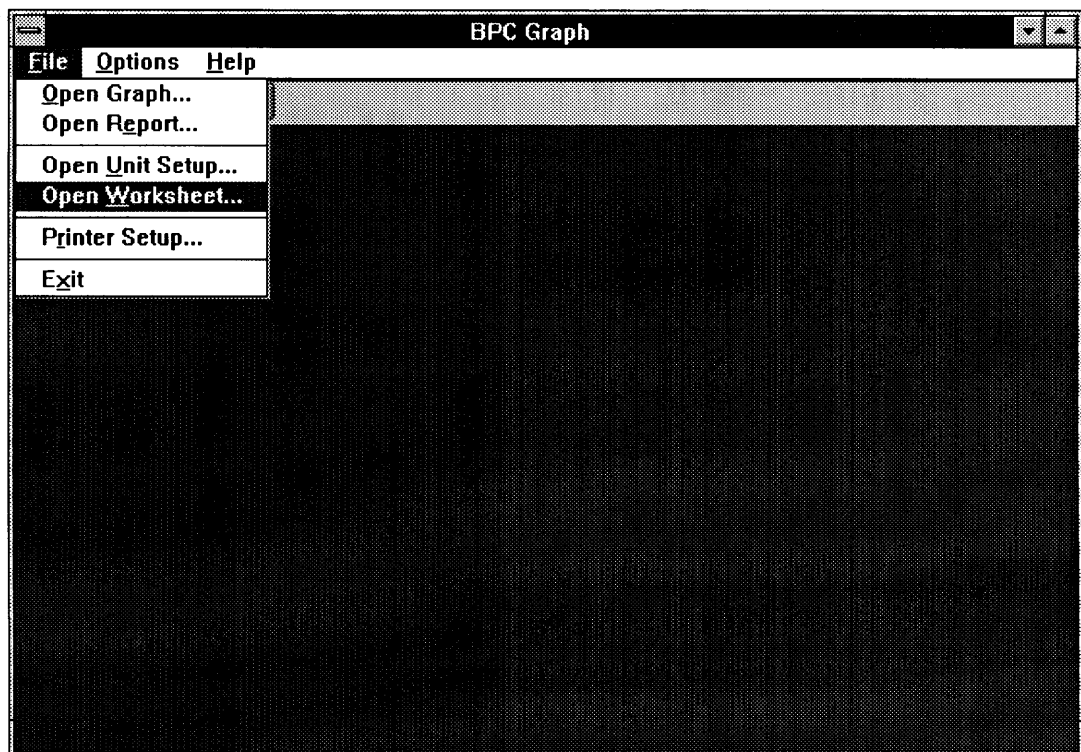


Figure 6-14 Opening a Worksheet

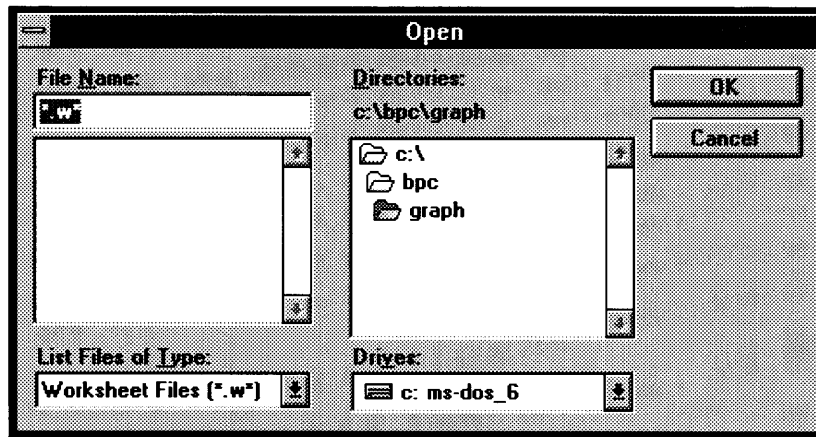


Figure 6-15 Selecting a Worksheet

Unit configuration

Unit Files (*.set)

Worksheets

Worksheet Files (*.w*)

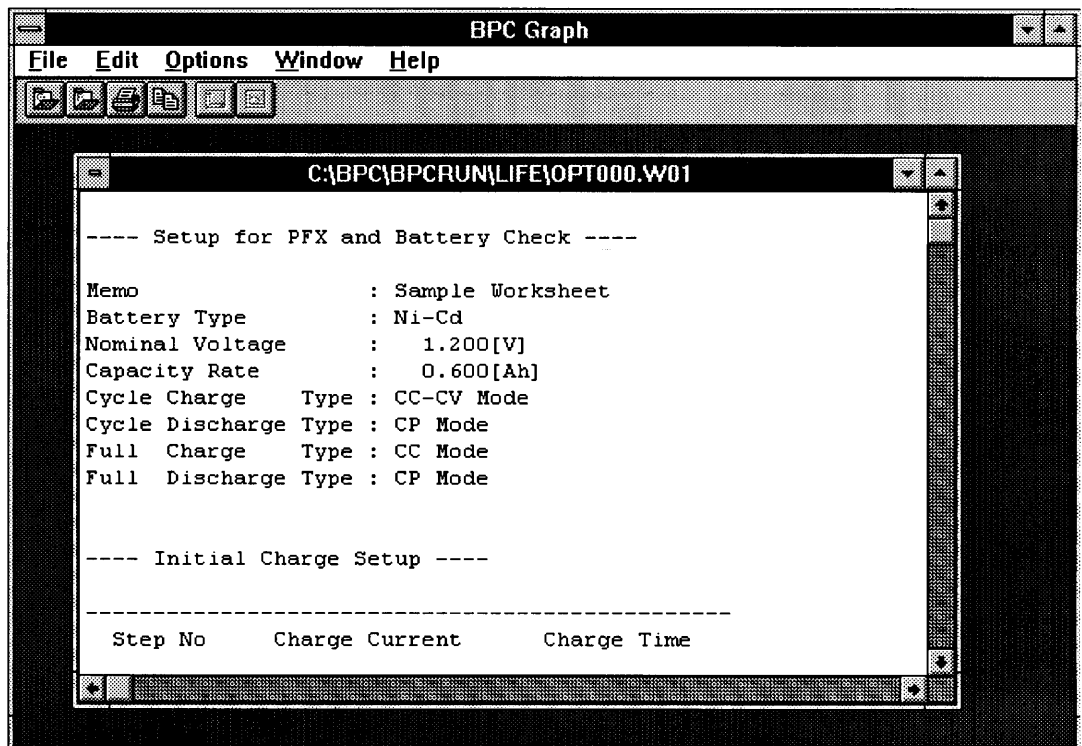


Figure 6-16 Worksheet

Just as with reports, contents of the screen can be saved in text format. To save data in text format, select "Save As Text" from the "File" menu. The file extension used at this time will be changed as shown below.

| | | | |
|--------------------|-------------|---|-------------|
| Unit configuration | xxxxxxx.SET | ⇒ | xxxxxxx.TXT |
| Worksheets | xxxxxxx.Wxx | ⇒ | xxxxxxx.Txx |

It is also possible to copy contents of the text window to the clipboard by selecting "Copy" (Ctrl+Ins) from under "Edit" on the menu bar. This feature can be used to paste data to other word processors and text editors such as "NotePad" which also run under Windows.

6.6 Printing

All the contents displayed under BPC Graph except the data window can be printed out.

If no printer driver has been installed under Windows, you must first open the Control Panel and select a printer. It is also possible to change printer settings by selecting "Printer Setup" from the "File" menu within BPC Graph.

Printings under BPC Graph are formatted for either A4 (210 x 297 mm) or letter size (8.5 x 11 inch) portraits. Be sure to prepare for printing under these conditions. To print, activate the window whose contents you wish to print out, and select "Print" from the "File" menu.

NOTE

- Although BPC Graph itself cannot print contents of a data window, it is possible to print this data from a spreadsheet application by pasting this data via the clipboard to that application.

Lines used for different graph types

When printing an overlay graph, different graph types are represented by lines of differing thickness and color. Under monochrome printing, this difference in line types can only be represented by differing thickness. We recommend you use a color printer when printing overlay graphs. The following colored lines are used when printing in color.

Voltage Green
 Current Red
 Temperature Blue
 Charge capacity Red
 Discharge capacity Green

Lines in graphs become thicker in the following order whether printing in monochrome or in color.

When the overlay graph combines voltage, current and temperature

| Overlay Type | Thin → Thick |
|-------------------------------|---------------------------------|
| Voltage, current, temperature | Voltage → current → temperature |
| Current, temperature | Current → temperature |
| Voltage, temperature | Voltage → temperature |

When the overlay graph combines charge and discharge life characteristics

| Overlay Type | Thin→Thick |
|--|---|
| Charge life characteristics, discharge life characteristics | Charge life characteristics →discharge life characteristic |

When the overlay graph combines graphs of the same type (same file extension)

Lines become thicker in the order the source graph file names are sorted. (The earlier the graph is processed, the thinner the lines used.)

6.7 Options

BPC Graph includes the following optional functions.

[How To Open Graph...]

This option is used to select whether you want a data window to be displayed first before displaying graph windows, or whether to go directly to displaying graph windows.

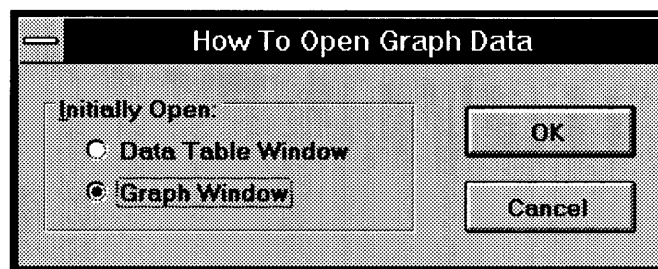


Figure 6-17 Selecting Graph Window Display

[Grid Lines]

This option can only be set when a graph window is active. This option is used to set whether or not grid lines are to be included when printing the graph.

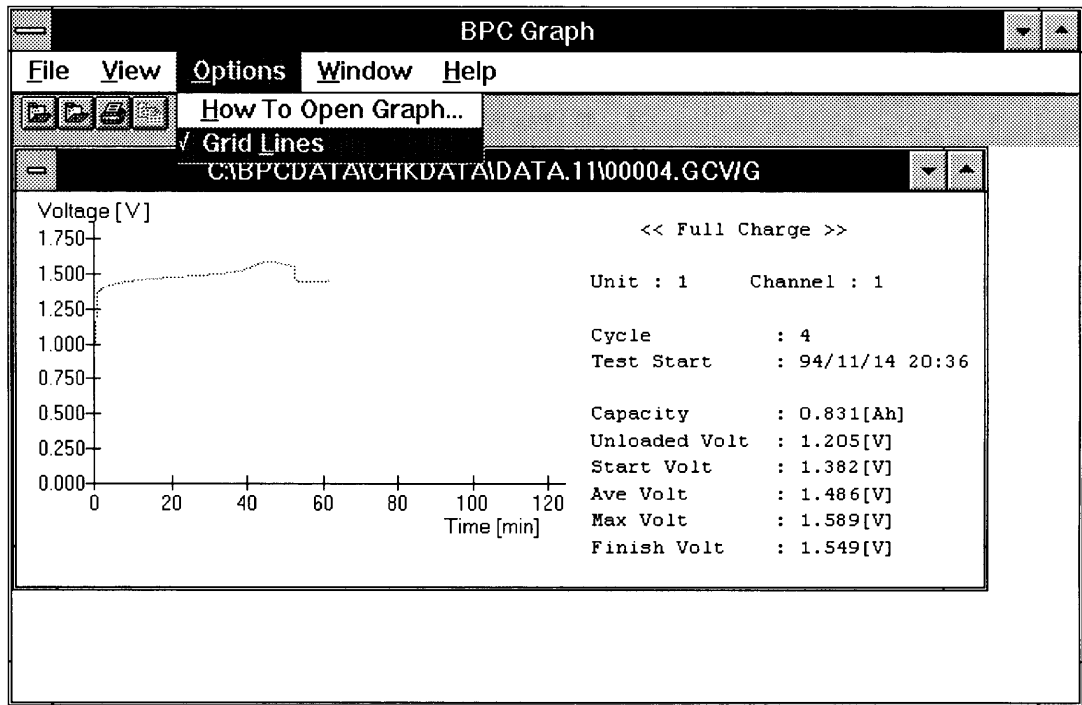


Figure 6-19 Selecting Grid Lines

7

CHAPTER 7 WATCHING DATA - BPC Spy

This chapter describes how to intercept data other than graph data created by Test Executive from other applications.

Sections in Chapter 7

- 7.1 BPC Spy
- 7.2 Starting BPC Spy
- 7.3 Setting Data Acquisition Conditions
- 7.4 Execution Screen
- 7.5 Editing Data
- 7.6 Options

7.1 BPC Spy

BPC Spy is an independent application program separate from the group of programs described through Chapter 6. This application program assumes the execution of Test Executive and is used for intercepting (obtaining) data monitored there.

Try using BPC Spy if you have any of the following dissatisfaction with graph data created by Test Executive.

- You wish to obtain cycle charge/discharge data and data during rest.
- There are too few data points for a single test.
- You want higher resolution data for parts where the amount of change in data is large.
- You wish to avoid missing graph data.

Note that this useful application suffers from the following disadvantages.

- Although it depends on CPU performance, BPC Spy can only execute on about eight channels while Test Executive is testing channels.
- BPC Spy cannot acquire data faster than the Timer Tick set by Test Executive.
- Data cannot be obtained while sending worksheet data to a unit, or while graph data is being acquired.
- Data cannot be made into graphs using BPC Graph. (Although it can be pasted to spreadsheet software such as Excel.)

When using BPC Spy with full understanding of these facts, select the best method for test contents based on the understanding that graph data should not be acquired.

7.2 Starting BPC Spy

To execute BPC Spy, double-click on the "BPC Spy" icon.

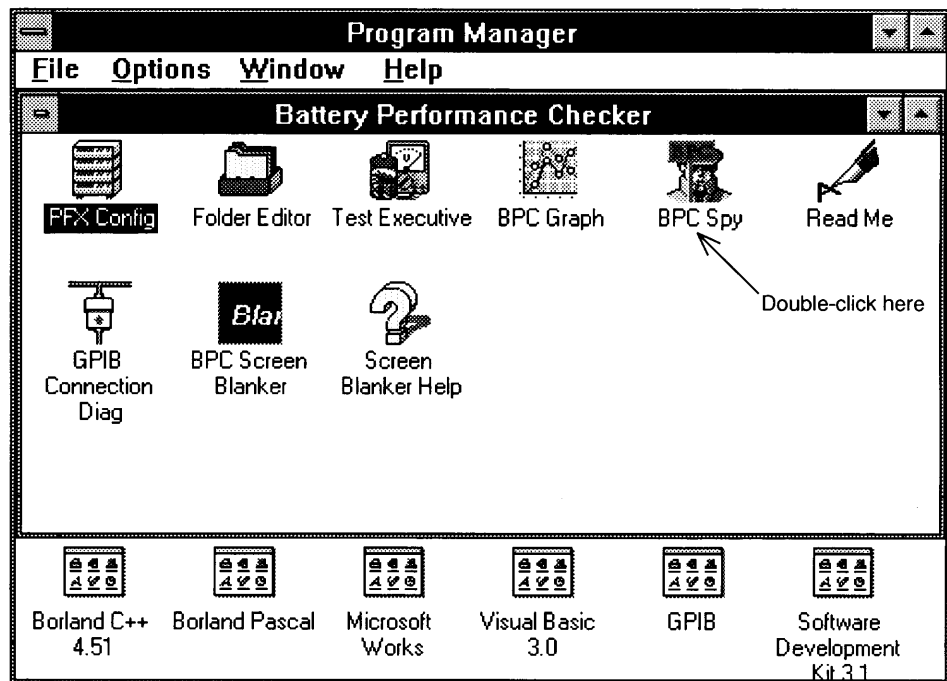


Figure 7-1 Starting BPC Spy

BPC Spy operates under the assumption that Test Executive is also running. If BPC Spy is started when Test Executive is not running, Test Executive will also be started. If Test Executive could not be started because PFX Config is running, quit PFX Config and start Test Executive.

