P F X 2 0 0 0   S E R I E S
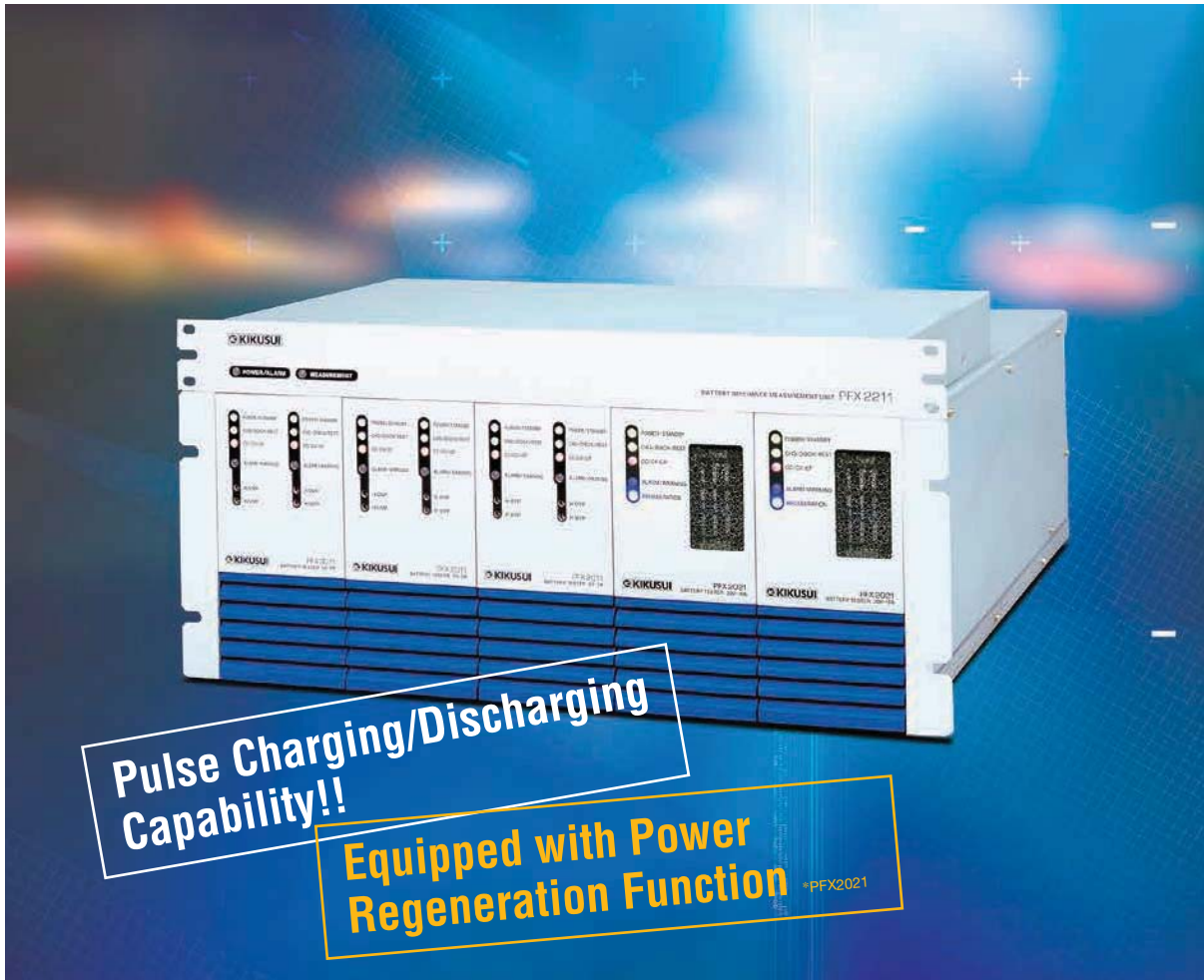
**Pulse Charging/Discharging
Capability!!**

**Equipped with Power
Regeneration Function** *PFX2021

Battery Test System
PFX2000 Series

· ·

5 V/5 A, 25 W × 2 channels (PFX2011)

10 μA resolution and low range operation for low rates (PFX2011)

High capacity of 20 V/10 A and 200 W supported (PFX2021)

