P F X 2 5 0 0 S E R I E S

Charge/Discharge System Controller

PFX2500 Series

Maximum voltage: 60.0000 V/Maximum current: 50.0000 A
Capable of seamless charging/discharging (high speed charging/discharging transfer control)(2512)
Capable of high-precision measurement of cumulative capacities and amount of power as well as voltage and current
Pattern charging/discharging capabilities by 1000 steps are installed
Supporting temperature measurement and capable of monitoring temperatures during charging/discharging
High speed sampling with maximum 1 ms can be realized (2512)
A 6 V range is newly installed and is capable of high-precision measurement (2512)
Fully equipped with safety features of the overcharge protection using voltage, electric charge and temperature
Battery deterioration is prevented by turning off the output after detecting wobbling and shock with vibration sensor
LAN as standard equipment (2512)

KIKUSUI

Energy Storage Essential to New Energy Application. Fully support Charge and Discharge Measurement from Basic Test to Simulation Test

The test system enables you to carry out easily for the battery simulation of the actual environment. Comprehensive Management from Test Condition Setting, Execution and Test Result Analysis can be conducted by the Exclusive Application Software

PFX2500 Series is a high performance Charge/Discharge system controller that takes measurements in combination with our DC power supply and electronic load in order to evaluate test sample (electric storage elements such as secondary batteries) characteristics. It is also capable to perform evaluation test with high-performance, large capacity and wide range of rating with the combination of DC power supply and electronic load.
Execution of the test is conducted by the exclusive application software. The test corresponds to long time continuous test and synchronization test with temperature chambers with the multiplexed protection performance. In addition, easy data editing is also capable with fulfilling graphic performance.

■Application software
BPCheccker3000 [SD007-PFX]

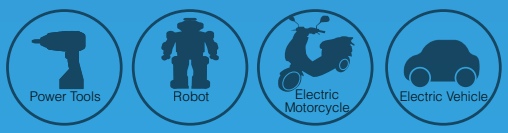
▲Configuration(example) *PC is provided by users.
Multi Range DC Power Supply PWR800L(upper left), DC Electronic load PLZ100W(lower)

Charge/Discharge System Controller PFX2512

Charge/Discharge System Controller

PFX2500 Series

Examples of Applicataions

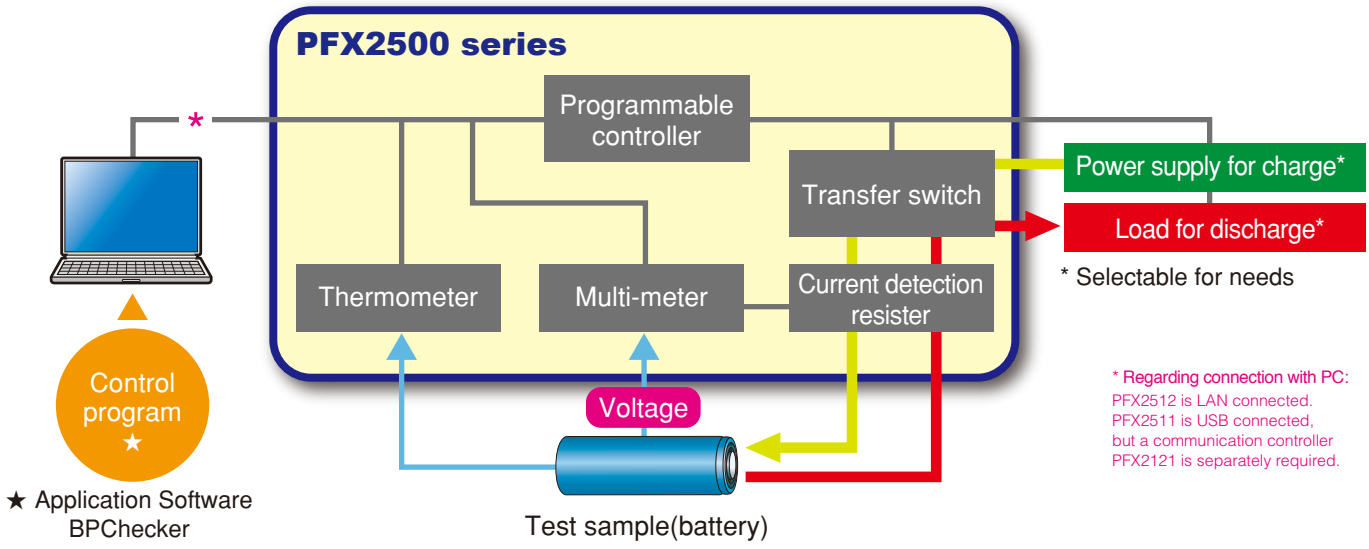


Item	PFX2512	PFX2511
Rating	60 V / 50 A	60 V / 50 A
Application software	BPChecker3000	BPChecker2000 (free version attached, 2-CH without limitation of function from qualifiedversion)
Communication interface	LAN	TP-BUS (PFX2121 is required for PC connection)
Monitoring data minimum time interval	0.1 s	1 s (up to 30 channels), 2 s (more than 30 channels)
High speed data sampling	◯ (Selected form 1 ms/10 ms/100 ms maximum 6000 points for every profile)	×
Charge/discharge mode	9 modes Charging: CC, CC-CV Discharging: CC, CP,CC-CV, CP-CV Others: Pattern, I-V, Pause	6 modes Charging: CC, CC-CV Discharging: CC, CP, CC-Pulse, CP-Pulse
Test condition configuration	Individual Profile Setting (unlimited) for Charging/Discharging, etc Conditional branching function from charge/discharge results is available.	Maximum 20 patterns are divided into individual loop setting and total repeat setting with charging and discharging as a pair.
Seamless charge/ discharge	◯ (Less than 50 ms for transfer time)	× (Approx. 2 seconds for charge/discharge transfer time: Depending on the number of channels)
Termination condition	Temperature condition	Fixed time

Complicated Systems Integrated into One

PFX2500 Series has integrated systems into one unit where battery evaluation is required. In addition, the series has high degrees of flexibility corresponding to wide range of rating since it is possible to combine our conventional DC power supply (for charging) and our electronic load (for discharging) tailored to needs. Introduction cost is able to be reduced by selecting equipment which meets charge/discharge test condition required.

● System Conceptual Diagram



Easy Configuration

It is possible to configure the system by yourself. All the parts required for connection can be purchased from us. The DC power supply and electronic load that are applied configuration with PFX2500 series, can be used for the system. This allows you to have a test system at low cost. * For details, please refer to system configuration on page 5 and the list of applied configuration and options on page 12.

Up to 1000 Steps for Pattern Charge/Discharge *

It is capable to set the CC/CP (with V, I limit) step values up to 1000. Complicated charge/discharge test with minimum 100 ms step of time window since high speed charge/discharge transfer control becomes functional. This widely corresponds to the generation of test patterns or simulation patterns for various specification tests. * PFX2512 only

Control of the Constant Current (CC) and Constant Voltage (CV)

The digital CC and CV control method is adopted to minimize the difference between the setting accuracy and the drift characteristic of constant current (CC) /constant voltage (CV) genera and the electronic load, and it can apply for the precise evaluation. Any of the adjustment are not required after the system configuration.

CC/CP Pulse Discharge Function

It allows discharge test that simulates a change of dynamic load current in cellular phones, digital cameras, laptop computers, etc. Capacity calculation is performed with the actual measurements from the pulse current, and the maximum and minimum voltages in the cycle are also measured. * PFX2511 only

Precise Measurement

The high-precision measurement circuit is equipped. It detects the battery voltage and the charge and discharge current in high accuracy. (Measurement resolutions: 100 µV and 100 µA, Elapsed time measurement: within 10 ppm)
Measurement on actual power amount and accumulated capacity is also capable even for the pulse current difficult to be captured.

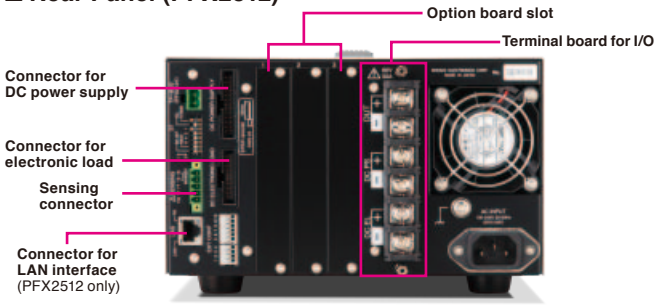
Capable of Expanding Measurement Function

Measurement points, 4 points for voltage and 4 points for temperature, are able to be added by installing optional voltage/temperature Unit, OP01-PFX/OP02-PFX. Since there are 3 slots for optional board, measurement point addition is capable up to 12 points for voltage and 12 points for temperature as maximum.

Protection Functions for Safety Operation

Equipped with protection functions provided by hardware and software against phenomena such as overcharge and overdischarge. The route switch (load switch) is built in the PFX2500 series and it equips with a function to ensure connection between the DUT (batteries) and the DC power supply/electronic load as well as a high-speed interruption function that promptly disconnects the DC power supply/electronic load in case any abnormal state is detected. In addition, the vibration sensor detects major vibration and shock in case of a disaster or accident during charge and discharge test, then shuts off the output, and it prevents a damage to the connected equipment and the DUT (batteries).