7.3 Setting Data Acquisition Conditions

Let's try opening a channel. Open the "Channel Open" dialog box by selecting "Open" from under "Channel" on the menu bar. This window can be used to set conditions for data acquisition.

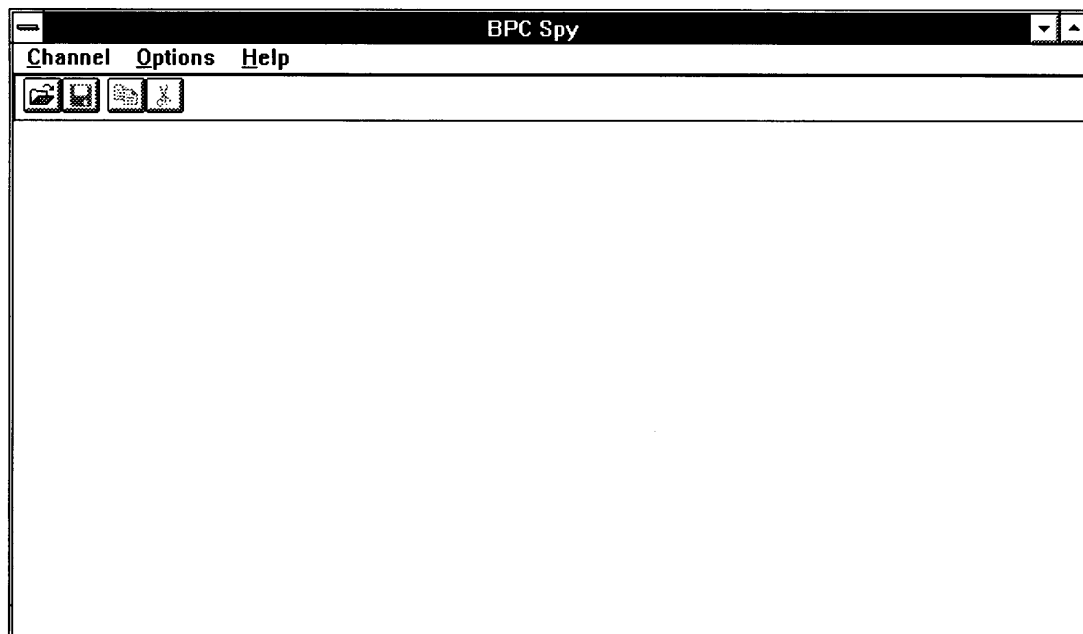


Figure 7-2 Opening a Channel

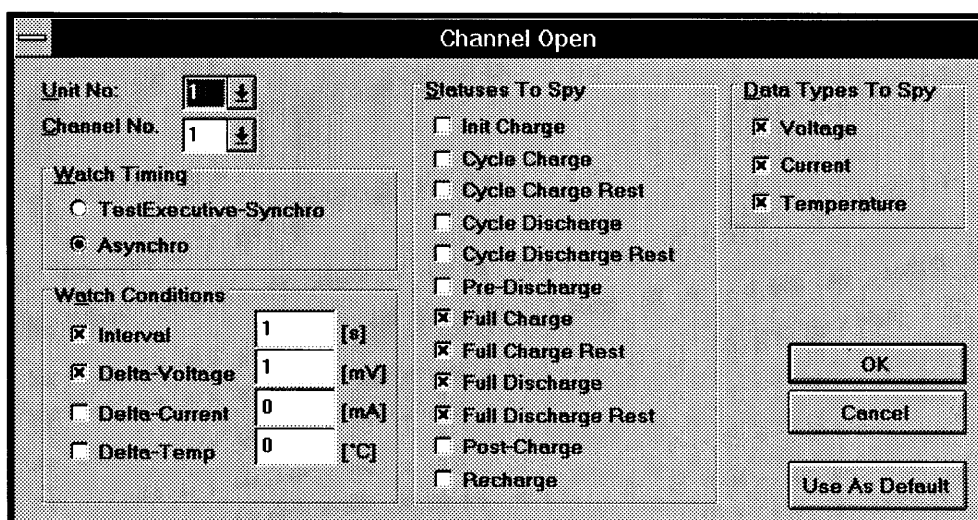


Figure 7-3 Channel Open Screen

■ Timing of data acquisition

The "Watch Timing" setting is used to set the timing for data acquisition. Data acquisition timing differs depending on whether "Test Executive Synchro" or "Asynchro" is selected.

[Test Executive Synchro]

With this setting, data is acquired based on the timing of the Timer Tick set under Test Executive. This is the fastest timing in which the status can be monitored.

[Asynchro]

When "Asynchro" is selected, the "Watch Conditions" option will appear. "Watch Conditions" can be used to set the timing under which data will be acquired. When you mainly want to gather changes in data, select this option and set acquisition conditions. This can save capacity of data.

[Watch Conditions]

Data acquisition timing can be determined based on a time interval, or amount of change (or percent change) in voltage, current or temperature values. Data can be acquired when any of the conditions checked here are met.

The setting range for the time interval is from 1 to 99999 seconds.

As for voltage, current and temperature, you can select whether to acquire data based on amount of change or percent change by selecting "Detection Method" from under "Options" on the menu bar. The range when amount of change is set is from 1 to 10% of the maximum value for that characteristic. The range when percent change is set is from 1 to 999%.

■ Status in which data is acquired

[Status To Spy] is used to set the statuses in which data is to be acquired. If the status set here is monitored by Test Executive, data will be appended to the spy window.

Status numbers in the spy window correspond to the following statuses.

- 1 Init Charge
- 2 Cycle Charge
- 3 Cycle Charge Rest
- 4 Cycle Discharge
- 5 Cycle Discharge Rest
- 6 Pre-Discharge
- 7 Full Charge
- 8 Full Charge Rest
- 9 Full Discharge
- 10 Full Discharge Rest
- 11 Post-Charge
- 12 Recharge

■ Data items to be acquired

Data which will be acquired are status, cycle, time as well as voltage, current or temperature data checked under "Data Type To Spy".

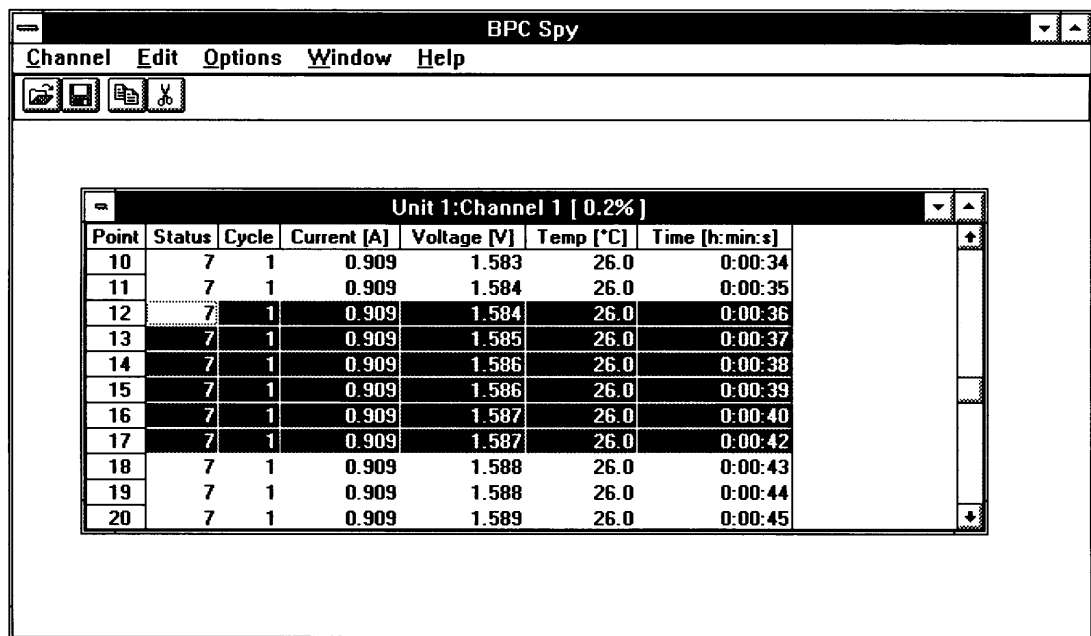
[Data Type To Spy]

This setting is used to select whether or not to gather voltage, current and temperature data. Only data for items checked here is acquired. Items which are not selected cannot be changed later.

■ Use As Default button

Clicking on this button causes all current settings to be used as default.

7.4 Execution Screen



| Point | Status | Cycle | Current [A] | Voltage [V] | Temp [°C] | Time [h:min:s] |
|-------|--------|-------|-------------|-------------|-----------|----------------|
| 10 | 7 | 1 | 0.909 | 1.583 | 26.0 | 0:00:34 |
| 11 | 7 | 1 | 0.909 | 1.584 | 26.0 | 0:00:35 |
| 12 | 7 | 1 | 0.909 | 1.584 | 26.0 | 0:00:36 |
| 13 | 7 | 1 | 0.909 | 1.585 | 26.0 | 0:00:37 |
| 14 | 7 | 1 | 0.909 | 1.586 | 26.0 | 0:00:38 |
| 15 | 7 | 1 | 0.909 | 1.586 | 26.0 | 0:00:39 |
| 16 | 7 | 1 | 0.909 | 1.587 | 26.0 | 0:00:40 |
| 17 | 7 | 1 | 0.909 | 1.587 | 26.0 | 0:00:42 |
| 18 | 7 | 1 | 0.909 | 1.588 | 26.0 | 0:00:43 |
| 19 | 7 | 1 | 0.909 | 1.588 | 26.0 | 0:00:44 |
| 20 | 7 | 1 | 0.909 | 1.589 | 26.0 | 0:00:45 |

Figure 7-4 Spy Window

A table format window will appear after all conditions regarding data to be acquired have been set. This window is called the "spy window", and it is connected to a given channel. While the spy window is displayed, data will be gathered in the window and you can see its operation once the target channel has been run using Test Executive. During this time, The [x.x%] indicator to the right of the channel indicator on the title bar of the spy window represents the usage of data being acquired. When this value reaches 100%, any further data acquisition becomes impossible, so you will have to save or cut the data until free area reaches full.

If you wish to change data acquisition conditions during execution, select "Spy Settings..." from under "Channel" on the menu bar.

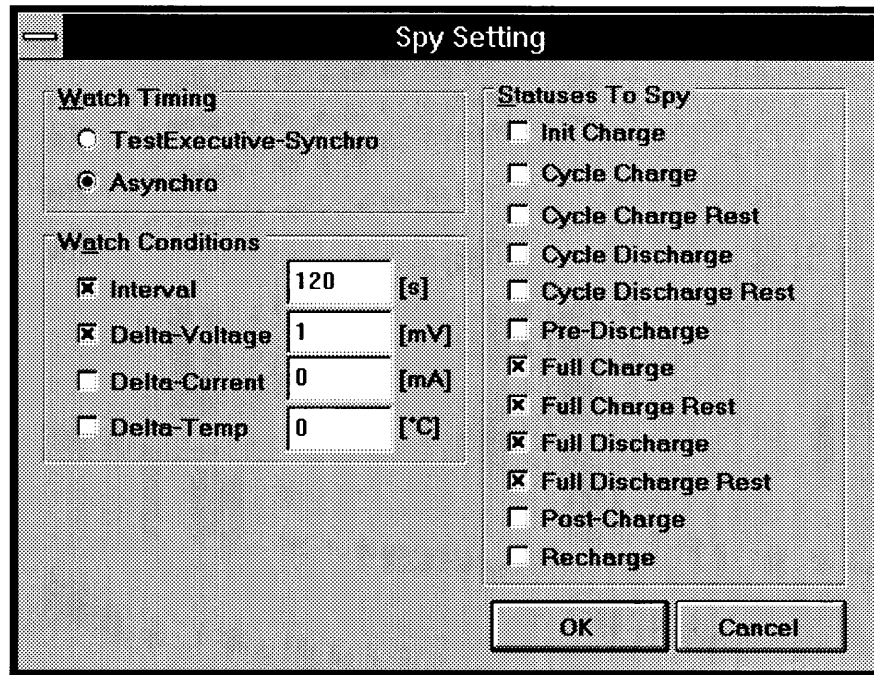
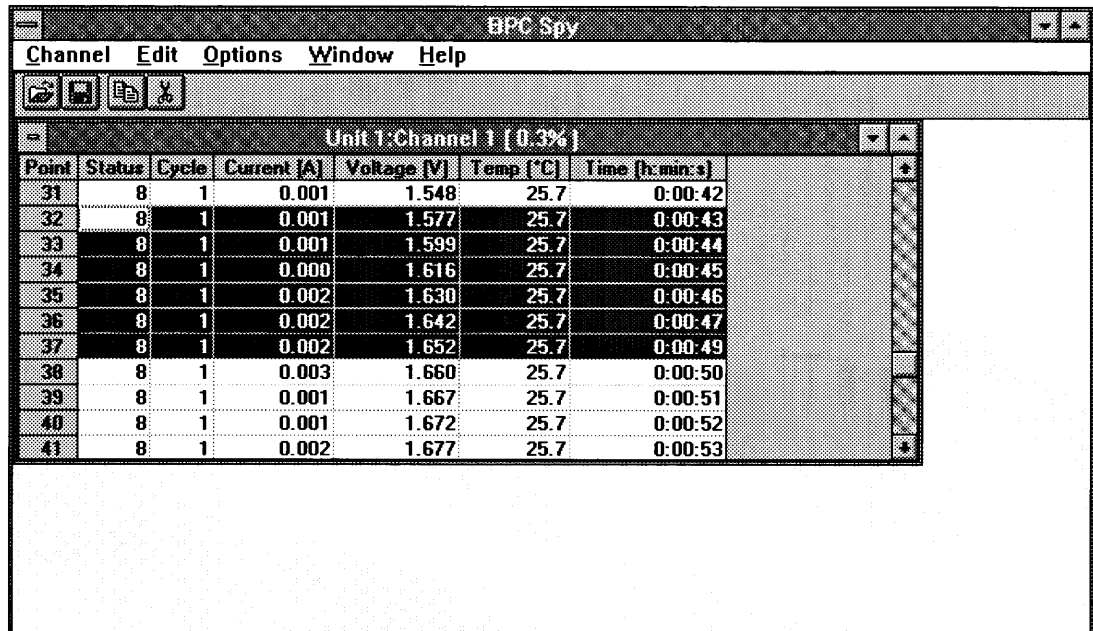


Figure 7-5 Screen for Changing Data Acquisition Conditions

Items displayed on this screen can be changed even during execution. These settings are valid for the currently selected channel. "Spy Settings..." exist only for the number of channels currently open.

7.5 Editing Data

At the point of time the data is just acquired into the table on the spy window, no data is saved yet. In order to effectively use this data, it is necessary to save this data in a file or copy it to a spreadsheet application such as Excel.



| Point | Status | Cycle | Current [A] | Voltage [V] | Temp [C] | Time [h:min:s] |
|-------|--------|-------|-------------|-------------|----------|----------------|
| 31 | 8 | 1 | 0.001 | 1.548 | 25.7 | 0:00:42 |
| 32 | 8 | 1 | 0.001 | 1.577 | 25.7 | 0:00:43 |
| 33 | 8 | 1 | 0.001 | 1.599 | 25.7 | 0:00:44 |
| 34 | 8 | 1 | 0.000 | 1.616 | 25.7 | 0:00:45 |
| 35 | 8 | 1 | 0.002 | 1.630 | 25.7 | 0:00:46 |
| 36 | 8 | 1 | 0.002 | 1.642 | 25.7 | 0:00:47 |
| 37 | 8 | 1 | 0.002 | 1.652 | 25.7 | 0:00:49 |
| 38 | 8 | 1 | 0.003 | 1.660 | 25.7 | 0:00:50 |
| 39 | 8 | 1 | 0.001 | 1.667 | 25.7 | 0:00:51 |
| 40 | 8 | 1 | 0.001 | 1.672 | 25.7 | 0:00:52 |
| 41 | 8 | 1 | 0.002 | 1.677 | 25.7 | 0:00:53 |

Figure 7-6 Specifying Data Ranges

BPC Spy can copy data in the table displayed to the clipboard or to save it in text format.

■ Saving data in text format

To save data in text format, select "Save As Text" from the "Channel" menu. All contents of the table will be saved.

■ Copying to the clipboard

Selected data can be copied to the clipboard by selecting "Copy" from under "Edit" on the menu bar. However, there is a restriction on the range of data which can be copied to the clipboard at once. If you wish to handle a large amount of data at once, create a text file and use that file.

■ Deleting data

Selected rows of data can be deleted by selecting "Delete Rows" from under "Edit"

on the menu bar. Note however that it can take a very long time when deleting large amounts of data at once. If you have saved the table data and it is no longer required, you can newly open a channel under the same settings, and just close the existing windows containing unnecessary data instead of deleting.

7.6 Options

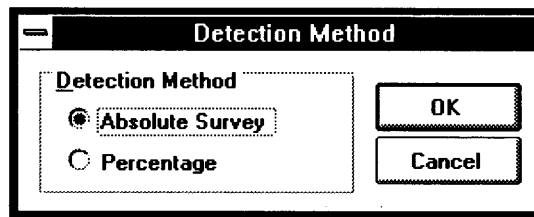


Figure 7-7 Setting Detection Method

Selecting "Detection Method" from under "Options" on the menu bar allows you to set the data acquisition timing as an absolute value in the amount of change in the voltage, current or temperature characteristic or as a percent change in the same characteristics. The setting made here will affect the data acquisition conditions for the next channel which is opened.

APPENDICES

There are four appendices. Appendix 1 lists the error messages which appear on the screen while operating BP checker. Appendix 2 gives samples of output produced by BP checker. Appendix 3 describes DDE server functions possessed by BP checker. Appendix 4 lists BP checker specifications.

- APPENDIX 1 ERROR MESSAGES
- APPENDIX 2 OUTPUT SAMPLES
- APPENDIX 3 COMMUNICATING WITH EXTERNAL PROGRAMS
(ADVANCED FUNCTION)
- APPENDIX 4 APPLICATION SPECIFICATIONS

APPENDIX 1 ERROR MESSAGES

An error number like that shown in the figure below is assigned to each error message. If you want a detailed understanding of an error message, use the error number appearing on the screen to search for the description of that error in the list below.

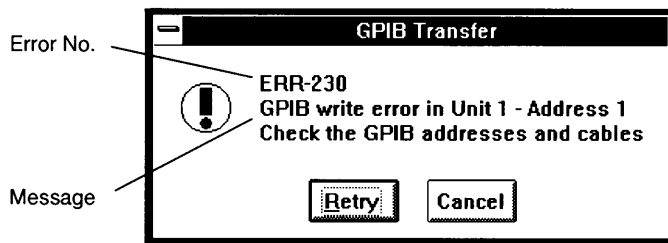


Figure A1-1 Typical Error Message

Overall BP Checker System-Related Error Messages

■ ERR-9001

Insufficient memory. Check memory capacity or quit needless applications.

There is not enough computer memory. Try increasing available memory by terminating all unnecessary applications.

■ ERR-9002

File read error. Check the hard disk drive.

There was an error reading a file. The hard disk drive may be broken.

■ ERR-9003

File write error. Check free disk space and the hard disk drive.

This error often occurs when the hard disk becomes full while creating data during testing. If this error occurs while Test Executive is conducting tests, all channels will be put in HOLD status. If this happens, try to free up disk space by deleting unnecessary data files using the File Manager. Then select "Run/Continue" from the "Group" menu to restart all channels.

■ERR-9008

Value must be between X and Y. Click the OK button and correct the highlighted item.

A value out of range was input. Please input a value between X and Y. Click on the "OK" button and correct the highlighted item.

GPIB-Related Error Messages

■ERR-220

Cannot open GPIB device. Please check GPIB adapter and driver configuration.

This error message appears when the device driver set under the system configuration differs from the actual GPIB card in the system. Try resending data after setting the correct driver.

■ERR-223

Different model access or invalid ROM version.

The system is connected to a model other than the PFX40W-08. Please check the model name.

■ERR-230

GPIB write error; Unit x; Address x. Please check GPIB addresses and cables.

There was a data write error during GPIB communications. This message usually appears when first executing a test.

■ERR-231

GPIB read error; Unit x; Address x. Please check GPIB addresses and cables.

There was a data read error during GPIB communications. This message usually appears when first executing a test.

■ERR-301

Cannot change the PFX operation mode to SETUP mode.

This warning message appears when there is a currently executing channel (including HOLD and END status) somewhere among the units displayed.

PFX Config-Related Error Messages

■ ERR-2001

PFX Config cannot be run while BPC Test Executive is running.

PFX Config cannot run because Test Executive is running. Please exit Test Executive.

■ ERR-2002

Max Cycle must be between 1 and 99999.

The max cycle setting is out of range. Please set it to between 1 and 99999.

■ ERR-2003

Interval must be between 1 and 999.

The interval setting is out of range. Please set it to between 1 and 999.

■ ERR-2004

Judgment margin must be between 1 and 100.

The judgment margin setting is out of range. Please set it to between 1 and 100.

■ ERR-2005

Judgment count must be between 1 and 9.

The judgment count setting is out of range. Please set it to between 1 and 9.

Folder Editor-Related Error Messages

■ ERR-3001

Value must be between 0.001 and xxxx. Click the OK button and correct the highlighted item.

A value out of range was input. Please input a value between 0.001 and xxxx. Click on the "OK" button and correct the highlighted item.

■ ERR-3003

Too many worksheet is being inserted.

The number of worksheets in the folder exceeds 99.

Test Executive-Related Error Messages

■ ERR-4001

BPC Test Executive cannot be run while the PFX Config is running.

Test Executive cannot be run because PFX Config is running. Please exit PFX Config.

■ ERR-4002

Failed to create directory *directory-name*.

The subdirectory could not be created. Please check that an appropriate directory name was specified.

■ ERR-4003

Failed to access directory *directory-name*.

The subdirectory could not be accessed. Please check that an appropriate directory name was specified.

■ ERR-4004

Graph interval must be between 1 and 1000.

The graph interval setting is out of range. Please set it to between 1 and 1000.

■ ERR-4005

Channel range is different from the PFX configuration. Do you wish to continue?

The PFX range information listed in the header of the folder is different from the range setting of the actual PFX unit. While testing can be forced, there is some concern that worksheets may not be set properly.

■ ERR-4006

Failed to run in Unit x - Channel x.

There was an error in executing a test on the channel given. Please check if worksheet contents are appropriate.

■ **ERR-4007**

GPIB communication problem has been generated.

This error is generated when there is some problem in GPIB communications. This is possibly caused by a GPIB cable coming loose, or an unexpected loss of power. If this error occurs, Test Executive will work to place all channels in HOLD status. (Of course, communications are not possible with PFX units whose lines are affected.) In this situation, return affected lines to operable condition, and select "Restart test loop" from the "Test" menu to restart all channels.

■ **ERR-4008**

File system problem has been generated

A problem has been found in the file system. The hard disk may be broken or there is insufficient free space.

■ **ERR-4009**

Alarm detected in Unitx - Channel x.

This error occurs when an alarm is generated by the PFX40W-08 during test execution. If this happens, Test Executive puts the channel on which the alarm was detected in HOLD status. Testing for other channels will continue normally. Once the cause of the alarm on the channel in HOLD status is cleared, select "Continue" from the "Test" menu, and restart the channel in HOLD status.

■ **ERR-4010**

Invalid folder/worksheet file

An attempt was made to read an invalid folder/worksheet file.

■ **ERR-4011**

Directory you specify should be a full path name that begins with a valid drive letter.

The directory name must be a full path name beginning with a valid drive letter.

BPC Graph-Related Error Messages

■ **ERR-5000**

Insufficient memory

There is not enough memory. Try increasing available memory by terminating all unnecessary applications.

■ERR-5001

No data is found in the graph file.

There is no data in the selected graph file.

■ERR-5002

No data is found in the report file.

There is no data in the selected report file.

■ERR-5003

File data error

There is a data error in the selected file. This may be test data used in the past.

■ERR-5004

Data is broken or not found.

The selected file or required file is destroyed or cannot be found.

■ERR-5005

Cannot open file.

An uneditable file name was input. Please input a proper file name.

■ERR-5006

There's no valid printer.

No printer driver has been set. Select a printer driver on the Control Panel.

■ERR-5007

Axis value out of range

Data out of range was input when changing axes. Valid data ranges are as follows.

Charge and discharge characteristics

Y axis Maximum is 1 to 9999

Minimum is 0 to 9998

X axis 0 hours, 1 minute to 999 hours, 59 minutes

Charge and discharge characteristics

- Y axis Maximum is 1 to 9999
 Minimum is 0 to 9998
 Y axis units can represent either [Ah] or [%]
- X axis Maximum is 1 to 99999
 Minimum is 0 to 99998

An error results when Maximum is less than Minimum or when the difference is less than 1.

■ERR-5008

Cannot overlay

A combination which cannot be overlaid has been selected.

■ERR-5009

Life graphs (Ah and %) cannot be combined.

An attempt has been made to overlay life characteristics graphs whose Y axes represent different units. Change the Y axis unit of one of the graphs to match the other and try again.

■ERR-5010

Disk Full

There is no free space on the disk. Clean out the hard disk by deleting unnecessary files.

BPC Spy-Related Error Messages

■ERR-6001

BPC-Test-Executive cannot be run.

Test Executive cannot be run. Quit PFX Config, and try executing BPC Spy again.

■ERR-6002

Insufficient memory

There is not enough memory. Try increasing available memory by terminating all unnecessary applications.

■ ERR-6003

Select any one of Watch Condition

None of the items listed under Watch Condition have been selected.

■ ERR-6004

Value must be between x and x.

An invalid range has been set. The valid range is 1 to 999% when setting percent change, and 1 to 10% of maximum value for that item when setting amount of change.

■ ERR-6005

The amount of spy data on the table is reaching full size.

The amount of data has reached the limit securable BPC Spy. Delete some rows after saving current data.

■ ERR-6006

Disk Full

There is no free space on the disk. Clean out the hard disk by deleting unnecessary files.

■ ERR-6007

The data being copied into the clipboard is too large.

The amount of data specified for copying onto the clipboard exceeds the amount that can be copied at one time. Copy the data in smaller pieces. If copying in smaller pieces is too troublesome, save it as a text file first.

■ ERR-6008

No Timer available

The timer cannot be used any further. Close any other applications using the timer and try again.

■ ERR-6010

Test Executive is too busy to respond DDE-conversation.

There was no DDE transmission from Test Executive. It is conceivable that Test Executive is currently acquiring graph data. Select "Retry" in the message box and try again. Execution on the selected channel can be terminated by selecting "Cancel".

Other BPC Graph and BPC Spy Error Messages

■ ERR-9999

unexpected error ! (Error message number)

An unexpected error has occurred. Check the following things and contact Kikusui's customer service department or your Kikusui agent.

Items to check:

1. Error message number
2. Name of the application generating the error message (BPC Graph or BPC Spy)
3. Status in which the error message was generated

Contact:

Kikusui Electronics Corp. Customer Service Department
TEL 045-593-0202 JAPAN
FAX 045-593-0207 JAPAN

APPENDIX 2 OUTPUT SAMPLES

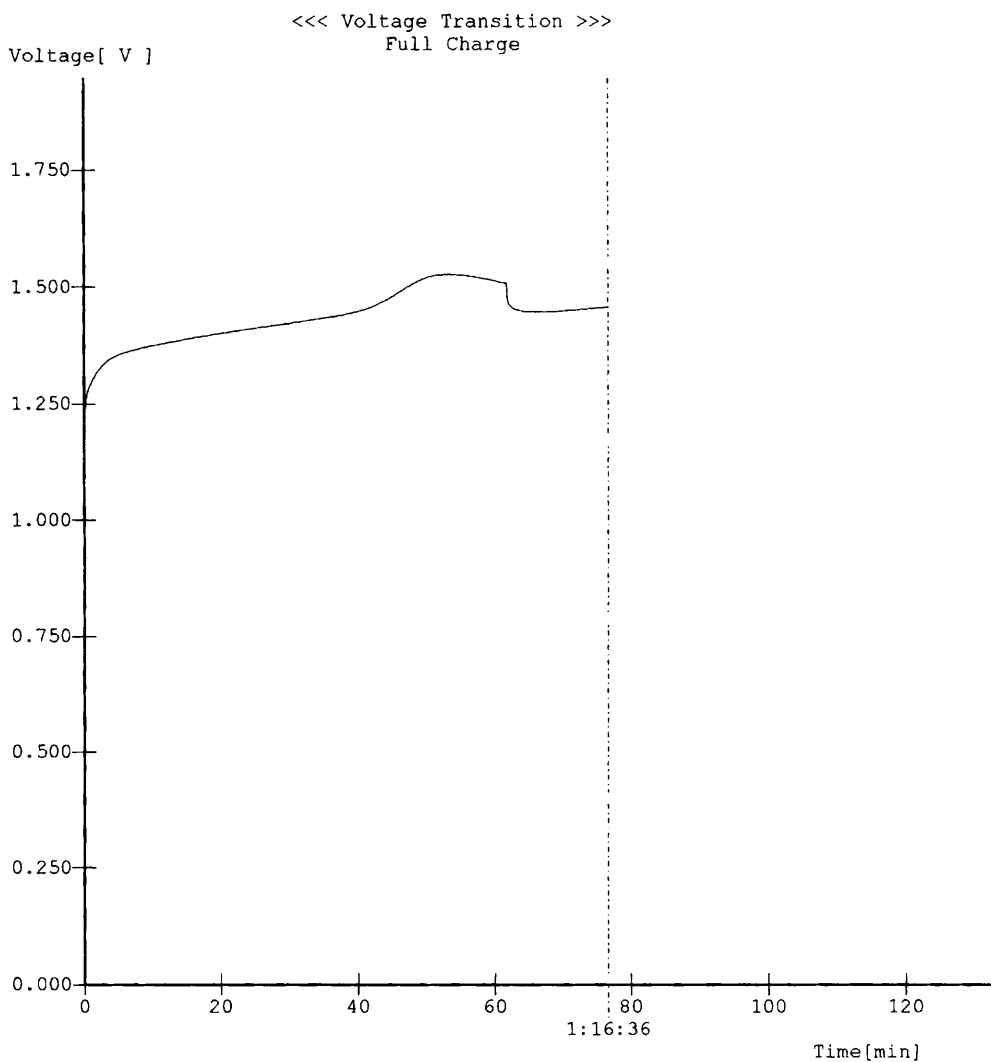
Appendix 2 lists 12 samples of output which can be generated using BPC Graph.