■ **Rear Panel (PFX2512)**

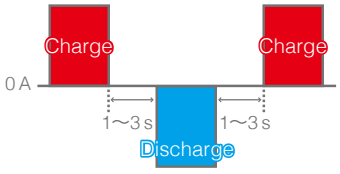


Corresponding to Specification Test Pattern by Realizing Seamless Charge/Discharge *

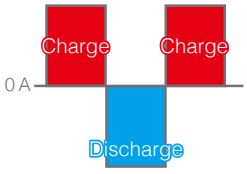
A certain time was required for transferring power supply and electronic load in the past. Seamless charge/discharge transfer has been realized at PFX2512 by the simultaneous control of power supply and electronic load. For this reason, correspondence to characteristic test of recapturing complex applications such as application where charge/discharge repeating without taking breath is performed for electric motorcycle and electric assisted bicycle as well as electric vehicle and hybrid vehicle, and application for UPS for peak shift and to specification test pattern where continuous charge/discharge is performed such as IEC62660 became possible.

* PFX2512 only

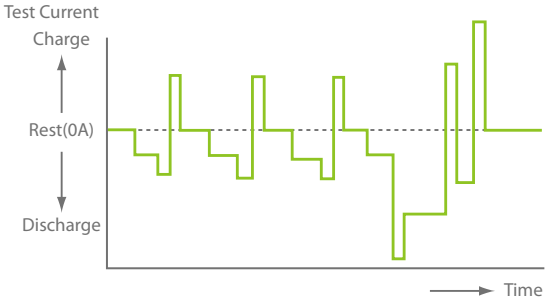
● Switching charge/discharge (conventional model)



● Seamless charge/discharge



● EV/HEV cycle test pattern (example)

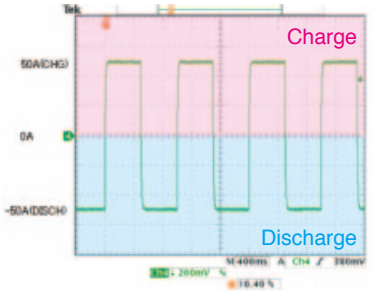


[Pattern Charge/Discharge]

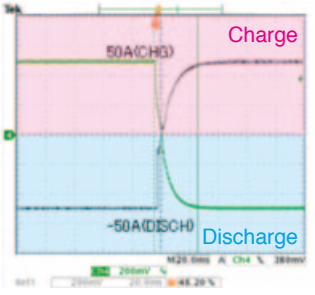
Setting condition

2 values CC pattern charge/discharge	
Step 1	CHG: 50 A 500 ms
Step 2	DISCH: -50 A 500 ms

● Pattern current waveform (example)



● The rising/falling wave forms of the pattern current (example)



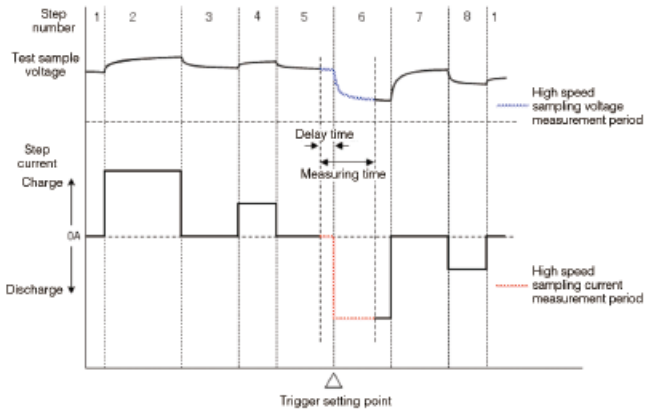
Realized Maximum 1 ms High Speed Data Sampling *

Minimum 1 ms (maximum 6000 points for every profile) voltage/current measurements are capable by assigned voltage and current steps as trigger. This is most suited to impedance analysis of test and evaluation of life determination since high-precision voltage waveform synchronized to step current can be acquired. * PFX2512 only

▶Sampling rate: selected from 1 ms/10 ms/100 ms
▶Cell voltage meter: fixed at 100 ms of sampling rate (at OP02-PFX installed)
▶4 types of measurement start triggering (just after charge-discharge start/just before charge-discharge completion)
▶Measurement data memory capacity (128 Mbits):
6000 sampling storage: 6 s @1 ms/60 s @10 ms/ 600 s @100 ms

● Pattern profile

Trigger point setting example (case of negative sign delay time)



More Accurate Single Cell Evaluation with 6V Range *

PFX2512 equips Voltage Range transfer capability between 6 V and 60 V. A 6 V range was newly installed in PFX2512 in order to perform evaluation more accurately even for a single cell. 6 V range accuracy = ± (0.05 % of rdng + 0.04 % of f.s), 60 V range accuracy = ± (0.05 % of rdng + 0.02 % of f.s). In addition to the stacked cell assembly, more accurate characteristic test is capable with single cell.

* 6 V range is only for PFX2512

Charge/Discharge Function and Others

Charging mode.....Constant current and Constant voltage (CC-CV), Constant current (CC)
Discharge mode.....Constant current (CC), Constant current and Constant voltage (CC-CV)*1, Constant power (CP)
Others.....Pattern*1, I-V*1, Pulse*2
Power I/O terminals, Load switch equipped (route transfer circuit)

*1: PFX2512 only *2: PFX2511 only

Applied to CAN interface

PFX2512 (BPChecker3000) is able to communicate with exclusive application where communication log, analysis, emulation functions, etc, are added. Herewith, it becomes possible corresponding to various demands such as synchronization between charge/discharge control and log segment, charge/discharge control from exclusive application. For details, please refer to page 6 and 7.

Descriptions of Charge/Discharge Test

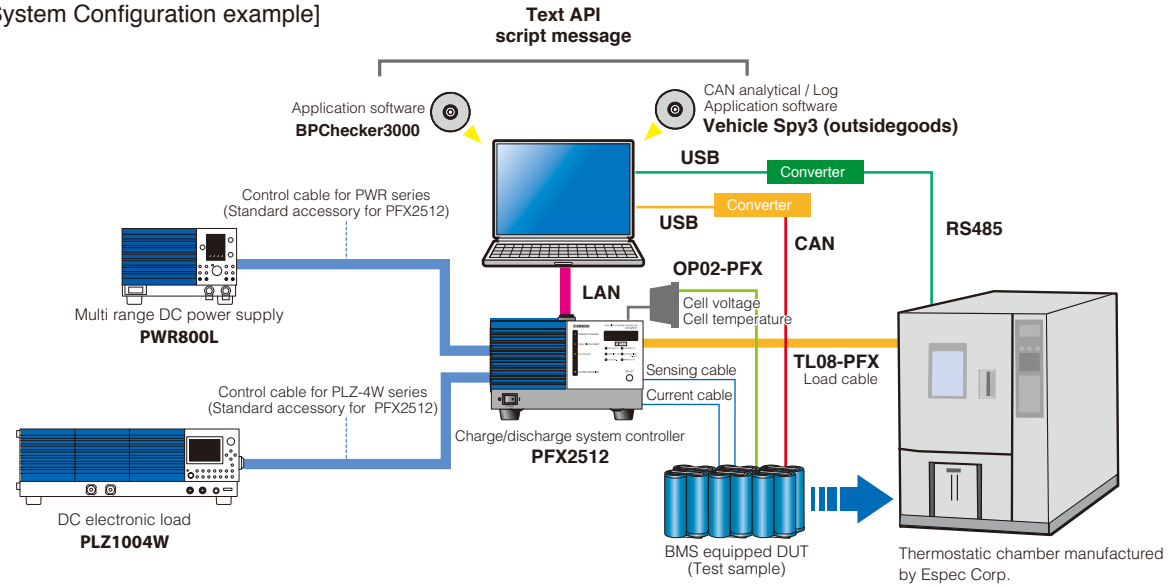
With the PFX2500 series, various electrical characteristic tests are able to be performed regardless battery manufacturer or customers.

* PFX2512 only

- I-V Characteristics Test *
- Cycle Characteristics Test
- Charge/Discharge Rate Test
- Temperature Characteristics Test
- Charge/Discharge Efficiency Test
- Capacitance Measurement Test
- Storage Characteristics Test
- Capacitance Change Test
- Actual Load Simulation Test *
- BMS Validation Test *

System Configuration

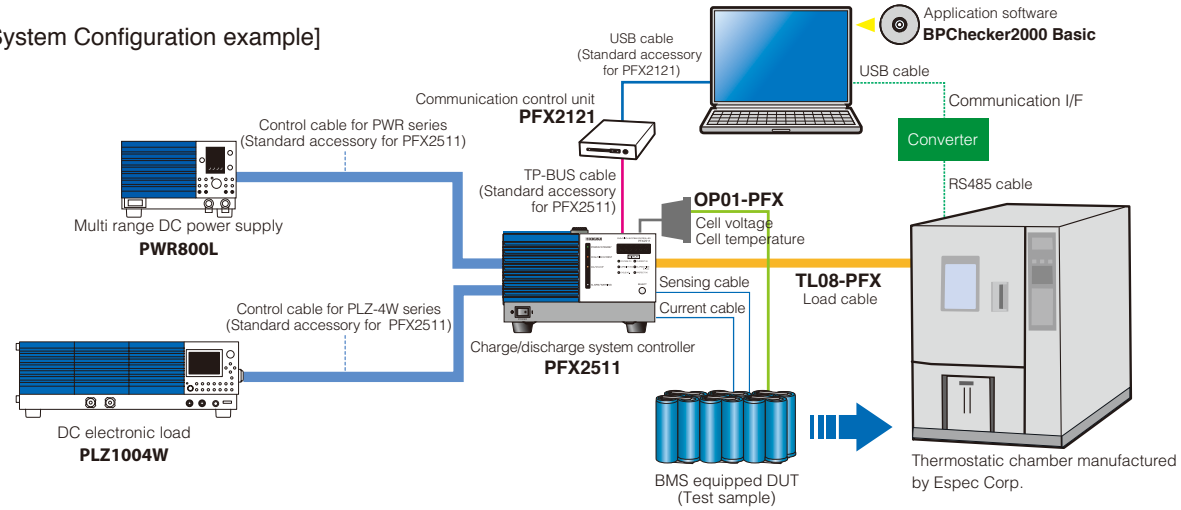
[2512 System Configuration example]



- Multi range DC power supply.....PWR800L
- DC electronic load.....PLZ1004W
- Charge/discharge system controller.....PFX2512
- Application software.....BPChecker3000
- Voltage/thermometer unit.....OP02-PFX
- Lead wire for voltage/thermometer unit....TL09-PFX
- Load cable(50 A, 5 m).....TL08-PFX

- Personal computer.....Windows XP or later. Display resolution: 1280 × 1024 or more Equipped with 10 Base T(or higher model) LAN interface
- Thermostatic chamber.....PFX2512 supports synchronized operation with temperature chambers. To perform synchronized operation, temperature chambers equipped with a communication function, manufactured by ESPEC and the associated components are required. For details, please consult with us.