- Sample 1 Charge Graph (Voltage: 1 Source) A-11
- Sample 2 Charge Graph Overlay (Voltage, Current, Temperature: 3 Sources) A-12
- Sample 3 Discharge Graph (Voltage: 1 Source) A-13
- Sample 4 Discharge Graph Overlay (Voltage: 3 Sources) A-14
- Sample 5 Charge Life Characteristics Graph Overlay (2 Sources [Ah])
Sequence Mode A-15
- Sample 6 Charge/Discharge Life Characteristics Graph Overlay (2 Sources [%])
Life Cycle Mode A-16
- Sample 7 Charge Life Characteristics Report
Life Cycle Mode A-17
- Sample 8 Discharge Life Characteristics Report
Sequence Mode A-18
- Sample 9 Charge Report
Sequence Mode A-19
- Sample 10 Discharge Report
Life Cycle Mode A-20
- Sample 11 Unit Configuration File A-21
- Sample 12 Worksheet File A-22, A-23

Sample 1 Charge Graph (Voltage: 1 Source)

UNIT : 1
CHANNEL : 2

Kikusui/BP-Checker
A:\NI-CD\DATA.12\00002.GCV

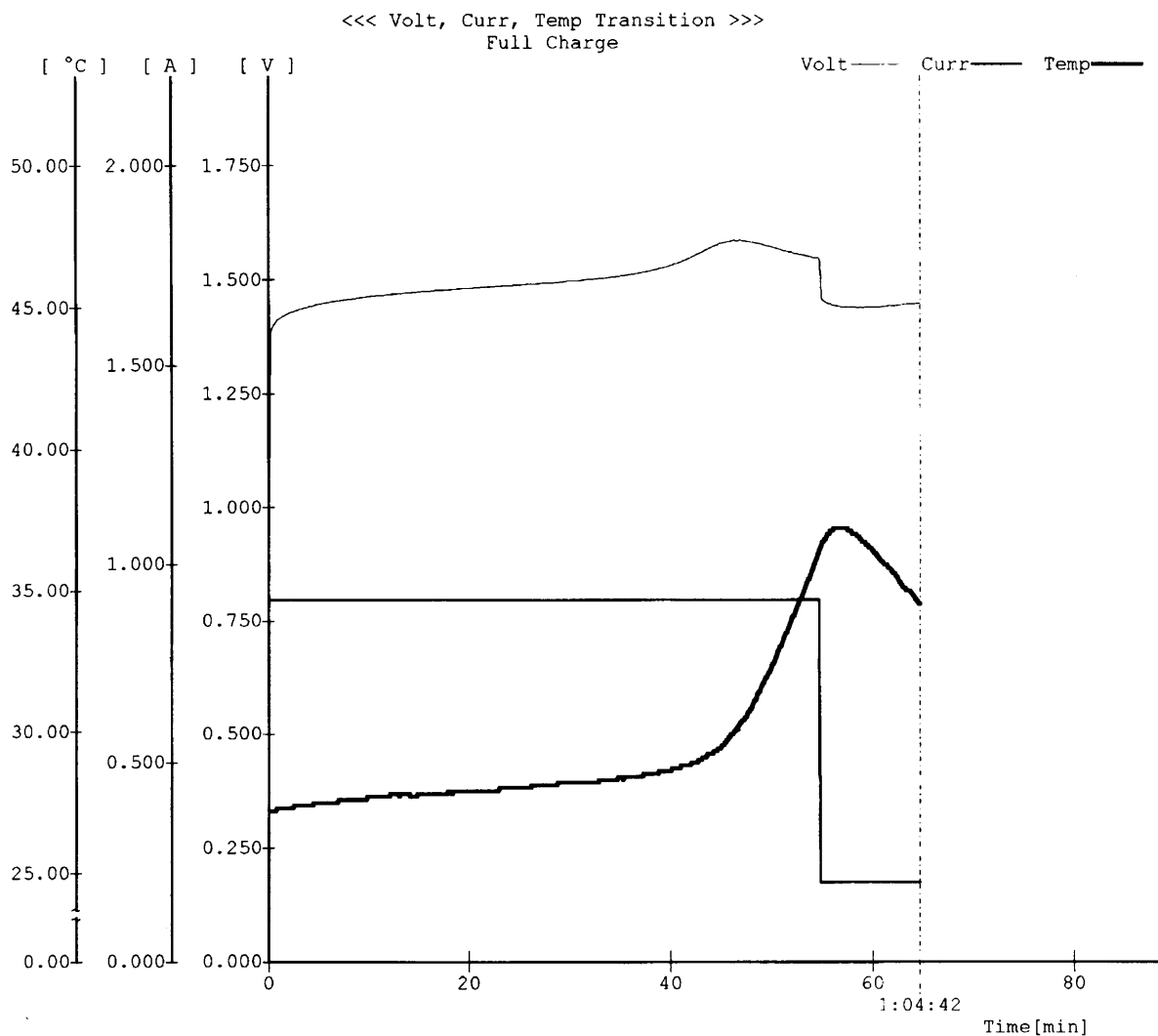


| | | | |
|-------------------|------------------------|------------------|------------------|
| Memo | : VER1.01 & bPC check | Cycle | : 2/800 |
| Battery Type | : Ni-Cd | Number Of Full | : 2/800 |
| Nominal Voltage | : 1.200[V] | Test Start | : 94/ 2/22 22:12 |
| Capacity Rate | : 0.700[Ah] | Finished By | : -dV |
| Charge On CC Mode | | Unloaded Voltage | : 1.199[V] |
| Current | : 0.700[A] (1.00[C]) | Start Voltage | : 1.294[V] |
| | | Average Voltage | : 1.436[V] |
| | | Peak Voltage | : 1.527[V] |
| | | Finish Voltage | : 1.507[V] |
| Judgment Margin | : 60[%] (0.420[Ah]) | | |
| Capacity | : 0.768[Ah] | Max Voltage | : 1.527[V] |
| Capacity / Nom | : 109.7[%] | Min Voltage | : 1.238[V] |

Sample 2 Charge Graph Overlay (Voltage, Current, Temperature: 3 Sources)

UNIT : 1
CHANNEL : 1

Kikusui/BP-Checker



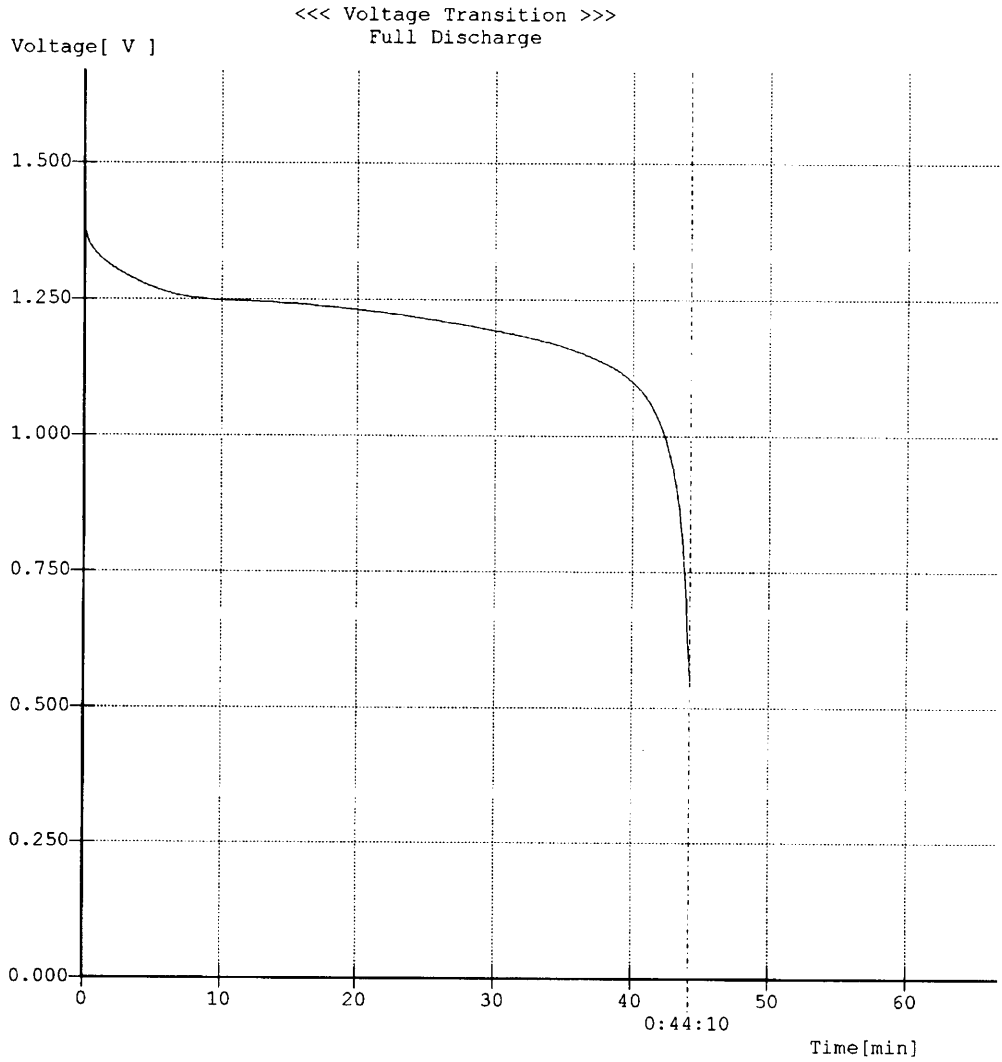
| | | | |
|-------------------|-----------------------|------------------|------------------|
| Memo | : Charge & Discharge | Cycle | : 2 |
| Battery Type | : Ni-Cd | Test Start | : 94/11/14 16:00 |
| Nominal Voltage | : 1.200[V] | Finished By | : -dV |
| Capacity Rate | : 0.700[Ah] | | |
| Charge On CC Mode | | Unloaded Voltage | : 1.216[V] |
| Current | : 0.910[A] (1.30[C] | Start Voltage | : 1.413[V] |
| | | Average Voltage | : 1.492[V] |
| | | Peak Voltage | : 1.586[V] |
| | | Finish Voltage | : 1.546[V] |
| Judgment Margin | : 100[%] (0.700[Ah]) | | |
| Capacity | : 0.863[Ah] | Max Voltage | : 1.586[V] |
| Capacity / Nom | : 123.2[%] | Min Voltage | : 1.022[V] |
| | | Max Current | : 0.910[A] |
| | | Min Current | : 0.200[A] |
| | | Max Temperature | : 37.2[°C] |
| | | Min Temperature | : 27.2[°C] |

Sample 3

Discharge Graph (Voltage: 1 Source)

UNIT : 1
CHANNEL : 2

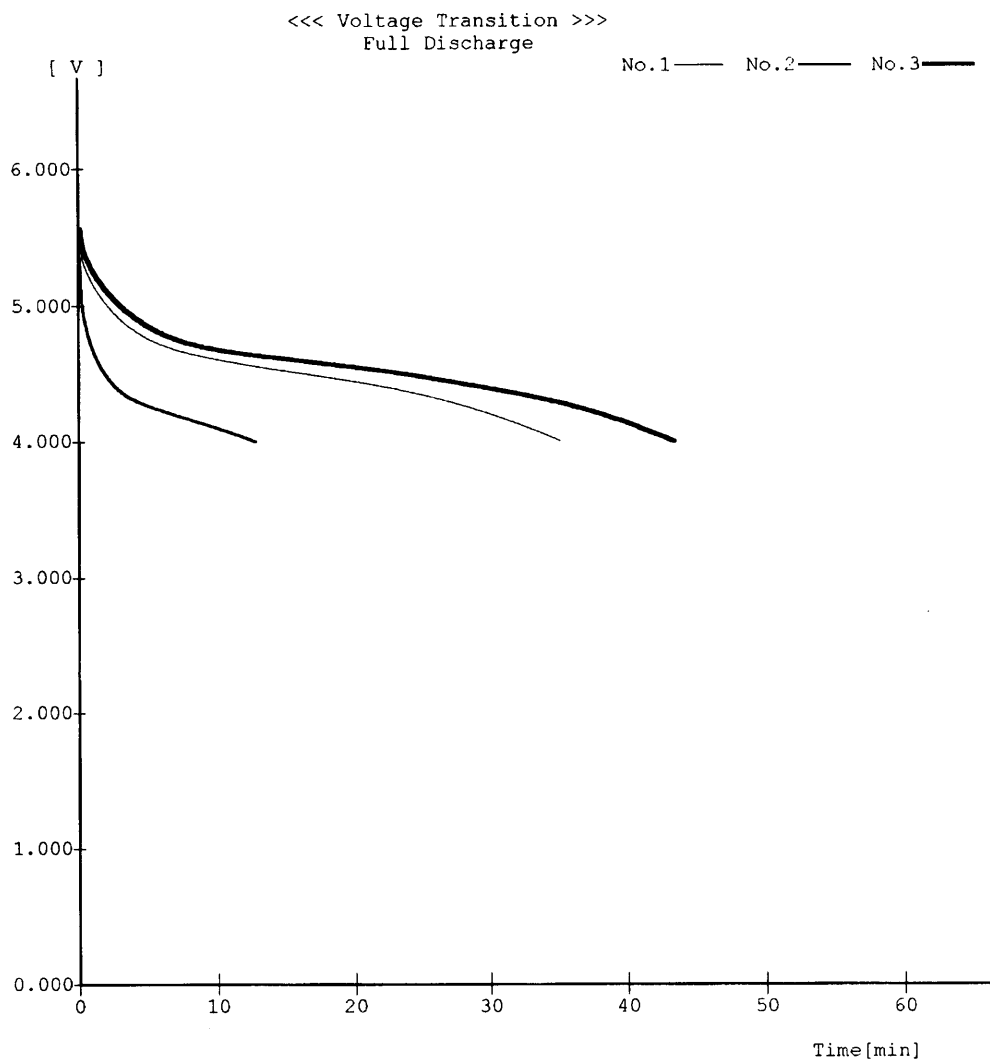
Kikusui/BP-Checker
A:\NI-CD\DATA.12\00001.GDV



| | | | |
|----------------------|------------------------|-----------------------|------------------|
| Memo | : VER1.01 & bPC check | Cycle | : 1/800 |
| Battery Type | : Ni-Cd | Number Of Full | : 1/800 |
| Nominal Voltage | : 1.200[V] | Test Start | : 94/ 2/22 20:58 |
| Capacity Rate | : 0.700[Ah] | Finished By | : OK |
| Discharge On CC Mode | | Unloaded Voltage | : 1.399[V] |
| Current | : 0.800[A] (1.14[C]) | Start Voltage | : 1.337[V] |
| Depth | : 142.9[%] | Middle Capacity Volt | : 1.225[V] |
| Cutoff Voltage | : 0.500[V] | Nominal Capacity Volt | : 0.000[V] |
| Judgment Margin | : 60[%] (0.420[Ah]) | Average Voltage | : 1.199[V] |
| Capacity | : 0.589[Ah] | Max Voltage | : 1.375[V] |
| Capacity / Nom | : 84.2[%] | Min Voltage | : 0.547[V] |