[2511 System Configuration example]

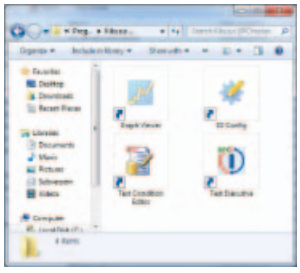


- Multi range DC power supply.....PWR800L
- DC electronic load.....PLZ1004W
- Charge/discharge system controller.....PFX2511
- Communication control unit.....PFX2121
- Application software.....BPChecker2000Basic.(Standard accessory)
- Voltage/thermometer unit.....OP01-PFX
- Lead wire for voltage/thermometer unit....TL09-PFX

- Load cable(50 A, 5 m).....TL08-PFX
- Personal computer.....Windows XP or later. Display resolution: 1024 × 768 or more
- Thermostatic chamber.....PFX2511 supports synchronized operation with temperature chambers. To perform synchronized operation, temperature chambers equipped with a communication function, manufactured by ESPEC and the associated components are required. For details, please consult with us.

PFX2512 Exclusive Application Software, BPChecker3000

Comprehensive management from test condition setting to execution and data analysis on test results by PFX2512 exclusive application software, BPChecker3000



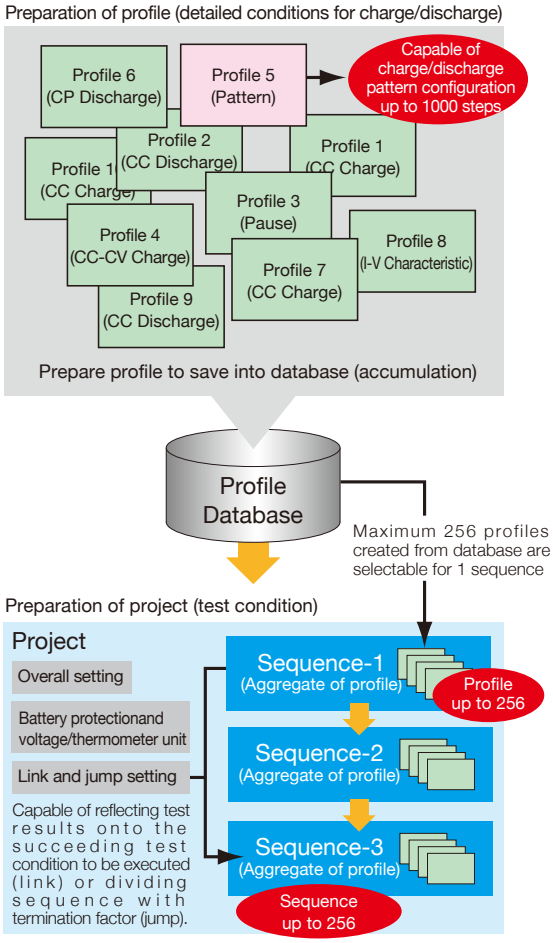
▲ Program structure
This software consists of four programs.

The application software, BPChecker3000 (SD007-PFX), equips with the new features of PFX2512 where test condition and graphical drawing function are emphasized on existing BPChecker2000, and it realizes [Seamless Charge/Discharge] and [High Speed Data Sampling]. At the test condition setting, the test condition (project) is created from database compiled charge/discharge condition (profile).
The test execution shows that graphical display function is emphasized in its extraction and overwriting functions for larger data integration. In addition, synchronized operation with a temperature chambers is capable and the charge/discharge test is comprehensively controlled including temperature control under test environment. Further more, it can be applied to the operation with [CAN Bus] for which demand will be increased accompanied by the technical development of battery management in future.

● Program Structure

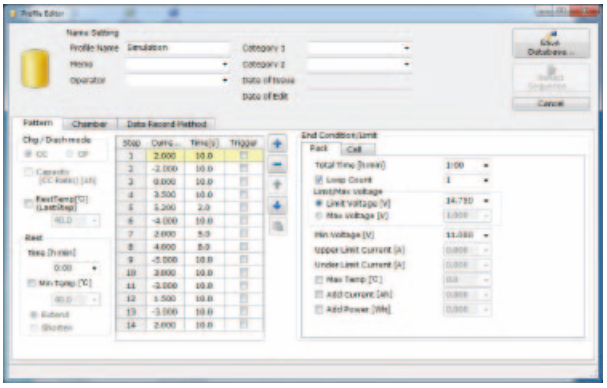
Test Condition Editor

This program is used to create and edit all of test conditions related to charge/discharge testing. After profile creation, sequence and total settings, etc, are performed to create a project. BPChecker3000 executes the test by the project.

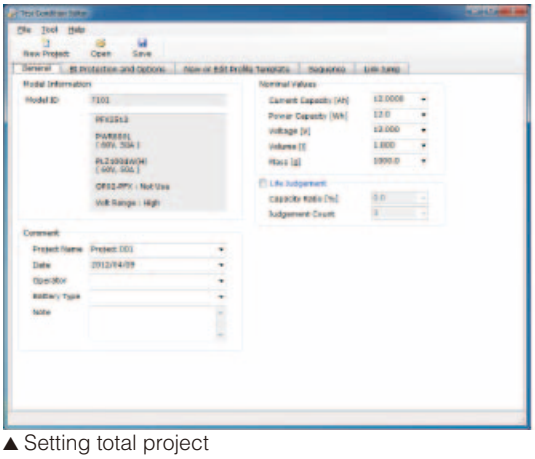


● Capable of setting battery temperature termination conditions (rest temp)
For stop time setting, it is capable to set termination conditions by battery temperature in addition to time setting (fixed time) determined after charge.

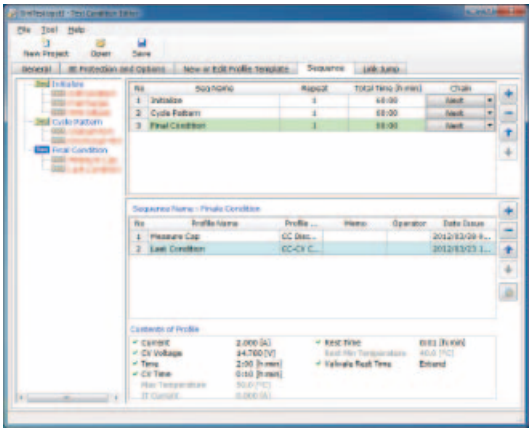
● Pause function installed
There is the pause function among profile types. Test is able to be paused by using this function.



▲ Preparation of profile



▲ Setting total project

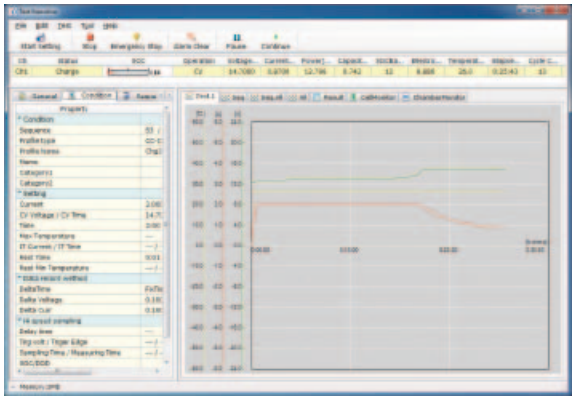


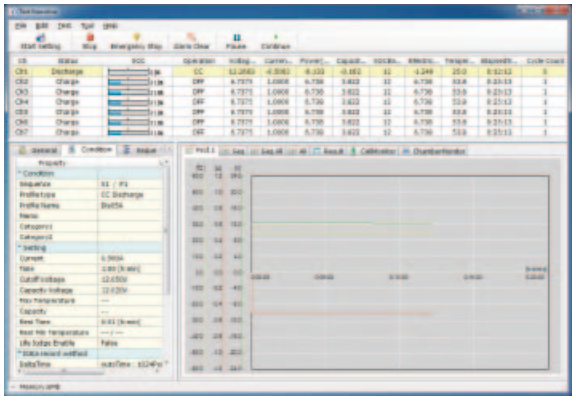
▲ Sequence setting

[Caution] BPChecker3000 is essential for PFX2512 performance.
PFX2512 does not work with BPChecker2000.

Test Executive

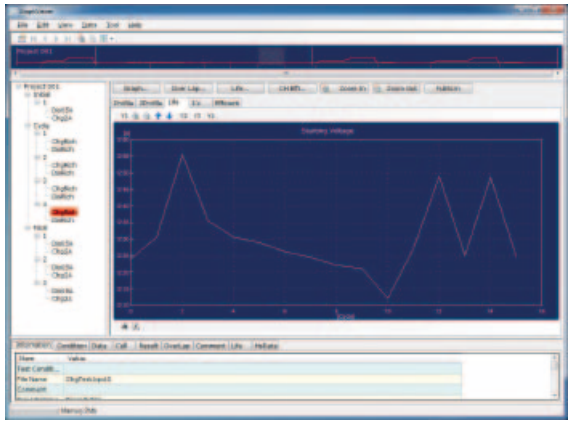
This program executes charge/discharge tests according to the test condition file created using the Test Condition Editor.

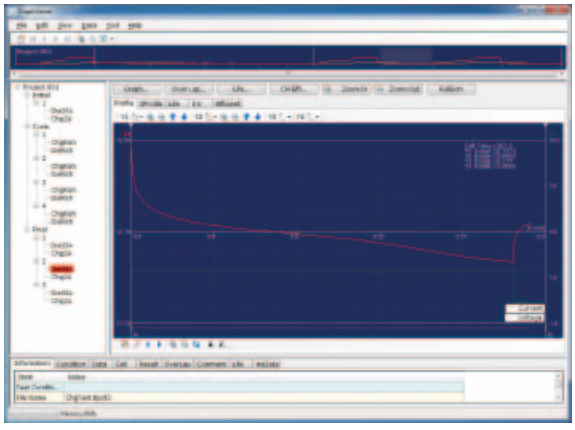


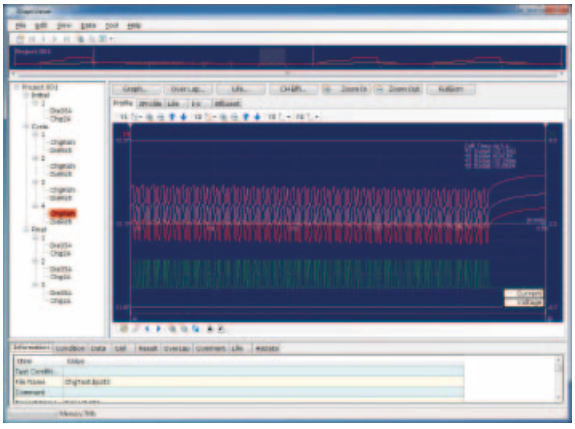


Graph Viewer

This program is used to display the graph of test data on the screen and print the graph. When the Graph Viewer is used, overall analysis is capable to display the calculated value acquired from the test data, and from test data for energy, etc, test conditions in addition to test data graph. The Graph Viewer also able to display overlapped graphs where multiple numbers of graphs are on the screen into one.





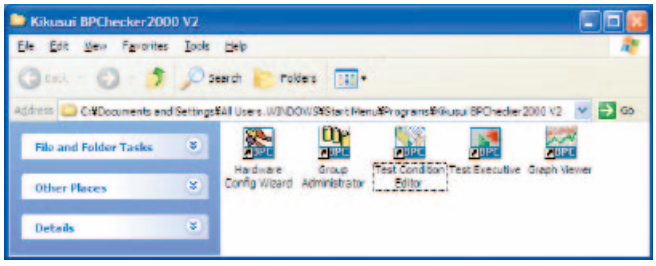


[Recommended operating environment]

- OS: Windows XP (SP3 or later) , Windows Vista , Windows 7, Windows8
- Memory: 2 GB or more
- HD drive: 100 MB or more of free hard disk space (the amount of additional space that is needed depends on the type of data you need to save)
- CD-ROM drive: Required for installing the applications
- Mouse or other pointing device
- Display resolution: 1280 × 1024 (17 inch) or more
- Equipped with 10 Base T (or higher model) LAN interface
- Printer: Compatible with windows
- The thermostatic chambers that can be controlled via Espec Corp.'s protocol converter/USB-RS485 converter
- VISA library: NI-VISA 3.3 or later, Agilent I/O Libraries Suite 15.0 or later, or KI-VISA 3.1.3 or later

PFX2511 Exclusive Application Software, BPChecker2000 Basic

Comprehensive management from test condition setting to execution and data analysis on test results by PFX2511 exclusive application software, BPChecker2000 Basic



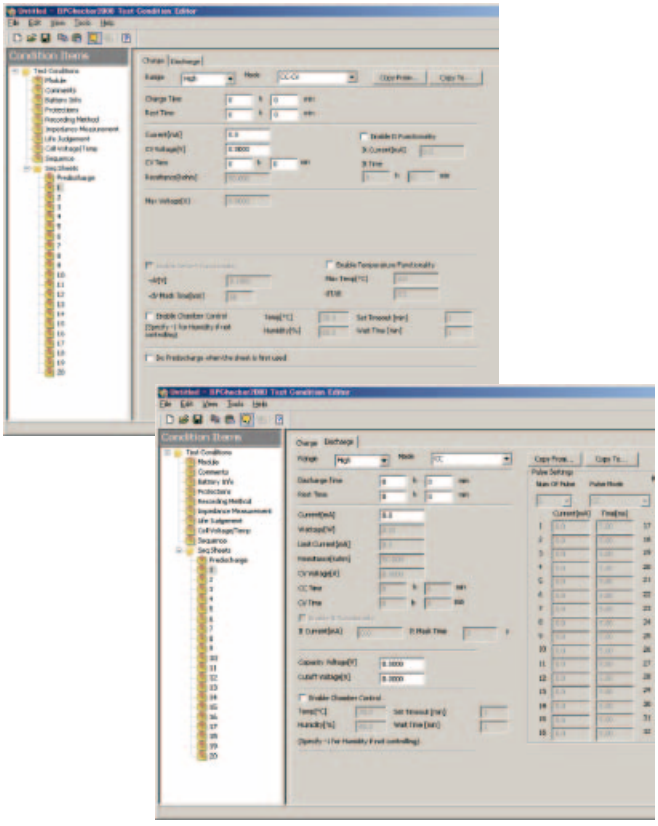
The application software, BPChecker2000, can manage all processes from creating the test condition file to output of the test result file. Setting and execution of conditions for battery charge and discharge characteristics test and an analysis of test results can be performed on the PC. In addition, if the PC is equipped with GPIB communication environment, it can externally control the temperature chambers manufactured by ESPEC, and it allows to synchronize with the temperatures in the chamber.

* The control of BPChecker2000 Basic supplied with PFX2511 is limited to 2 channels. BPChecker2000 Full Edition with no function limit is sold separately.

● Program Structure

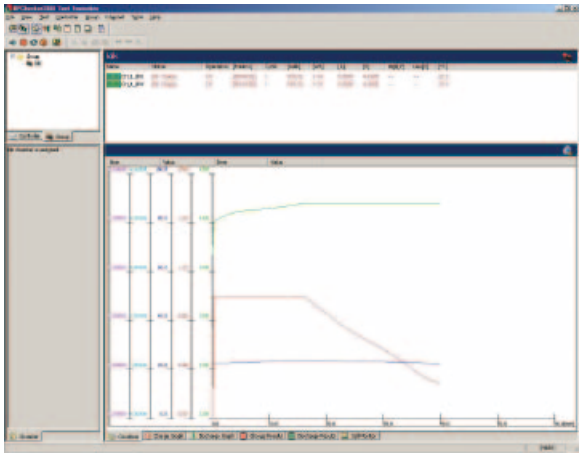
Test Condition Editor

This program is used to create and edit all test conditions related to charge/discharge testing. A total of 20 sheets of test condition data can be created, with each sheet specifying both charge and discharge conditions. It is also possible to set the number of times (repeats) that an individual sheet is to be repeated to form a particular charge/discharge cycle, as well as the repeated number of (loops) the entire sheets can be set.



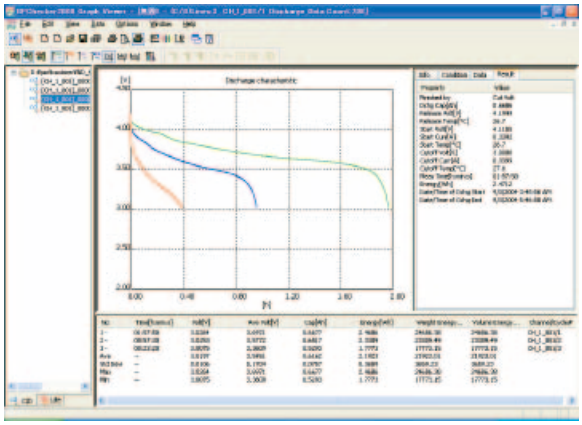
Test Executive

This program executes charge/discharge tests according to the test condition file created using the Test Condition Editor. It starts and stops the test and monitors the test execution. The program provides a real-time graphic representation of the per-channel charge/discharge trends.



Graph Viewer

This program is used to display the graph of test data on the screen and print the graph. It offers a graphic representation of the charge/discharge data of each cycle. You can display up to 99 sets of data to superimpose the graph of each other and perform statistical processing.