Sample 4 Discharge Graph Overlay (Voltage: 3 Sources)

Kikusui/BP-Checker



Test Contents

| No. | Unit | Channel | Memo | Battery Type | Discharge |
|-----|------|---------|---------|--------------|-----------|
| 1 | 1 | 7 | seq No1 | Ni-MH | 0.600[A] |
| 2 | 1 | 7 | seq No3 | Ni-MH | 1.000[A] |
| 3 | 1 | 7 | seq No4 | Ni-MH | 0.500[A] |

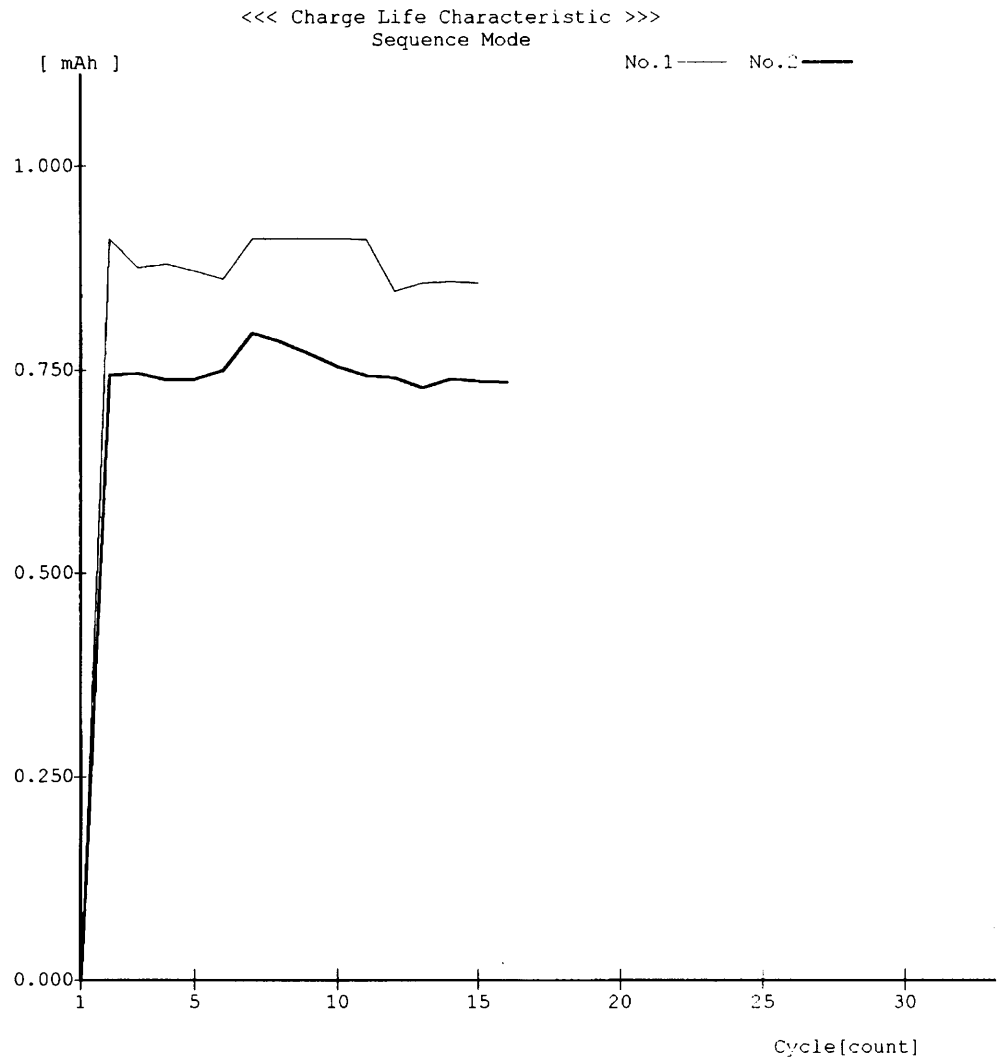
Test Results

| No. | Cycle | Capacity | Unloaded Voltage | Start Voltage | Middle Voltage | NomiCap Voltage | Max Voltage | Min Voltage | Average Voltage | Judgment |
|-----|-------|----------|------------------|---------------|----------------|-----------------|-------------|-------------|-----------------|----------|
| 1 | 1 | 0.351 | 5.831 | 5.213 | 4.481 | 0.000 | 5.544 | 4.001 | 4.495 | Min Volt |
| 2 | 6 | 0.212 | 5.866 | 4.754 | 4.217 | 0.000 | 5.350 | 4.002 | 4.277 | Min Volt |
| 3 | 7 | 0.360 | 5.887 | 5.226 | 4.527 | 0.000 | 5.564 | 4.002 | 4.531 | Min Volt |

Sample 5

Charge Life Characteristics Graph Overlay (2 Sources [Ah])
Sequence Mode

Kikusui/BP-Checker



Test Contents

| No. | Unit | Channel | Memo | Battery Type |
|-----|------|---------|------------------|--------------|
| 1 | 1 | 1 | normal test (1C) | Ni-Cd |
| 2 | 1 | 3 | normal test (1C) | Ni-Cd |

Test Results

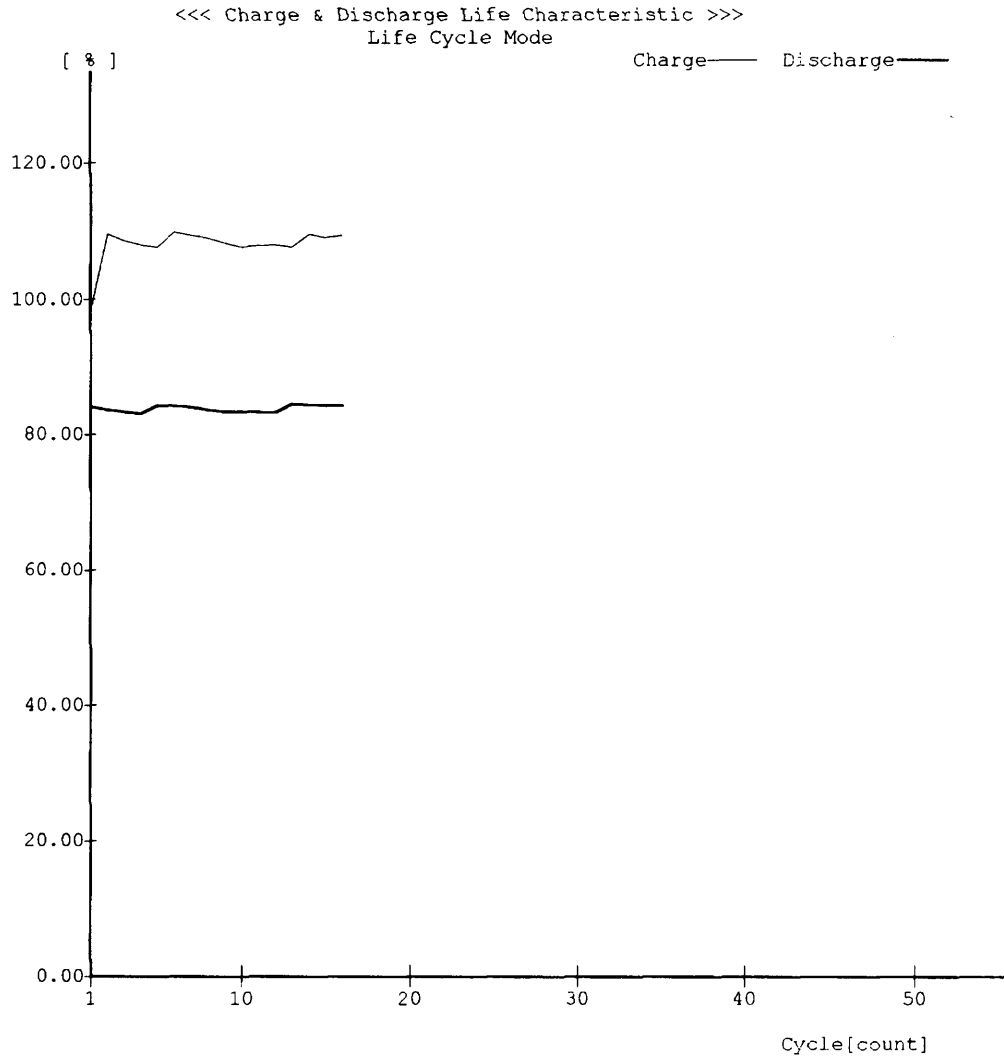
| No. | Start Time | Last Time | Cycle | MaxCap | MinCap |
|-----|----------------|----------------|-------|--------|--------|
| 1 | 94/11/29 15:51 | 94/12/ 1 17:16 | 15 | 0.911 | 0.000 |
| 2 | 94/11/29 15:51 | 94/12/ 1 15:24 | 16 | 0.796 | 0.000 |

Sample 6

Charge/Discharge Life Characteristics Graph Overlay
(2 Sources [%]) Life Cycle Mode

UNIT : 1
CHANNEL : 2

Kikusui/BP-Checker



| | | | |
|-----------------|-----------------------|----------------|------------------------|
| Memo | : VER1.01 & bPC check | Cycle | : 16/800 |
| Battery Type | : Ni-Cd | Number Of Full | : 16/800 |
| Nominal Voltage | : 1.200[V] | Max Capacity | : 0.769[Ah] 0.592[Ah] |
| Capacity Rate | : 0.700[Ah] | Min Capacity | : 0.754[Ah] 0.582[Ah] |
| Start | : 94/ 2/22 19:18 | Result | : |
| Last | : 94/ 2/24 16:15 | NG Count | : 0/9 |
| Cycle[count] | | | |
| Cycle Charge | Mode : CC | Current | : 0.800[A] (1.14[C]) |
| Cycle Discharge | Mode : CC | Current | : 0.600[A] (0.86[C]) |
| | Discharge Depth | : 114.3[%] | |
| | Cutoff Voltage | : 0.500[V] | |
| Full Charge | Mode : CC | Current | : 0.700[A] (1.00[C]) |
| Full Discharge | Mode : CC | Current | : 0.800[A] (1.14[C]) |
| | Discharge Depth | : 142.9[%] | |
| | Cutoff Voltage | : 0.500[V] | |

Sample 7

Charge Life Characteristics Report
Life Cycle Mode

1/2

UNIT : 1
CHANNEL : 2

Kikusui/BP-Checker
Date: 12-05-1994
Time: 16:57:28

C:\DATA\DATA.12\RSLTCHG.REP

Charge Result

```

Memo          :                               Cycle       : 30/30
Battery Type  : Li                           Number Of Full : 30/30
Nominal Voltage : 14.400[V]
Capacity Rate : 1.000[Ah]                    Max Capacity   : 1.067[Ah]
                                                Min Capacity   : 0.878[Ah]
Start         : 94/ 6/17 18:47
Last          : 94/ 6/21 7:21                Result        : OK
                                                NG Count      : 0/9
    
```

```

Cycle Charge  Mode       : CC
               Current    : 0.001[A] ( 0.00[C])

Cycle Discharge Mode     : CC
                Current   : 0.001[A] ( 0.00[C])
                Discharge Depth : 0.0[%]
                Cutoff Voltage : 0.001[V]

Full Charge    Mode       : CC-CV
                Current    : 1.000[A]
                Voltage     : 16.800[V]

Full Discharge Mode     : CC
                Current    : 1.000[A] ( 1.00[C])
                Discharge Depth : 150.0[%]
                Cutoff Voltage : 10.800[V]
    
```

2/2

Date: 12-05-1994
Time: 16:57:28

Charge Result

| Cycle | Date | Time | Capacity | Unloaded Voltage | Start Voltage | Average Voltage | Max Voltage | Finish Voltage | Finished By |
|-------|-----------|---------|----------|------------------|---------------|-----------------|-------------|----------------|-------------|
| | [Y/ M/ D] | [h:min] | [Ah] | [V] | [V] | [V] | [V] | [V] | |
| 1 | 94/ 6/17 | 18:47 | 0.878 | 14.082 | 15.173 | 16.584 | 16.818 | 16.808 | Time |
| 2 | 94/ 6/17 | 21:35 | 1.067 | 12.161 | 13.388 | 16.264 | 16.823 | 16.809 | Time |
| 3 | 94/ 6/18 | 0:38 | 1.056 | 12.185 | 13.418 | 16.271 | 16.809 | 16.809 | Time |
| 4 | 94/ 6/18 | 3:39 | 1.050 | 12.201 | 13.439 | 16.276 | 16.809 | 16.809 | Time |
| 5 | 94/ 6/18 | 6:40 | 1.047 | 12.216 | 13.453 | 16.279 | 16.826 | 16.804 | Time |
| 6 | 94/ 6/18 | 9:40 | 1.041 | 12.219 | 13.454 | 16.280 | 16.809 | 16.809 | Time |
| 7 | 94/ 6/18 | 12:39 | 1.030 | 12.264 | 13.515 | 16.292 | 16.823 | 16.809 | Time |
| 8 | 94/ 6/18 | 15:37 | 1.023 | 12.294 | 13.556 | 16.301 | 16.809 | 16.809 | Time |
| 9 | 94/ 6/18 | 18:35 | 1.034 | 12.274 | 13.523 | 16.293 | 16.824 | 16.784 | Time |
| 10 | 94/ 6/18 | 21:33 | 1.033 | 12.273 | 13.511 | 16.291 | 16.814 | 16.808 | Time |
| 11 | 94/ 6/19 | 0:32 | 1.025 | 12.304 | 13.553 | 16.299 | 16.810 | 16.809 | Time |
| 12 | 94/ 6/19 | 3:30 | 1.019 | 12.330 | 13.582 | 16.305 | 16.809 | 16.808 | Time |
| 13 | 94/ 6/19 | 6:26 | 1.014 | 12.349 | 13.605 | 16.310 | 16.822 | 16.809 | Time |
| 14 | 94/ 6/19 | 9:23 | 1.009 | 12.372 | 13.628 | 16.315 | 16.829 | 16.808 | Time |
| 15 | 94/ 6/19 | 12:19 | 1.009 | 12.383 | 13.634 | 16.316 | 16.835 | 16.825 | Time |
| 16 | 94/ 6/19 | 15:14 | 1.003 | 6.699 | 13.661 | 16.320 | 16.829 | 16.809 | Time |
| 17 | 94/ 6/19 | 18:09 | 0.999 | 6.721 | 13.684 | 16.324 | 16.832 | 16.808 | Time |
| 18 | 94/ 6/19 | 21:04 | 0.991 | 6.747 | 13.715 | 16.331 | 16.809 | 16.809 | Time |
| 19 | 94/ 6/19 | 23:58 | 0.984 | 6.773 | 13.750 | 16.338 | 16.809 | 16.808 | Time |
| 20 | 94/ 6/20 | 2:51 | 0.978 | 6.797 | 13.780 | 16.345 | 16.809 | 16.809 | Time |
| 21 | 94/ 6/20 | 5:43 | 0.972 | 6.821 | 13.807 | 16.350 | 16.816 | 16.809 | Time |
| 22 | 94/ 6/20 | 8:34 | 0.976 | 6.830 | 13.795 | 16.346 | 16.811 | 16.808 | Time |
| 23 | 94/ 6/20 | 11:27 | 0.972 | 6.849 | 13.821 | 16.352 | 16.813 | 16.808 | Time |
| 24 | 94/ 6/20 | 14:18 | 0.970 | 6.867 | 13.832 | 16.354 | 16.809 | 16.808 | Time |
| 25 | 94/ 6/20 | 17:10 | 0.966 | 6.885 | 13.849 | 16.357 | 16.826 | 16.809 | Time |
| 26 | 94/ 6/20 | 20:01 | 0.966 | 6.905 | 13.867 | 16.360 | 16.827 | 16.800 | Time |
| 27 | 94/ 6/20 | 22:52 | 0.960 | 6.918 | 13.871 | 16.361 | 16.820 | 16.808 | Time |
| 28 | 94/ 6/21 | 1:43 | 0.950 | 6.945 | 13.917 | 16.371 | 16.809 | 16.808 | Time |
| 29 | 94/ 6/21 | 4:32 | 0.944 | 6.968 | 13.947 | 16.377 | 16.809 | 16.808 | Time |
| 30 | 94/ 6/21 | 7:21 | 0.944 | 6.988 | 13.965 | 16.380 | 16.828 | 16.812 | Time |

Sample 8

Discharge Life Characteristics Report Sequence Mode

1/2

UNIT : 1
CHANNEL : 3

Kikusui/BP-Checke
Date: 12-06-199
Time: 11:02:58

C:\BPCDATA\SEQDATA\DATA.13\RSLTDCHG.RE

Discharge Result

Battery Type : Ni-Cd
Nominal Voltage : 1.200[V]
Capacity Rate : 0.600[Ah]

| Cycle | Memo | Charge | Discharge |
|-------|--------------------|----------|-----------|
| 1 | charge skip test | 0.001[A] | 0.700[A] |
| 2 | normal test (1C) | 0.910[A] | 0.700[A] |
| 3 | normal test (1C) | 0.910[A] | 0.700[A] |
| 4 | normal test (1C) | 0.910[A] | 0.700[A] |
| 5 | normal test (1C) | 0.910[A] | 0.700[A] |
| 6 | normal test (1C) | 0.910[A] | 0.700[A] |
| 7 | normal test (0.5C) | 0.455[A] | 0.350[A] |
| 8 | normal test (0.5C) | 0.455[A] | 0.350[A] |
| 9 | normal test (0.5C) | 0.455[A] | 0.350[A] |
| 10 | normal test (0.5C) | 0.455[A] | 0.350[A] |
| 11 | normal test (0.5C) | 0.455[A] | 0.350[A] |
| 12 | normal test (1C) | 0.910[A] | 0.700[A] |
| 13 | normal test (1C) | 0.910[A] | 0.700[A] |
| 14 | normal test (1C) | 0.910[A] | 0.700[A] |
| 15 | normal test (1C) | 0.910[A] | 0.700[A] |
| 16 | normal test (1C) | 0.910[A] | 0.700[A] |

2/2

Date: 12-06-1994
Time: 11:02:58

Discharge Result

| Cycle | Date | Time | Capacity | Unloaded Voltage | Start Voltage | Middle Voltage | NomiCap Voltage | Average Voltage | Judgment |
|-------|-----------|---------|----------|------------------|---------------|----------------|-----------------|-----------------|----------|
| | [Y/ M/ D] | [h:min] | [Ah] | [V] | [V] | [V] | [V] | [V] | |
| 1 | 94/11/29 | 15:52 | 0.613 | 1.388 | 1.193 | 1.102 | 0.963 | 1.091 | OK |
| 2 | 94/11/29 | 17:53 | 0.628 | 1.401 | 1.217 | 1.103 | 0.996 | 1.092 | OK |
| 3 | 94/11/29 | 19:57 | 0.627 | 1.401 | 1.219 | 1.105 | 0.994 | 1.093 | OK |
| 4 | 94/11/29 | 21:59 | 0.626 | 1.405 | 1.224 | 1.107 | 0.992 | 1.095 | OK |
| 5 | 94/11/30 | 8:49 | 0.605 | 1.377 | 1.189 | 1.106 | 0.775 | 1.090 | OK |
| 6 | 94/11/30 | 10:51 | 0.629 | 1.402 | 1.222 | 1.108 | 1.000 | 1.097 | OK |
| 7 | 94/11/30 | 13:50 | 0.644 | 1.403 | 1.308 | 1.191 | 1.101 | 1.180 | OK |
| 8 | 94/11/30 | 17:44 | 0.643 | 1.407 | 1.311 | 1.192 | 1.102 | 1.181 | OK |
| 9 | 94/11/30 | 21:36 | 0.641 | 1.409 | 1.314 | 1.193 | 1.101 | 1.182 | OK |
| 10 | 94/12/ 1 | 1:26 | 0.639 | 1.413 | 1.317 | 1.194 | 1.101 | 1.184 | OK |
| 11 | 94/12/ 1 | 5:13 | 0.638 | 1.416 | 1.319 | 1.195 | 1.101 | 1.185 | OK |
| 12 | 94/12/ 1 | 8:12 | 0.627 | 1.409 | 1.235 | 1.115 | 1.005 | 1.104 | OK |
| 13 | 94/12/ 1 | 10:14 | 0.628 | 1.407 | 1.233 | 1.114 | 1.005 | 1.103 | OK |
| 14 | 94/12/ 1 | 12:17 | 0.629 | 1.403 | 1.228 | 1.113 | 1.004 | 1.101 | OK |
| 15 | 94/12/ 1 | 14:20 | 0.629 | 1.402 | 1.227 | 1.111 | 1.004 | 1.100 | OK |
| 16 | 94/12/ 1 | 16:22 | 0.629 | 1.403 | 1.228 | 1.112 | 1.004 | 1.101 | OK |

Sample 9

Charge Report Sequence Mode

1/2

UNIT : 1
CHANNEL : 3

Kikusui/BP-Checker
Date: 12-06-1994
Time: 11:04:40

C:\BPCDATA\SEQDATA\DATA.13\RSLTCHG.REP

=====
Charge Result
=====

Battery Type : Ni-Cd
Nominal Voltage : 1.200[V]
Capacity Rate : 0.600[Ah]

| Cycle | Memo | Charge | Discharge |
|-------|--------------------|----------|-----------|
| 1 | charge skip test | 0.001[A] | 0.700[A] |
| 2 | normal test (1C) | 0.910[A] | 0.700[A] |
| 3 | normal test (1C) | 0.910[A] | 0.700[A] |
| 4 | normal test (1C) | 0.910[A] | 0.700[A] |
| 5 | normal test (1C) | 0.910[A] | 0.700[A] |
| 6 | normal test (1C) | 0.910[A] | 0.700[A] |
| 7 | normal test (0.5C) | 0.455[A] | 0.350[A] |
| 8 | normal test (0.5C) | 0.455[A] | 0.350[A] |
| 9 | normal test (0.5C) | 0.455[A] | 0.350[A] |
| 10 | normal test (0.5C) | 0.455[A] | 0.350[A] |
| 11 | normal test (0.5C) | 0.455[A] | 0.350[A] |
| 12 | normal test (1C) | 0.910[A] | 0.700[A] |
| 13 | normal test (1C) | 0.910[A] | 0.700[A] |
| 14 | normal test (1C) | 0.910[A] | 0.700[A] |
| 15 | normal test (1C) | 0.910[A] | 0.700[A] |
| 16 | normal test (1C) | 0.910[A] | 0.700[A] |

2/2

Date: 12-06-1994
Time: 11:04:41

=====
Charge Result
=====

| Cycle | Date | Time | Capacity | Unloaded Voltage | Start Voltage | Average Voltage | Max Voltage | Finish Voltage | Finished By |
|-------|-----------|---------|----------|------------------|---------------|-----------------|-------------|----------------|-------------|
| | [Y/ M/ D] | [h:min] | [Ah] | [V] | [V] | [V] | [V] | [V] | |
| 1 | 94/11/29 | 15:51 | 0.000 | 1.390 | 0.000 | 0.810 | 1.389 | 1.041 | Time |
| 2 | 94/11/29 | 16:54 | 0.745 | 1.212 | 1.520 | 1.637 | 1.741 | 1.711 | -dV |
| 3 | 94/11/29 | 18:57 | 0.748 | 1.212 | 1.519 | 1.636 | 1.738 | 1.708 | -dV |
| 4 | 94/11/29 | 21:00 | 0.739 | 1.211 | 1.518 | 1.636 | 1.742 | 1.713 | -dV |
| 5 | 94/11/29 | 23:03 | 0.740 | 1.212 | 1.517 | 1.635 | 1.742 | 1.713 | -dV |
| 6 | 94/11/30 | 9:51 | 0.750 | 1.214 | 1.507 | 1.626 | 1.733 | 1.704 | -dV |
| 7 | 94/11/30 | 11:55 | 0.797 | 1.212 | 1.380 | 1.509 | 1.589 | 1.559 | -dV |
| 8 | 94/11/30 | 15:50 | 0.786 | 1.199 | 1.383 | 1.510 | 1.595 | 1.565 | -dV |
| 9 | 94/11/30 | 19:44 | 0.770 | 1.201 | 1.384 | 1.511 | 1.601 | 1.571 | -dV |
| 10 | 94/11/30 | 23:36 | 0.755 | 1.202 | 1.385 | 1.513 | 1.608 | 1.578 | -dV |
| 11 | 94/12/ 1 | 3:25 | 0.743 | 1.203 | 1.386 | 1.514 | 1.613 | 1.583 | -dV |
| 12 | 94/12/ 1 | 7:13 | 0.741 | 1.203 | 1.514 | 1.631 | 1.743 | 1.713 | -dV |
| 13 | 94/12/ 1 | 9:16 | 0.729 | 1.214 | 1.508 | 1.624 | 1.736 | 1.706 | -dV |
| 14 | 94/12/ 1 | 11:18 | 0.740 | 1.212 | 1.506 | 1.621 | 1.724 | 1.695 | -dV |
| 15 | 94/12/ 1 | 13:21 | 0.737 | 1.211 | 1.507 | 1.621 | 1.723 | 1.693 | -dV |
| 16 | 94/12/ 1 | 15:24 | 0.736 | 1.210 | 1.508 | 1.622 | 1.724 | 1.694 | -dV |

Sample 10 Discharge Report

Life Cycle Mode

1/2

UNIT : 1
CHANNEL : 2

Kikusui/BP-Checker
Date: 12-05-1994
Time: 16:57:45

C:\DATA\DATA.12\SLTDCHG.REP

Discharge Result

```

Memo          :                               Cycle          : 30/30
Battery Type  : Li                           Number Of Full   : 30/30
Nominal Voltage : 14.400[V]
Capacity Rate  : 1.000[Ah]                   Max Capacity     : 1.051[Ah]
                                                Min Capacity     : 0.934[Ah]

Start         : 94/ 6/17 20:23
Last          : 94/ 6/21  9:03                Result          : OK
                                                NG Count        : 0/9
  
```

```

Cycle Charge  Mode      : CC
               Current   : 0.001[A] ( 0.00[C] )
  
```

```

Cycle Discharge Mode    : CC
                Current  : 0.001[A] ( 0.00[C] )
                Discharge Depth : 0.0[%]
                Cutoff Voltage : 0.001[V]
  
```

```

Full Charge    Mode      : CC-CV
                Current   : 1.000[A]
                Voltage   : 16.800[V]
  
```

```

Full Discharge Mode    : CC
                Current  : 1.000[A] ( 1.00[C] )
                Discharge Depth : 150.0[%]
                Cutoff Voltage : 10.800[V]
  