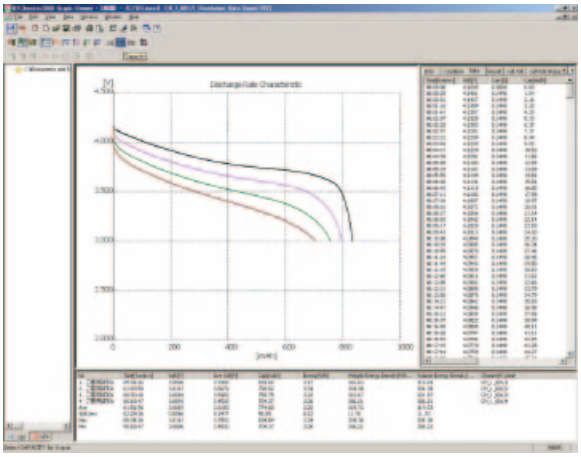
[Recommended operating environment]

- CPU: Pentium IV 1 GHz or faster
- OS: Windows XP (SP2 or later, x86) , Vista (x86, x64), 7(x86, x64)
- Memory: 512 MB or more
- HD drive: 50 MB of free space or more required for installation: 10 GB of free space or more recommended for data
- CD-ROM drive: Required for installing the applications
- Mouse: Required
- Display resolution: 1024 × 768 or more
- Printer: Compatible with windows
- No. of USB ports: More free USB ports than the number of control units to be used
- The thermostatic chambers that can be controlled via Espec Corp.'s protocol converter/USB-RS485 converter.
- VISA library: NI-VISA 3.3 or later, Agilent I/O Libraries Suite 15.0 or later , or KI-VISA 3.1.3 or later

Test sample data taken by the application software BPChecker2000

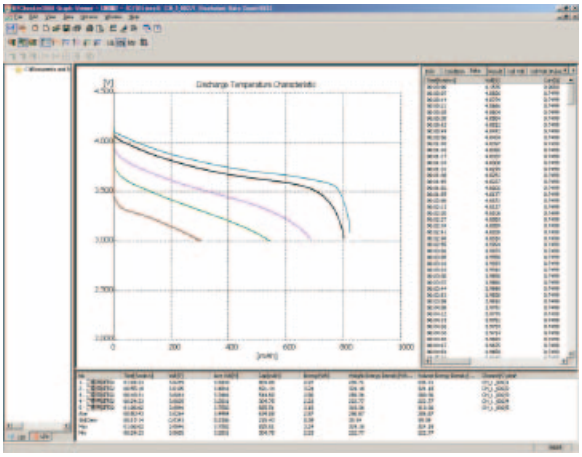
Discharge Rate Characteristics Test

Test to observe characteristics with varying load conditions under constant charge condition and discharge temperature.



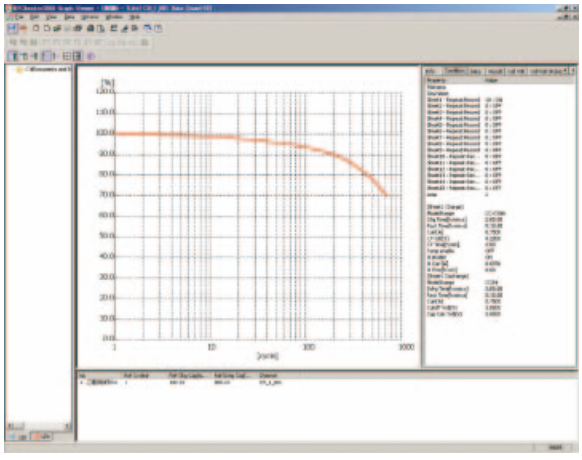
Discharge Temperature Characteristics Test

Test to observe characteristics with varying discharge temperatures under constant charge condition and discharge current.



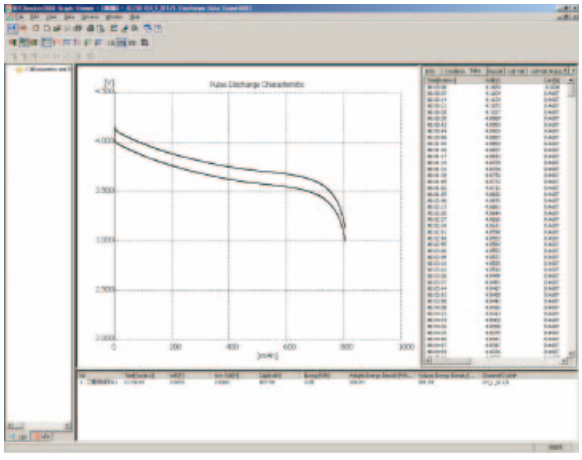
Cycle Life Test

Test to observe capacity deterioration in repeated cycles under constant charge and discharge conditions.



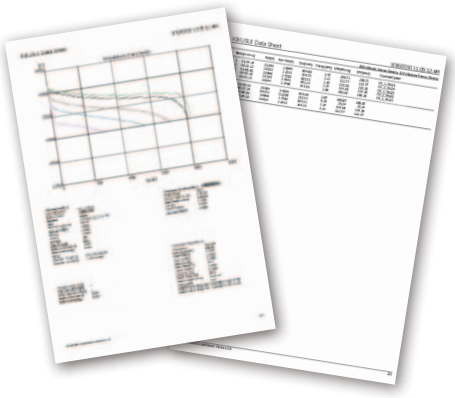
Pulse Discharge Test

Discharge characteristics similar to the actual load environment can be obtained using the pulse discharge mode.



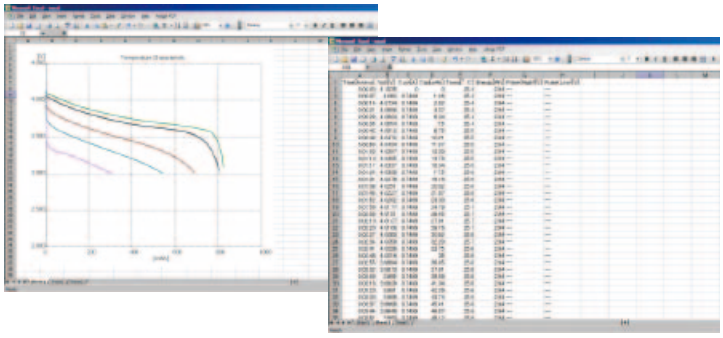
Report Output

Plotted images can be printed out by Graph Viewer.



Copy & Paste to Excel and PowerPoint

The plotted graphs and numerical data can be pasted to other application software such as Excel and PowerPoint.



Example of Excel display

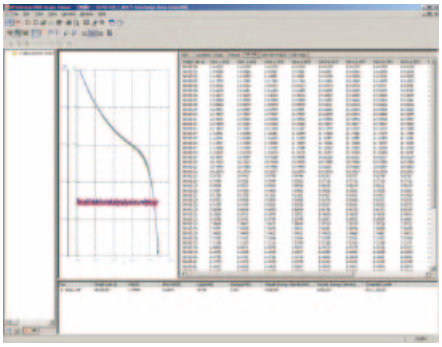
Optional

Voltage/thermometer unit (optional)

When monitoring the status of each cell of the battery pack is required, install the optional voltage/thermometer unit OP01-PFX/OP02-PFX. By installing OP01-PFX on PFX2511 and by installing OP02-PFX on PFX2512, voltages/temperatures for four cells are able to be monitored /logged with one sheet, respectively. (Up to 3 boards can be installed.)

Voltage/thermometer unit
[OP01-PFX]
[OP02-PFX]
Lead wire for voltage/
thermometer unit
[TL09-PFX]

For a battery pack connected in series,monitoring of balance among cells is important. With OP01-PFX, the charge and discharge control can be stopped according to the status of each cell.In addition, it is equipped with a function to stop charge and discharge when the balance beteen the cells in the battery pack becomes large (maximum voltage - minimum voltage). Furthermore, at the time of pulse discharge, voltage can be measured at the same time as the synchronization of all cells for load fluctuations.



■ Expanded features

Monitor data: Cell voltage, cell temperature, cell high voltage* and cell low voltage*1
Charge stop conditions: Cell voltage, cell temperature and potential difference among cells
Discharge stop conditions: Cell voltage and potential difference among cells, cell temperature
Charge/discharge conditions*2: Cell voltage, cell temperature, Cell unbalance
Protective functions: Cell voltage, cell temperature and potential difference among cells

*1: Pulse discharge only. OP01-PFX only *2: OP02-PFX only

■ Restricted functions

The maximum number of channels that 1 unit of personal computer can control is 5 ch.

■ **Voltage/thermometer unit OP01-PFX/OP02-PFX**

		OP01-PFX	OP02-PFX
Cell measurement function			
Static/Pattern (OP02-PFX only)			
Cell voltage		Average voltage of the every 500 ms	Average voltage of the every 100 ms
Cell temperature		Temperature measurement function to make thermocouple as temperature detecting element, updated every second	
Pulse			
Cell voltage		Maximum voltage and minimum voltage in a cycle	–
		Arbitrarily set voltage measuring point	
Cell temperature		Temperature Measurement Function to make thermocouple as temperature detecting element, updated every second	–
Cell voltage measurement			
Static/Pattern (OP02-PFX only)			
Number of measurement terminals		4	
Measurable range *1		-2.0000 V to 20.0000 V	
Accuracy *2		± (0.05 % of rdng + 0.02 % of f.s)	
Measurement resolution		0.1 mV	
Measurement value		Average voltage of the every 500 ms	Average voltage of the every 100 ms
Measurement Interval		500 ms	100 ms
Pulse			
Number of measurement terminals		4	–
Measurable range *1		-2.0000 V to 20.0000 V	–
Accuracy *2		± (0.05 % of rdng + 0.02 % of f.s)	–
Measurement resolution		0.1 mV	–
Measurement valu *3	High voltage	Maximum voltage in one cycle	–
	Low voltage	Maximum voltage in one cycle	–
Measurement Interval *4		1 ms	–
Cell temperature measurement *5			
Number of measurement terminals		4	
Thermocouple type		K type	
Measurable range *6		-100.0 °C to 400.0 °C	
Accuracy *2 *7		± 1.5 °C (TYP values)	
Reference junction accuracy *2 *7		± 0.5 °C(TYP values)	
Resolution		0.1 °C	
Measurement interval		1 s	

*1. You can apply a voltage from -20 V to 22 V.
*2. Ambient temperature at 18 °C to 28 °C.
*3. Automatically synchronized with the BPChecker2000 pulse setting (specify two points from high voltage, low voltage, and user-specified).
*4. The application software records data every second. [Data recording time] BPChecker2000 : 1 s to...
*5. The temperature scale conforms to JIS C 1602-1995 (ITS-90). (ITS-90 is an international temperature scale.)
*6. Depending on your thermocouple's specifications (thermocouple class, wire diameter and insulation), the usable temperature range will vary.
*7. When the voltage that the thermocouple calibrator produces is measured.
*8. This shows the internal sensor performance. This indicates the temperature measurement accuracy of the thermocouple connector.
Thermometer accuracy = Measurement accuracy + reference junction compensation + thermocouple tolerance

Charge and discharge system controller for large capacity (200 A)

For larger capacity more than 50 A, charge and discharge controllers that can support up to 200 A are available.