```

2/2

Date: 12-05-1994
Time: 16:57:46

Discharge Result

| Cycle | Date | Time | Capacity | Unloaded Voltage | Start Voltage | Middle Voltage | NomiCap Voltage | Average Voltage | Judgment |
|-------|-----------|---------|----------|------------------|---------------|----------------|-----------------|-----------------|----------|
| | [Y/ M/ D] | [h:min] | [Ah] | [V] | [V] | [V] | [V] | [V] | |
| 1 | 94/ 6/17 | 20:23 | 1.044 | 16.662 | 15.807 | 14.401 | 11.332 | 14.013 | OK |
| 2 | 94/ 6/17 | 23:25 | 1.051 | 16.690 | 15.842 | 14.422 | 11.409 | 14.036 | OK |
| 3 | 94/ 6/18 | 2:26 | 1.043 | 16.685 | 15.831 | 14.413 | 11.350 | 14.036 | OK |
| 4 | 94/ 6/18 | 5:27 | 1.039 | 16.685 | 15.828 | 14.409 | 11.317 | 14.033 | OK |
| 5 | 94/ 6/18 | 8:28 | 1.038 | 16.685 | 15.832 | 14.419 | 11.318 | 14.043 | OK |
| 6 | 94/ 6/18 | 11:28 | 1.026 | 16.679 | 15.809 | 14.392 | 11.203 | 14.027 | OK |
| 7 | 94/ 6/18 | 14:26 | 1.017 | 16.674 | 15.796 | 14.386 | 11.120 | 14.023 | OK |
| 8 | 94/ 6/18 | 17:23 | 1.019 | 16.668 | 15.789 | 14.377 | 11.123 | 14.014 | OK |
| 9 | 94/ 6/18 | 20:22 | 1.026 | 16.682 | 15.822 | 14.409 | 11.231 | 14.048 | OK |
| 10 | 94/ 6/18 | 23:21 | 1.021 | 16.683 | 15.817 | 14.404 | 11.178 | 14.045 | OK |
| 11 | 94/ 6/19 | 2:19 | 1.013 | 16.678 | 15.805 | 14.394 | 11.091 | 14.044 | OK |
| 12 | 94/ 6/19 | 5:16 | 1.008 | 16.676 | 15.799 | 14.391 | 11.016 | 14.043 | OK |
| 13 | 94/ 6/19 | 8:12 | 1.003 | 16.675 | 15.794 | 14.385 | 10.923 | 14.044 | OK |
| 14 | 94/ 6/19 | 11:08 | 1.001 | 16.673 | 15.792 | 14.386 | 10.841 | 14.043 | OK |
| 15 | 94/ 6/19 | 14:04 | 0.998 | 16.677 | 15.799 | 14.393 | 0.000 | 14.057 | OK |
| 16 | 94/ 6/19 | 17:00 | 0.993 | 16.674 | 15.793 | 14.386 | 0.000 | 14.057 | OK |
| 17 | 94/ 6/19 | 19:55 | 0.988 | 16.673 | 15.791 | 14.387 | 0.000 | 14.060 | OK |
| 18 | 94/ 6/19 | 22:49 | 0.979 | 16.671 | 15.779 | 14.375 | 0.000 | 14.059 | OK |
| 19 | 94/ 6/20 | 1:42 | 0.973 | 16.668 | 15.771 | 14.368 | 0.000 | 14.057 | OK |
| 20 | 94/ 6/20 | 4:35 | 0.967 | 16.665 | 15.763 | 14.363 | 0.000 | 14.054 | OK |
| 21 | 94/ 6/20 | 7:26 | 0.966 | 16.663 | 15.765 | 14.369 | 0.000 | 14.064 | OK |
| 22 | 94/ 6/20 | 10:19 | 0.966 | 16.670 | 15.773 | 14.372 | 0.000 | 14.072 | OK |
| 23 | 94/ 6/20 | 13:11 | 0.963 | 16.670 | 15.776 | 14.378 | 0.000 | 14.080 | OK |
| 24 | 94/ 6/20 | 16:02 | 0.961 | 16.673 | 15.780 | 14.382 | 0.000 | 14.083 | OK |
| 25 | 94/ 6/20 | 18:54 | 0.956 | 16.671 | 15.774 | 14.377 | 0.000 | 14.087 | OK |
| 26 | 94/ 6/20 | 21:45 | 0.958 | 16.677 | 15.794 | 14.403 | 0.000 | 14.110 | OK |
| 27 | 94/ 6/21 | 0:36 | 0.948 | 16.672 | 15.770 | 14.377 | 0.000 | 14.092 | OK |
| 28 | 94/ 6/21 | 3:26 | 0.939 | 16.667 | 15.757 | 14.362 | 0.000 | 14.087 | OK |
| 29 | 94/ 6/21 | 6:15 | 0.934 | 16.665 | 15.750 | 14.357 | 0.000 | 14.082 | OK |
| 30 | 94/ 6/21 | 9:03 | 0.938 | 16.672 | 15.778 | 14.387 | 0.000 | 14.114 | OK |

Sample 11 Unit Configuration File

Date: 12-05-1994
Time: 16:46:24

C:\BPCHKR\UNIT1.SET

Unit Setup

---- Test Condition ----

Range : 8channels/20V-2A
Measurement : Yes
Synchronization : No

---- Cycle Format ----

Max Cycle :1000
Interval : 1
Judgment Margin : 100
Judgment Count : 9
Final Recharge : No

Sample 12 Worksheet File

1/2

Date: 12-05-1994
Time: 16:52:30

C:\BPCHKR\LIFE\TEST1.W01

WorkSheet

---- Setup for PFX and Battery Check ----

Memo :
Battery Type : Ni-Cd
Nominal Voltage : 1.200[V]
Capacity Rate : 0.700[Ah]
Cycle Charge Type : CC Mode
Cycle Discharge Type : CC Mode
Full Charge Type : CC Mode
Full Discharge Type : CC Mode

---- Initial Charge Setup ----

| Step No | Charge Current [A] | Charge Time [h:min] |
|---------|-----------------------|------------------------|
| 1 | 0.000 | 0:00 |
| 2 | 0.000 | 0:00 |
| 3 | 0.000 | 0:00 |
| 4 | 0.000 | 0:00 |
| 5 | 0.000 | 0:00 |
| 6 | 0.000 | 0:00 |
| 7 | 0.000 | 0:00 |
| 8 | 0.000 | 0:00 |
| 9 | 0.000 | 0:00 |
| 10 | 0.000 | 0:00 |
| 11 | 0.000 | 0:00 |
| 12 | 0.000 | 0:00 |
| 13 | 0.000 | 0:00 |
| 14 | 0.000 | 0:00 |
| 15 | 0.000 | 0:00 |
| 16 | 0.000 | 0:00 |
| 17 | 0.000 | 0:00 |
| 18 | 0.000 | 0:00 |
| 19 | 0.000 | 0:00 |
| 20 | 0.000 | 0:00 |
| 21 | 0.000 | 0:00 |
| 22 | 0.000 | 0:00 |
| 23 | 0.000 | 0:00 |
| 24 | 0.000 | 0:00 |
| 25 | 0.000 | 0:00 |
| 26 | 0.000 | 0:00 |
| 27 | 0.000 | 0:00 |
| 28 | 0.000 | 0:00 |
| 29 | 0.000 | 0:00 |
| 30 | 0.000 | 0:00 |

```

=====
WorkSheet
=====

```

---- Cycle Charge Setup ----

```

Mode                : CC
Charge Current      : 0.500[A]
Charge Time        : 0:30 [h:min]
Aux Charge Current  : 0.001[A]
Aux Charge Time    : 0:01 [h:min]
Rest Time         : 0:05 [h:min]
-dV               : 30[mV]
dT/dt             : 1.2[°C/min]
Max Voltage       : 1.800[V]
Max Temperature   : 60[°C]

```

---- Cycle Discharge Setup ----

```

Mode                : CC
Dscharge Current   : 0.500[A]
Dscharge Time     : 0:30 [h:min]
Rest Time        : 0:05 [h:min]
Min Voltage      : 0.600[V]

```

---- Full Charge Setup ----

```

Mode                : CC
Charge Current     : 0.910[A]
Charge Time       : 1:10 [h:min]
Aux Charge Current : 0.200[A]
Aux Charge Time   : 0:20 [h:min]
Rest Time        : 0:10 [h:min]
-dV             : 30[mV]
dT/dt          : 1.2[°C/min]
Max Voltage     : 1.800[V]
Max Temperature : 60[°C]
Pre-Discharge Current : 0.001[A]
Pre-Discharge Time : 0:00 [h:min]
Pre-Discharge Min Voltage : 0.001[V]

```

---- Full Discharge Setup ----

```

Mode                : CC
Discharge Current  : 0.700[A]
Discharge Time    : 1:30 [h:min]
Rest Time        : 0:10 [h:min]
Min Voltage      : 0.600[V]
Post-Charge Current : 0.001[A]
Post-Charge Time  : 0:00 [h:min]

```

APPENDIX 3 COMMUNICATING WITH EXTERNAL PROGRAMS (ADVANCED FUNCTION)

NOTE

- Knowledge of Windows application development techniques are necessary in using this function. The sample program introduced here is written in Visual Basic, and utilizes Windows API functions. Therefore, knowledge of Visual Basic (particularly DDE conversation) and knowledge of API functions described in the Windows SDK are required. Also, be absolutely sure to use DDEML.DLL (the DDE management library) when creating a DDE client application using C++ or another language.
- Note that this advanced function cannot operate with Visual Basic ver4.0 (32bit issue).

The Test Executive program monitors each executing channel at a constant interval. If there is a change in status (such as a change from full charge status to full charge rest status), BP checker can, if required, retrieve graph data from PFX units. However, this type of status monitoring can all only be performed within the Test Executive program.

But what should you do if you want to trigger some action depending on the execution status of a channel? For example, this may occur when you want to control an thermostatic chamber in response to changes in the testing process or display voltage or temperature transitions on an external terminal device or printer. These functions are not included in the BP checker programs, much less something that can be done by the user through improvements to these programs.

But is there no way for application programs to find out status changes in tests under execution? Actually, there is a way. You just need to use the DDE (Dynamic Data Exchange) functions built into Windows. DDE is a standard method for implementing communications between Windows applications. DDE server functions (a function to supply data) are built into Test Executive. This function can be implemented if you build a DDE client application (to accept the supplied data).

Obtained information

The DDE functions supported by Test Executive can be grouped into the following two broad categories.

- Notification of changes in status
- Notification of status monitor value

"Notification of changes in status" means that it is possible to notify an external application of status changes which occur during testing. For example, a typical status change would be a transition from full charge to full charge rest. This function can be used to notify the current cycle number and status after the change.

"Notification of status monitor value" means that an external application can be notified of various monitored values as set intervals regardless of changes in status. Rather than just notifying the current cycle number and status, this function can be used to also notify data items such as current, voltage and temperature. The set interval used is that set for the timer under Test Executive.

Once a conversation has been established, these notification functions can be used to spontaneously send data from Test Executive to an external application. Accordingly, the external application program does not need to actively retrieve data. Services using DDE allow realtime data notification by using automatic links (also called hot links).

Service name, topic name, item name

Now let's look at what's necessary in creating an actual DDE client application.

A DDE server application identifies data or service requested by a DDE client by service name, topic name and item name. All of these are represented by a character string. Although Test Executive has only one service name, it has two types of topic names depending on the function classification previously described.

■ Notification of changes in status

The following names can be used with this function.

| | |
|--------------|--------|
| Service name | BPCRUN |
| Topic name | STATUS |
| Item name | UxCx |

Pay particular attention to the item name, UxCx, given here. In actual practice, the x parts of the item name are the associated unit number and channel number, respectively. For example, the item name for unit number 1 (the first PFX unit) and channel number 4 would actually be U1C4. Also, there is no upper/lower case distinction in these names.

■ Notification of status monitor value

The following names are used with this function.

| | |
|--------------|---------|
| Service name | BPCRUN |
| Topic name | MONITOR |
| Item name | UxCx |

For this function, the topic name changes to MONITOR. Everything else is the same as for notification of changes in status. The next section will finally give an example of an actual DDE conversation using Visual Basic. Please use Visual Basic version 2 or higher. All samples in this manual are written in Visual Basic 3.0.

Sample 1 Finding changes in status

To notify changes in status, use the STATUS topic described above. First, run Test Executive. It doesn't matter if there are no channel windows open, you can just iconize Test Executive. Iconization is recommended so that the Test Executive window doesn't interfere with Visual Basic windows. Now start Visual Basic.

Under the Visual Basic development environment, first place a label control and a text box control on the main form as shown in the figure below.

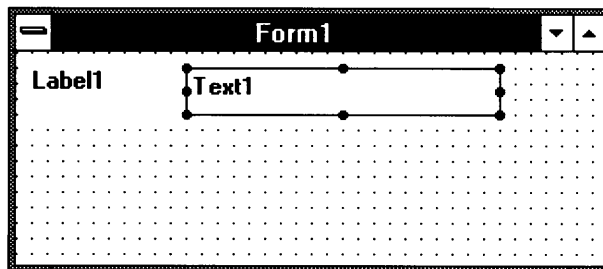


Figure A3-1 Placing Controls on the Main Form

Now, change the Caption property of the label control (Label1) to "Status."

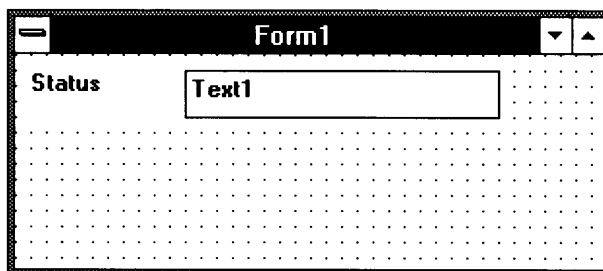


Figure A3-2 Changing the Label Control Caption

Finally, change the link-related properties of the text box control (Text1) as shown below. Be sure to set the LinkMode property last. (Operations are guaranteed to fail if you set LinkMode before properly setting LinkTopic and LinkItem.)

| | |
|-----------|---------------|
| LinkTopic | BPCRUN:STATUS |
| LinkItem | UIC1 |
| LinkMode | 1 - Automatic |

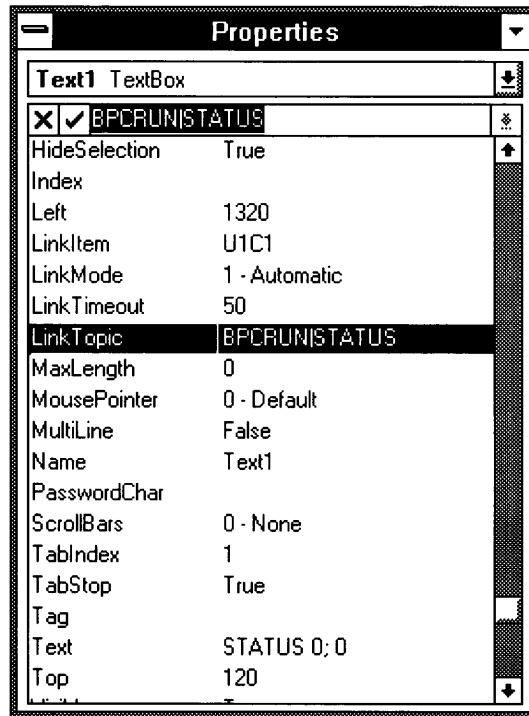


Figure A3-3 Setting Text Box Properties

Once these properties are set, the text box control display (actually the Text property) will change to "STATUS 0; 0" as sent from Test Executive. The first 0 represents the status, while the second 0, represent the current cycle number. Since no testing is being conducted on Channel 1 of Unit 1, both read 0.

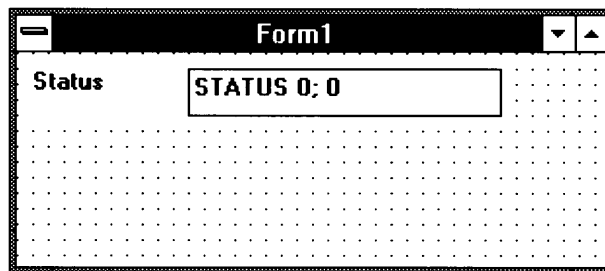


Figure A3-4 Data Sent from Text Executive

Now, call up the previously iconized Test Executive, and try running Channel 1 of Unit 1. After the first status is monitored, the display in the text box control will change again. This display is not updated every timer tick of Test Executive, but rather updated only when the status actually changes. In the example below, a notification is made because a channel which was in IDLE status changes to "Full Charge".