- Maximum voltage 60 V, maximum current 100 A
- Maximum voltage 60 V, maximum current 200 A

Rack mount system

We also provide a rack mounting service.

- System rack: KRC363L

* The picture shown below is an example of the rack mount system

Coordination between BPChecker3000 and Vehicle Spy3

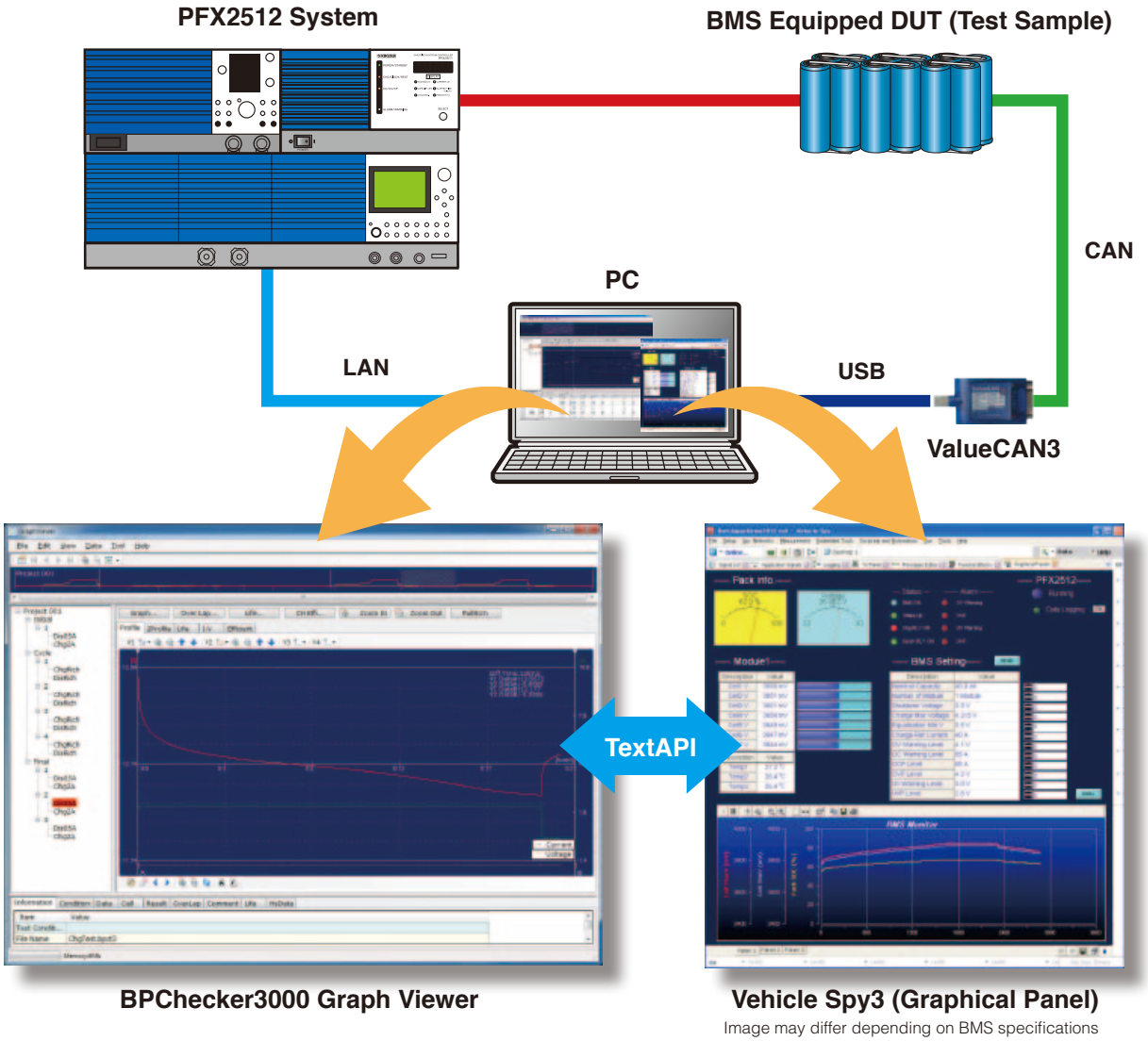
PFX2512 system is able to be connected to battery pack where BMS (Battery Management System) is equipped. Charge/discharge test is able to be conducted while communicating with BMS by combining exclusive application software [BPChecker3000], and vehicle-installed network analysis tool [Vehicle Spy3].

■ Function example (May not be realized depending on BMS specifications *)

- Record data BMS data during charge/discharge test (save text file)
- BPChecker3000 receives alarm generated by BMS and stops charge/discharge test
- Parameters assigned to BMS at charge/discharge starting time are automatically sent out
- Readout/writing BMS setting parameters

* Our company will perform Vehicle Spy3 customization upon accepting the presentation of BMS specifications by customers. Please consult us separately since BMS specifications are different by every customer. In addition, please contact the following for inquiry related to Application Software, [Vehicle Spy3].
Embedded Car Unit (ECU) Developing Tool; Japan Intrepid Control Systems, Inc.
Yokohama World Porters 6F, 2-2-1, SHINKO, Naka-Ku, Yokohama-City, 231-0001 Phone: 045-222-2014 www.intrepidcs.com

■ System Outline Drawing



The System with PFX2500 Series

● Applied configuration (model ID)

Model ID is used for combination of the selected power supply and electronic load if you wish to have a combination that is not on the available model ID list, please consult with us. More model IDs will be added in future. The latest information for the system configuration is available on our website.

Model ID		Power supply for charge	Electronic load for discharge
PFX2511	PFX2512		
5101	**7101**	PWR800L	PLZ1004W
5102	**7102**	PWR800L	PLZ1004W *1
5103	**7103**	PWR1600L	PLZ1004W×2
5104	**7104**	PWR800L	PLZ334W
5105 *2	**7105** *2	PAT60-67T	PLZ1004W+2000WB
5106	**7106**	PWR1600L	PLZ1004W

Model ID		Power supply for charge	Electronic load for discharge
PFX2511	PFX2512		
5107	**7107**	PAS10-70	PLZ1004W
5108	**7108**	PAS20-36	PLZ1004W
5109	**7109**	PAS20-54	PLZ1004W
5110	**7110**	PAS40-27	PLZ1004W
5111	**7111**	PWR800L	PLZ164W
5112	**7112**	PAS10-35	PLZ334W

*1: M range *2: Additional adjustment fee is required.

[As of the end of February, 2012]

● Note on selecting power supply for charge (route loss)

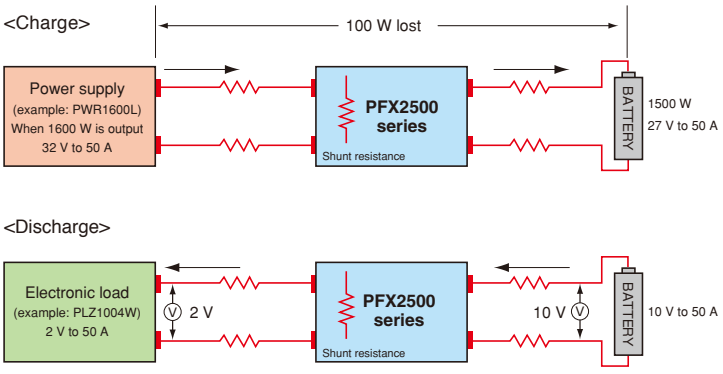
Application of the charge current causes a voltage drop in the DUT cable, connecting cables, the current pass route of the PFX2500 series, etc. The power loss at charging caused by this voltage drop is the route loss. The maximum power that can be used for charging is the value from which the route loss is subtracted.
[Maximum charge power = Maximum rated power of DC power supply - Route loss]

● Note on selecting electronic load for discharge (minimum operating voltage for discharge)

The electronic load has minimum operating voltage (1.5 V in PLZ1004W), and it does not operate at the voltage below the specified level. The result of an addition of this level and the route loss (voltage drop) is the minimum operating voltage for discharge.[Minimum operating voltage for discharge = Minimum operating voltage of electronic load + Voltage drop caused by route loss]

The list of compatible models for combination shown below uses the test lead (TL08-PFX) instead of the rated outputs, and shows the estimated outputs at the battery terminal when used with the maximum current.

[Conceptual diagram of route loss]



● List of the applied configuration with PFX2500 series

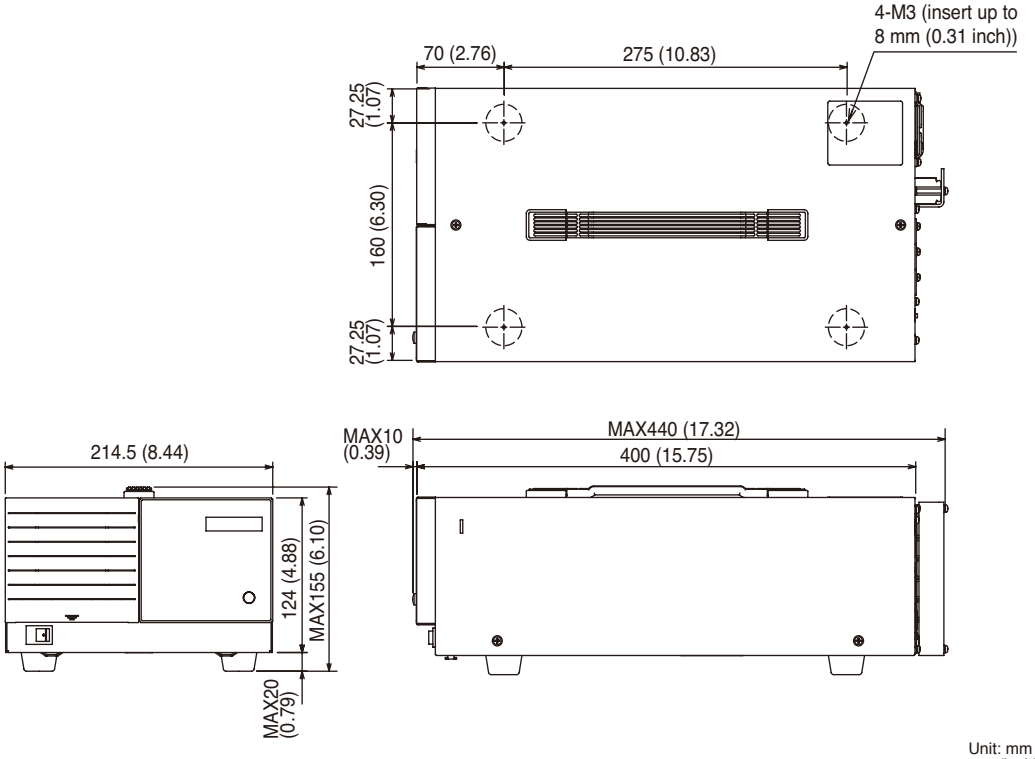
* If you wish to have a combination other than the models below, please contact with us.

Power supply for charging	Estimated output			Input	Remark	Appearance
	Voltage (V)	Current (A)	Power limit (W)			
PWR400L	0 to 60	0 to 25	350	AC 100/200 V 6.5/3.3 A	Wide range DC power supply Constant power type power supply with wide variable ranges of voltage and current. One unit serves as multiple units of a single range DC power supply.	 PWR Sereis
PWR800L	0 to 60	0 to 50	700	AC100/200 V 13/6.5 A		
PWR1600L	0 to 60	0 to 50	1400	AC100/200 V 26/13 A		
Electronic load for discharging	**Estimated output**			**Input**	**Remark**	**Appearance**
	Voltage (V)	Current (A)	Power limit (W)			
PLZ164W	6 to 60	0 to 33	165	AC 90 to 250 V 80 VA	By adding a bias power supply, the minimum discharge voltage can be lowered. For details, please contact with us.	 PLZ-4W Series
PLZ334W	8 to 60	0 to 50	330	AC 90 to 250 V 90 VA		
PLZ1004W	8 to 60	0 to 50	1000	AC 90 to 250 V 90 VA		
PLZ2004WB	8 to 60	0 to 50	2000	AC 90 to 250 V 200 VA		
PLZ164WA	4.5 to 60	0 to 33	165	AC 90 to 250 V 450 VA		
PLZ664WA	4.5 to 60	0 to 50	660	AC 90 to 250 V 1500 VA		

● Options

Model name	Description	Remark
PFX2121	Charge/discharge system controller	PFX2511 exclusive.
TL08-PFX	Load cable(with voltage current, and temperatur sensing cable.)	Supplied with sensing cable.Heat resistant up to 105 °C
SD002	Application software BPChecker2000 Full Edition	PFX2511 exclusive.The 2-channel version is supplied with PFX2511
SD007-PFX	Application software BPChecker3000	PFX2512 exclusive.
OP01-PFX	Voltage/thermometer unit	PFX2511 exclusive.Up to 3 boards can be mounted
OP02-PFX	Voltage/thermometer unit	PFX2512 exclusive.Up to 3 boards can be mounted
TL09-PFX	Voltage lead wire for OP01/02-PFX for 4 cells, K type thermocouple for 4 cells	Heat resistant up to 105 °C
KRA3	Rack mount frame (EIA)	
KRA150	Rack mount frame (JIS)	

Outline Drawing



Unit: mm
(inch)

Specifications

■ Rated Output

		PFX2511	PFX2512
Number of output		1 ch	1 ch
Charging current range *1		0.000 A to 50.000 A	0.000 A to 50.000 A
Charging voltage range *1	60 V range	0.000 V to 60.000 V	0.000 V to 60.000 V
	6 V range	–	0.000 V to 6.000 V
Discharge current range *1		0.000 A to 50.000 A	0.000 A to 50.000 A
Discharge voltage range *1 *2	60 V range	0.000 V to 60.000 V	0.000 V to 60.000 V
	6 V range	–	0.000 V to 6.000 V

*1 Range might be different depending on power supply to be connected, model of electronic load, wiring situation, etc.
*2 Lowest dischargeable voltage might be different depending on electronic load model to be connected, wiring situation, etc.

■ Setting Accuracy

			PFX2511	PFX2512
Static				
Constant current charge/ discharge	Range *1		0.000 A to 50.000 A	0.000 A to 50.000 A
	Accuracy *2		*3	*3
	Resolution		1 mA	1 mA
Constant voltage charging	Range *1	60 V range	0.000 V to 60.000 V	0.000 V to 60.000 V
		6 V range	–	0.000 V to 6.000 V
	Accuracy *2		*3	*3
	Resolution		1 mV	1 mV
Constant power discharging	Range *1		0.10 W to 3000.00 W	0.10 W to 3000.00 W
	Accuracy *2 *4		*3	± (0.5 % of set + 1 W) *7
	Resolution*5		100 mW	10 mW
Pulse				
Constant current discharging	Range *1		0.000 A to 50.000 A	–
	Accuracy *2		*3	–
	Resolution		1 mA	–
	Number of settings		20 values	–
	Time width	Range	5.0 ms to 65000.0 ms	–
		Accuracy *2 *6	± (0.05 % of set + 0.05 ms)	–
		Resolution	100 µs	–
Constant power discharging	Range *1	60 V range	0.1 W to 3000.0 W	–
		6 V range	–	–
	Accuracy *2 *4		*3	–
	Resolution	60 V range	100 mW	–
		6 V range	–	–
	Number of settings		20 values	–
	Time width	Range	5.0 ms to 65000.0 ms	–
		Accuracy *2 *6	± (0.05 % of set + 0.05 ms)	–
		Resolution	100 µs	–
Pattern *8				
Pattern constant current	Range *1		–	-50.000 A to 50.000 A
	Accuracy *2		–	*3
	Resolution		–	1 mA
	Number of settings		–	1000 values (Maximum number of steps)
	Time width	Range	–	0.1 s to 9999.9 s (Time width for 1 step)
		Accuracy *2	–	± (0.05 % of set + 10 ms)
		Resolution	–	100 ms
Pattern constant power	Range *1		–	-3000.00 W to 3000.00 W
	Accuracy *2		–	± (0.5 % of set + 1 W) *7
	Resolution		–	10 mW
	Number of settings		–	1000 values (Maximum number of steps)
	Time width	Range	–	0.1 s to 9999.9 s
		Accuracy *2	–	± (0.05 % of set + 10 ms)
		Resolution	–	100 ms

*1 Range might be different depending on DC power supply to be connected, model of electronic load, wiring situation, etc.
*2 Ambient temperature at 18 °C to 28 °C
*3 External equipment is controlled so as to Measurement Value being equal to Set Value by the software control.
*4 60 V range = At battery voltage above 5 V, 6 V range = at above 0.5 V
*5 Voltage activation rage for constant power discharge: 5 V to 60 V (assured value)
*6 Measure time after setting trigger at the half position (1/2) of pulse width (current amplitude)
*7 With battery voltage of 2 V or more. The battery voltage is measured, and the control current (constant current control) is calculated from the set power value through software calculation. The time required to process one calculation (from the voltage measurement to the output setting) is approximately 1 ms.
*8 The operating voltage range is 1 V or more (when the TL08-PFX is being used; regardless of whether a bias power supply is being used).

Unless otherwise specified, specifications should pursuant to the following settings and conditions.
* Worm-up time should be 30 minutes.
* TYP Value indicates typical values. Not assuring performance.
* "reading" shows readout value. * "set" indicates setting value. * "rating" indicates rating.