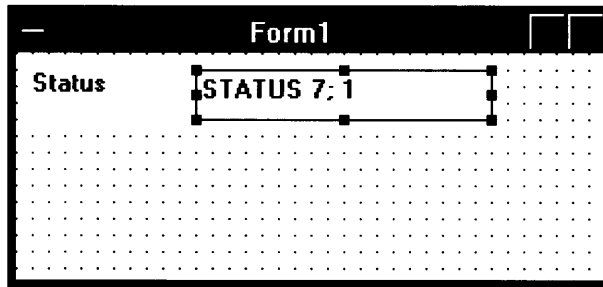


Figure A3-5 Data Sent from Test Executive (During Test Execution)

All notifications from Test Executive are in text format. Multiple data are notified in a formatted style. The meaning of this notification text string will be explained later.

Sample 2 Obtaining status monitor values

To notify each status value which is monitored, use the MONITOR topic described previously. Change the Caption property of the label control created in the previous example to "Monitor".

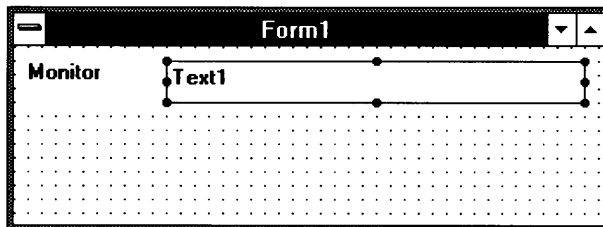


Figure A3-6 Changing the Label Control Caption

Finally, change the link-related properties of the text box control (Text1) as shown below.

| | |
|-----------|----------------|
| LinkTopic | BPCRUN!MONITOR |
| LinkItem | U1C1 |
| LinkMode | 1 - Automatic |

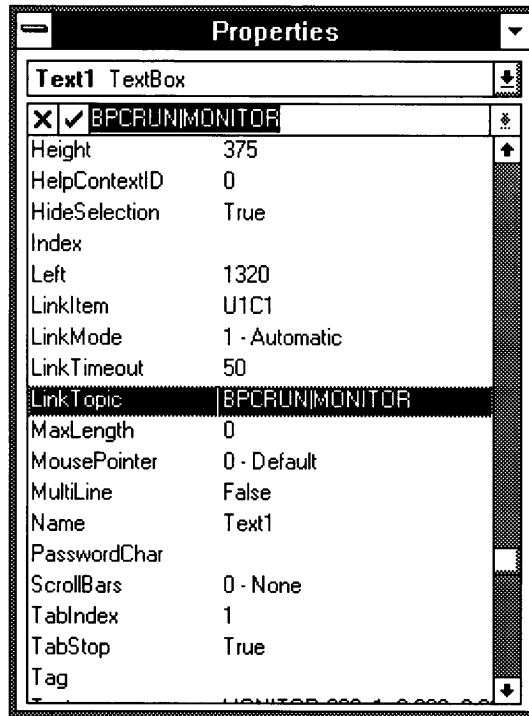


Figure A3-7 Setting Text Box Properties

Once these properties are set, the text box control display (actually the Text property) will change to the contents of the monitor. The first number represents the status, while the second number represents the current cycle number. The remaining values represent current, voltage and temperature, respectively.

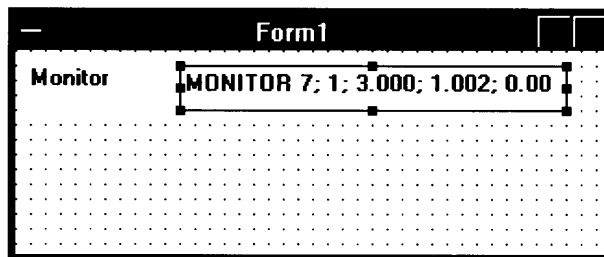


Figure A3-8 Data Sent from Text Executive

Unlike notification of change in status, this display is actually updated every timer tick of Test Executive. If the timer is set for 10 second intervals, this display will be updated every 10 seconds.

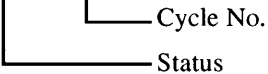
All notifications from Test Executive are in text format. Multiple data are notified in a formatted style. The meaning of this notification text string will be explained in the next section.

Format of notification data

Notification messages are sent as text strings whether you use notification of changes in status or notification of status monitor value. The format for each type of notification is explained here.

■String used for notification of changes in status

STATUS status; cycle



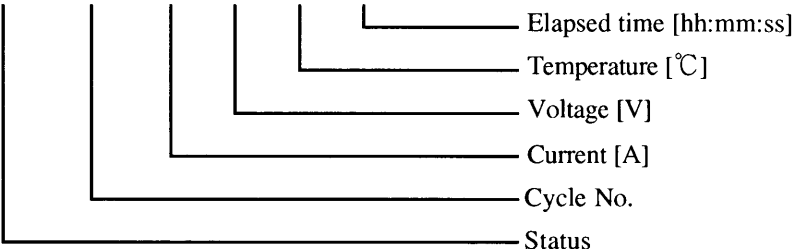
The cycle number returns 0 when IDLE and a value of 1 or greater while executing. Status is represented by a numeric value shown in the table below. Each numeric value is delimited by a semicolon.

Note that no value is defined for HOLD status. Test Executive does not recognize that status has changed when a transition from one status to HOLD occurs or when HOLD status is released. DDE conversation using the STATUS topic therefore cannot be used to detect HOLD status. If you need to make notifications of HOLD status you need to set up communications using the MONITOR topic.

| Meaning | Value |
|----------------------|-------|
| Idle | 0 |
| Initial charge | 1 |
| Cycle charge | 2 |
| Cycle charge rest | 3 |
| Cycle discharge | 4 |
| Cycle discharge rest | 5 |
| Pre-discharge | 6 |
| Full charge | 7 |
| Full charge rest | 8 |
| Full discharge | 9 |
| Full discharge rest | 10 |
| Post-charge | 11 |
| End | 13 |
| Recharge | 14 |
| Alarm | 20 |

■String used for notification of status monitor value

MONITOR status; cycle; curr; volt; temp; time



The cycle number returns 0 when IDLE and a value of 1 or greater while executing. Status is represented by a numeric value shown in the table below. The remaining values represent current, voltage and temperature, respectively. Each numeric value is delimited by a semicolon.

Note that the value associated with HOLD status is the value of the last status plus 256. For example, the status identification number of full charge is 7. If HOLD status occurs during full charge status the result is 263. Naturally, HOLD status does not occur during IDLE or END status.

| Meaning | Value |
|----------------------|-------|
| Idle | 0 |
| Initial charge | 1 |
| Cycle charge | 2 |
| Cycle charge rest | 3 |
| Cycle discharge | 4 |
| Cycle discharge rest | 5 |
| Pre-discharge | 6 |
| Full charge | 7 |
| Full charge rest | 8 |
| Full discharge | 9 |
| Full discharge rest | 10 |
| Post-charge | 11 |
| End | 13 |
| Recharge | 14 |
| Alarm | 20 |

| Meaning | Value |
|---------|-------|
| Hold | 256 |

A status value of 0 (IDLE) is notified when a test is RUN or QUIT.

Other communications functions

The Test Executive program includes several other data retrieval functions in addition to the various services using DDE functions. DDE-based services are used for realtime data notification using dynamic links. However, it is possible to retrieve data using simpler communication methods when that data does not change during test execution.

Test Executive can respond to external window messages. If you send the appropriate window message from Visual Basic, a simple kind of communication can be established. However, Windows API must be used in order to send a window message. Fortunately, Visual Basic is equipped with functions for accessing Windows APIs. Here, we will describe how to retrieve data using two API functions: SendMessage() and FindWindow(). Use the Declare statement of Visual Basic to call Windows API.

For details on these API functions, please refer to the Windows SDK and Visual Basic Professional Edition manual.

This simple communications method can be used to retrieve data such as that listed below.

- Retrieving the operation mode
- Retrieving the folder file name
- Retrieving the active worksheet number
- Retrieving the data directory name

"Retrieving the operation mode" means to find out whether the BP checker system is operating in life cycle mode or sequence mode. "Retrieving the folder file name" returns the file name (full path name) of the folder assigned to the specified channel. "Retrieving the active worksheet number" returns the number of the worksheet currently active. "Retrieving the data directory name" returns the name of the data directory for the specified channel.

■ Retrieving a window handle

Before sending a window message to the Test Executive program, you must first find out Test Executive's window handle. This is because the first parameter of the `SendMessage()` function is the window handle of the recipient window. So how do you find out the window handle? The answer is use the `FindWindow()` function. The `FindWindow()` function uses the window class name or caption character string (the character string appearing on the title bar) of a window and searches all windows in the Windows system (excluding MDI child windows) until it finds one that matches the given condition. To find the window handle of Test Executive use the window class name "BpcRunFrame".

■ Sending messages

Once you have determined the window handle of the recipient window, all you have to do is send a message using the `SendMessage()` function. Message parameters `WParam` and `LParam` are especially important.

You must specify a combination value of desired unit number and channel number on the `WParam`. Specify the unit number in the lower byte of `WParam`, and the channel number in the upper byte. Note that these numbers are counted from 0. For example, if specifying channel 1 of the first unit, both the unit number and channel number should be specified as 0.

The meaning of `LParam` differs depending on the message. The meaning of the return value of `SendMessage()` also depends on the message.

The following listing is part of a program used to retrieve the data described so far. This data is retrieved using the SendMessage() function.

```

' Message constant definitions
Const WM_USER = &H400
Const FW_CHECKSEQMODE = WM_USER + 500
Const FW_GETFOLDERNAME = WM_USER + 501
Const FW_GETACTIVIEWS = WM_USER + 502
Const FW_GETDATADIR = WM_USER + 503
Const FW_GETTICKRATE = WM_USER + 504

' Declaration for calling Windows APIs
Declare Function SendMessage% Lib "user" (ByVal hWnd%, ByVal Msg%,
    ByVal wParam%, ByVal lParam As Any)
Declare Function FindWindow% Lib "user" (ByVal lpszClassName As
    Any, ByVal lpszCaption As Any)

' Retrieve BPC/RUN window handle
hWndBpc% = FindWindow("BpcRunFrame", 0&)
If hWndBpc% <> 0 Then 'If handle is obtained (if other than 0)...
    ' Form unit number and channel number
    wParam% = (nUnitNo% - 1) + ((nChanNo% - 1) * 256)
    ' Check operation mode
    bSeq% = SendMessage(hWndBpc%, FW_CHECKSEQMODE, 0, 0&)
    ' Retrieve folder name
    sFolder$ = Space$(128)
    r% = SendMessage(hWndBpc%, FW_GETFOLDERNAME, wParam%, sFolder$)
    ' Retrieve active worksheet number
    nActiveWks% = SendMessage(hWndBpc%, FW_GETACTIVIEWS, wParam%,
        0&)
    ' Retrieve data directory
    sDataDir$ = Space$(128)
    r% = SendMessage(hWndBpc%, FW_GETDATADIR, wParam%, sDataDir$)
    ' Retrieve timer tick speed
    Tick% = SendMessage(hWndBpc%, FW_GETTICKRATE, 0, 0&)

End If

```

■ Retrieving the operation mode

This message finds out whether the BP checker system is operating in life cycle mode or sequence mode.

| | |
|--------------|--|
| Message Name | FW_CHECKSEQMODE (&H400 + 500) |
| WParam | None (always 0) |
| LParam | None (always 0) |
| Return value | 1 = sequence mode; 0 = life cycle mode |

■ Retrieving the folder file name

This message returns the file name (full path name) of the folder assigned to the specified channel.

| | |
|--------------|---|
| Message Name | FW_GETFOLDERNAME (&H400 + 501) |
| WParam | Lower byte = unit number-1 Upper byte = channel number-1 |
| LParam | Pointer to string buffer |
| Return value | None |

■ Retrieving the active worksheet number

This message returns the number of the active worksheet in the folder assigned to the specified channel.

| | |
|--------------|--|
| Message Name | FW_GETACTIVEWKS (&H400 + 502) |
| WParam | Lower byte = unit number-1 Upper byte = channel number-1 |
| LParam | None (always 0) |
| Return value | Represents worksheet number if 1 or greater No worksheet found if 0 |

■ Retrieving the data directory name

This message returns the name of the data directory for the specified channel.

| | |
|--------------|---|
| Message Name | FW_GETDATADIR (&H400 + 503) |
| WParam | Lower byte = unit number-1 Upper byte = channel number-1 |
| LParam | Pointer to string buffer |
| Return value | None |

■ Retrieving the timer tick speed

This message returns the timer tick speed set within Test Executive.

| | |
|--------------|---------------------------------------|
| Message Name | FW_GETTICKRATE (&H400 + 504) |
| WParam | None (always 0) |
| LParam | None (always 0) |
| Return value | Timer tick speed (unit: milliseconds) |

APPENDIX 4 APPLICATION SPECIFICATIONS

Hardware Requirements (Minimum Requirements)

| | |
|------------------|---|
| Computer | IBM-PC/AT compatible 80386 CPU or better 4MB RAM or better VGA or better display adaptor and color monitor 3.5-inch diskette drive (1.44MB) Hard disk Microsoft mouse or compatible pointing device |
| Operating system | Microsoft Windows 3.1/3.11, Windows for Workgroups 3.11 or Windows 95 |
| Printer | Printer supported by Microsoft Windows |
| GPIB board | National Instruments NI-488.2-compatible GPIB |

PFX Config

| | |
|-------------------------------|---|
| Setup functions | System configuration Specifies number of PFX40W-08 units (up to 6) Switches operation mode (sequence/life cycle) Unit configuration Sets testing environment Sets cycle format Sets synchronous testing |
| GPIB communications functions | Sends the above setup data |

Folder Editor

| | |
|-------------------------------|--|
| Setup functions | Edits battery information and worksheets |
| Specifiable testing modes | Cycle charge (shallow charge) CC/CCCV/CC-Pattern/CCCV-Pattern Cycle discharge (shallow discharge) CC/CP/CC-Pattern/CP-Pattern Full charge (deep charge) CC/CCCV Full discharge (deep discharge) CC/CP Initial charge CC |
| Maximum number of worksheets | 99 |
| GPIB communications functions | None |

Test Executive

| | |
|-------------------------------|--|
| Testing functions | Retrieves characteristics data (voltage, current, temperature, life characteristics. However, only for full charge, full |
| Maximum number of channels | 48 (8 channels x 6 units) |
| GPIB communications functions | Transfers worksheets Monitors test progress status Retrieves graph data |

BPC Graph

| | |
|-------------------------------|--|
| Display functions | Table format display of characteristics data Graph display of characteristics data Graph overlay (up to three layers) Test reports (text format) Test conditions (text format) |
| Printing functions | Graphs and overlay graphs (color-compatible) Test reports (text format) Test conditions (text format) |
| Data pasting functions | Pasting of table format contents to spreadsheet software via the clipboard Pasting of text format data to word processing software via the clipboard |
| GPIB communications functions | None |

BPC Spy

| | |
|-------------------------------|--|
| Monitoring functions | Test progress status and monitor values |
| Monitoring conditions | Synchronized with Test Executive Any one of: By amount of change in monitor value By percent of change in monitor value |
| Display functions | Displays monitor data in table format |
| Data pasting functions | Pasting of data to spreadsheet software via the clipboard |
| GPIB communications functions | None |

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worksheets 1-2, 4-2
 Creating ~ 4-6
 file name of ~ 4-18
 Saving ~ 4-17