■ Measurement Accuracy

				PFX2511	PFX2512
Static					
Charge / discharge current measurement	Range			0.0000 A to 50.0000 A	0.0000 A to 50.0000 A *1
	Accuracy *2 *3			± (0.15 % of reading + 0.02 % of rating)	± (0.15 % of reading + 0.02 % of rating)
	Resolution			0.1 mA	0.1 mA
Voltage measurement	Range		60 V range	-6.0000 V to 60.0000 V	-6.0000 V to 60.0000 V *4
			6 V range	–	-1.0000 V to 6.0000 V *5
	Accuracy *2 *3 *6		60 V range	± (0.05 % of reading + 0.02 % of rating)	± (0.05 % of reading + 0.02 % of rating)
			6 V range	–	± (0.05 % of reading + 0.04 % of rating)
	Resolution *6			0.1 mV	0.1 mV
Power measurement	Range			–	0.000 W to 3000.000 W
	Accuracy			–	Software calculation (voltage measurement x current measurenent)
	Resolution			–	1 mW
Capacity calculation	Range			0.000 Ah to 2000.000 Ah	0.000 Ah to 2000.000 Ah
	Accuracy *2 *3			Rely on the current measuring accuracy and the time accuracy	
	Resolution			0.1 mAh	1 mAh
Time *7	Accuracy *2 *8			±10 ppm (TYP values)	±10 ppm (TYP values)
Pulse					
Charge / discharge current	Range			0.0000 A to 50.0000 A	–
	Accuracy *2 *3			± (0.2 % of reading + 0.03 % of rating)	–
	Resolution			0.1 mA	–
	Measured value			Average current, Update a data per period of 500 ms	–
Battery voltage	Range			0.0000 V to 60.0000 V	–
	Accuracy *2 *3			± (0.05 % of reading + 0.02 % of rating)	–
	Resolution			0.1 mV	–
	Measurement		High voltage	Indicates the maximum battery voltage in one cycle of the pulse setting.	–
			Low voltage	Indicates the minimum battery voltage in one cycle of the pulse setting.	–
			Arbitrary	At the specified pulse point	–
Capacity calculation	Range			0.0000 Ah to 2000.0000 Ah	–
	Accuracy *2 *3			Rely on the current measuring accuracy and the time accuracy	–
	Resolution			0.1 mAh	–
Time *7	Accuracy *2 *8			±10 ppm (TYP values)	–
Pattern					
Charge / discharge current	Range			–	-50.0000 A to 50.0000 A *1
	Accuracy *2			–	± (0.2 % of reading + 0.03 % of rating)
	Resolution			–	0.1 mA
	Measured value			–	Average current, Update a data per period of 1 s
Voltage measurement	Range		60 V range	–	-6.0000 V to 60.0000 V *4
			6 V range	–	-1.0000 V to 6.0000 V *5
	Accuracy *2		60 V range	–	± (0.05 % of reading + 0.02 % of rating)
			6 V range	–	± (0.05 % of reading + 0.04 % of rating)
	Resolution *6			–	0.1 mV
Power measurement	Range			–	-3000.000 W to 3000.000 W
	Accuracy *2			–	Software calculation (voltage measurement x current measurement)
	Resolution			–	1 mW
Capacity calculation	Range			–	-2000.000 Ah to 2000.000 Ah
	Accuracy *2			–	Rely on the current measuring accuracy and the time accuracy
	Resolution			–	1 mAh
Time *7	Accuracy *2 *8			–	±10 ppm (TYP values)

Specifications

■ Measurement Accuracy

			PFX2511	PFX2512
High speed sampling				
Current measurement	Range *9		–	-50.0000 A to 50.0000 A
	Accuracy *2 *9 *10	1 ms sampling	–	± (0.2 % of reading + 0.5 % of rating)
		10 ms sampling		± (0.15 % of reading + 0.05 % of rating)
		100 ms sampling		± (0.15 % of reading + 0.02 % of rating)
	Resolution	1 ms sampling	–	0.1 mA
		10 ms sampling		0.1 mA
		100 ms sampling		0.1 mA
Voltage measurement	Range	60 V range	–	-6.0000 V to 60.0000 V
		6 V range		-1.0000 V to 6.0000 V
	Accuracy *2 *9 *10	1 ms sampling *6	–	± (0.1 % of reading + 0.1 % of rating)
		10 ms sampling *6		± (0.1 % of reading + 0.05 % of rating)
		100 ms sampling		60 V range: ± (0.05 % of reading + 0.02 % of rating)
				6 V range: ± (0.05 % of reading + 0.04 % of rating)
	Resolution *6	1 ms sampling	–	0.1 mV
		10 ms sampling		0.1 mV
		100 ms sampling		0.1 mV

*1 Measurable range: - 52.500 A to 52.500 A (TYP value) However, accuracy outside of the range is not assured.
*2 Ambient temperature at 18 °C to 28 °C
*3 Measurable range: Within the above listed range
*4 Measurable range: - 6.500 V to 65.000 V (TYP value) However, accuracy outside of the range is not assured.
*5 Measurable range: - 6.500 V to 6.500 V (TYP value) However, accuracy outside of the range is not assured.
*6 Common with 6 V/60 V ranges
*7 Accuracy of transit times (termination condition) at charge/discharge time and at rest.
*8 Corresponding to 30 seconds of monthly difference.
*9 Accuracy outside of the rating output range is not assured.
*10 Fluctuation due to ripple noise of power supply and AC line noise (50 Hz/60 Hz) are not included.

■ Temperature measurement

*The thermistor 103AT-2 (Ishizuka denshi) is used for temperature detecting element.

	PFX2511	PFX2512
Resistor (temperature) measuring section *1		
Measurement range	-40.0 °C to 100.0 °C	
Measurement resolution	0.1 °C	
Measurement accuracy *2 *3	± 0.5 °C (measurement temperature at 0 °C to 40.0 °C)	
	± 1 °C (measurement temperature at -20 °C to 80 °C)	
Reference (thermistor 103AT-2)		
Part name	Thermistor (103AT-2, Ishizuka denshi)	
R25	10.0 k , Nominal zero-power resistor value at 25 °C	
Operating temperature range	-50.0 °C to 110.0 °C	
Temperature accuracy *3	± 0.5 °C (measurement temperature at 0 °C to 40.0 °C)	
Tolerance	± 1 %	
Constant-B	3435 K ± 1 % (measurement temperature at 25 °C)	

*1 The temperature measurement does not mean tracing absolute temperature. Resistor to temperature conversion value
*2 Error of temperature detecting element is excluded.
*3 Ambient temperature at 18 °C to 28 °C

■ Protection Functions

	PFX2511	PFX2512
Overvoltage (overcharge) protection	Software OVP, Hardware OVP	
Undervoltage (overdischarge) protection	Software UVP, Hardware UVP	
Overcurrent protection	Software OCP *3, Hardware OCP Load shorting protection	
Capacity (overcharge/overdischarge) protection	Software OAH *4	
Overtemperature (DUT) protection	Software OTP	
Vibration alarm		

*1 At rating value of each range
*2 Ambient temperature at 18 °C to 28 °C
*3 The application software automatically sets the value to which software OCP added 1 A to the set current.
*4 The application software calculates the value of nominal capacity multiplied by set percentage and set the capacity.

■ General Specifications

		PFX2511	PFX2512
Nominal input rating		100 Vac to 240 Vac, 50 Hz/60 Hz	
Input voltage range		90 Vac to 250 Vac	
Power consumption		60 VAmax OP01-PFX 3 boards installed: 80 VAmax	60 VAmax OP02-PFX 3 boards installed: 80 VAmax
Operating temperature/ humidity range		0 °C to 40 °C, 20 % rh to 85 % rh (No condensation)	
Storage temperature/humidity range		-10 °C to 60 °C, 0 % rh to 90 % rh (No condensation)	
Operating environment		Indoors, Overvoltage category II	
Altitude		Up to 2000 m	
Isolation voltage	Across the I/O terminals and chassis	± 80 Vmax	
Insulation resistance	Primary and chassis	500 Vdc, 30 M or greater, 70 % rh or less	
	Primary and across the I/O terminals		
Withstand voltage	Primary and chassis	1500 Vac, No abnormalities over 1 minute	
	Primary and across the I/O terminals		
Safety *1		Compliant with the requirements in the following standard Low voltage directive 2006/95/EC EN61010-1 (Class I *2 , Pollution degree 2)	
Electromagnetic compatibility(EMC) *1		Compliant with the requirements in the following standard EMC Directive 2004/108/EC EN61326-1 (Class A *3) EN55011 (Class A *3, Group 1 *4) EN61000-3-2 EN61000-3-3 [Application conditions] All cables and wires used to connect the product should be less than 5 meter length.	
External dimensions		Refer to the dimensions	
Weight		Approx. 7 kg (15.43 lb)	
Accessories	Power cord	1 pc	
	Cable with crimp terminal	4 pcs. (Red: 2 pcs, White: 2 pcs) 45 cm each (17.72 inch)	
	26-core flat cable	1 pc	
	20-core flat cable	1 pc	
	Twisted pair cable with TP-BUS connector	1 pc (1 m)	–
	Sensing connector	1 pc	
	Thermistor	1 pc	
	Lock lever	2 pcs	
	LAN cable	–	1 pc (2 m)
	Operation manual	1 copy	
	BPChecker 2000 setup guide	1 copy	–
	BPChecker2000 Basic edition CD-ROM	1 pc	–

*1 Limited to the product with CE marking on panel. Not applied to specially ordered or modified articles.
*2 This product is the Class I equipment. Please be sure to connect the protection conductor terminal of product to ground. If not correctly connected to ground, safeness is not guaranteed.
*3 This product is the Class A equipment. It is aimed to use the product under the industrial environment. If this product is used in housing area, it might be the cause of interference. If it is the case, special action to reduce electromagnetic radiation might be required for users in order to prevent receiving interference.
*4 This product is the Group 1 equipment. The product does not generate/use radio frequency energy in the form of electromagnetic radiation, induction and/or static coupling intentionally for material processing or inspection/analysis.

Order Information

Description	Model	Remark
Charge/discharge system controller	PFX2511	
Charge/discharge system controller	PFX2512	
Communication control unit *1	PFX2121	PFX2511 exclusive
Load cable(with voltage current, and temperatur sensing cable.)	TL08-PFX	Supplied with sensing cable. Heat resistant up to 105 °C
Application software BPChecker3000 *2	SD007-PFX	PFX2512 exclusive
Application software BPChecker2000 Full Edition	SD002	PFX2511 exclusive. The 2-channel version is supplied with PFX2511
Voltage/thermometer unit	OP01-PFX	PFX2511 exclusive. Up to 3 boards can be mounted
Voltage/thermometer unit	OP02-PFX	PFX2512 exclusive. Up to 3 boards can be mounted
Sensing cable set (voltage sensing cable and thermocouple)	TL09-PFX	K type thermocouple for 4 cells, heat resistant up to 105°C

*1 Essential product for the actuation of PFX2511.
*2 Essential product for the actuation of PFX2512.

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