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battery test system
PFX2000

Supporting highly flexible battery evaluations for various test configurations from small-size desktop systems to large-scale systems with up to 240 channels
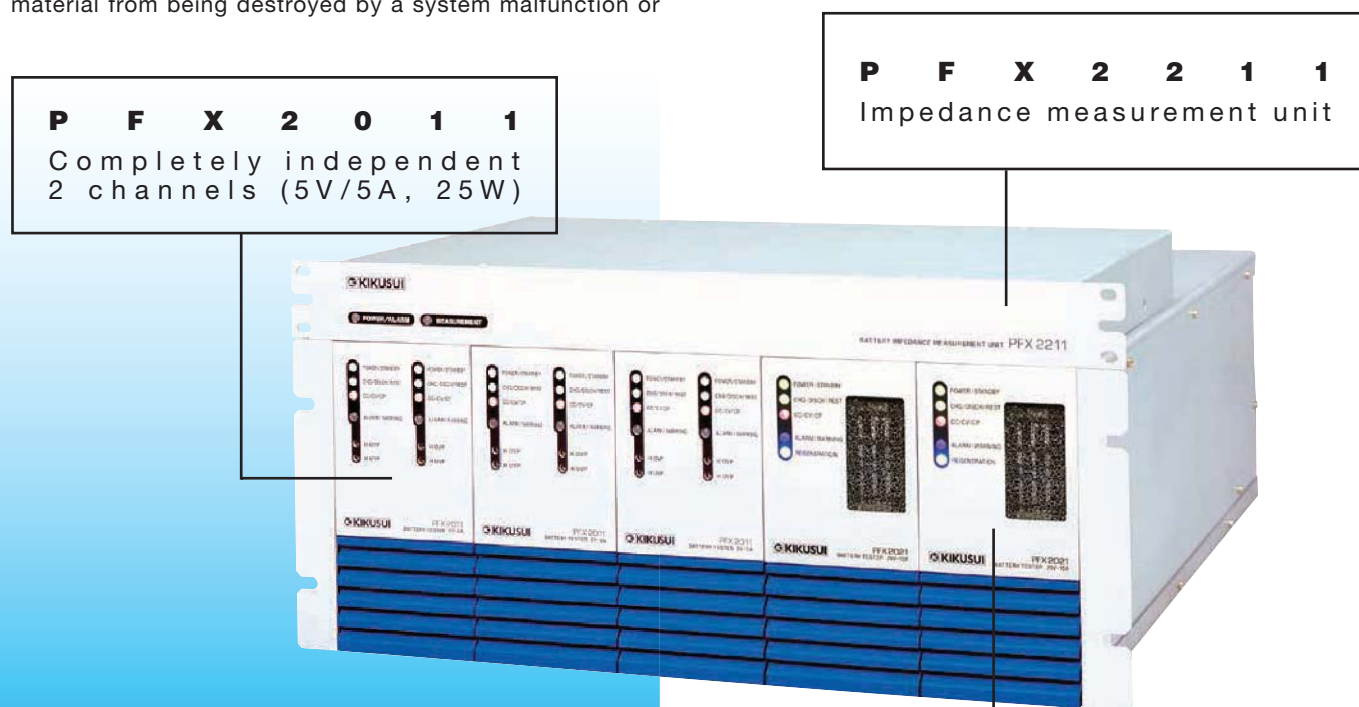
The PFX2000 Series offers a battery test system developed on the basis of the experience and know-how that we have amassed through implementing numerous custom-built battery evaluation systems.

This product adopts a unit structure that houses charging/discharging power supply units (PFX2011 or PFX2021) in a single unit frame (PFX2332). This enables you to build your battery test environment in varying scale, from a small-size system with a single cell to a large-scale system consisting of up to 120 units (max. 240 channels when all the units used are PFX2011), thus making it possible to support virtually any number of channels necessary for the intended test. What's more, the PFX2000 Series provides high availability by allowing you to replace only those units that need maintenance and to continue the test without shutting down the entire system (hot plug feature). Each channel is completely independent of one another and thus can be controlled under different test and timing conditions. In addition, the system supports a rich set of protection features (OVP, UVP, OHP, etc.) to prevent the test material from being destroyed by a system malfunction or

operation mistake.

PFX2021 (200-W unit) has a discharging mode that supports 20-value CC pulse and 20-value CP pulse discharging. It employs a V/F converter to measure current during pulse discharge, enabling quick measurement of the varying current and highly accurate capacity evaluation. This makes PFX2021 suitable for use in charging/discharging simulations for such devices as PCs and digital cameras. Furthermore, PFX2021 features a power regeneration function that allows the energy lost internally during discharge to be reused as the operation (charging) power, making this product more sophisticated as a charging/discharging power supply.

The application software (BPChecker2000), which is used to control the PFX2000 Series system, is capable of controlling up to six Espec Corp.'s thermostatic chambers for synchronized testing. Using this software in combination of the optional impedance measurement unit (PFX2211) can automate the temperature characteristic testing process including impedance measurement.

P F X 2 0 1 1
Completely independent 2 channels (5V/5A, 25W)

P F X 2 2 1 1
Impedance measurement unit

P F X 2 0 2 1
2 0 0 W (2 0 V / 1 0 A)
Equipped with power regeneration function

Lineup

PFX2021	Charging/discharging power supply unit (20V/10A/200W×1CH)
PFX2011	Charging/discharging power supply unit (5V/5A/25W×2CH)
PFX2332	5-unit frame
PFX2121	Control unit
PFX2211	Impedance measurement unit
SD002	Application software (BPChecker2000)

[Note]
PFX2021 cannot be operated in the previous model of the 5-unit frame (PFX2331).

PFX2011 5V-5A 25W 2CH

● Completely independent channels

The two channels of the unit are completely independent of one another and thus can be controlled under different test conditions.

● 8-value CC pulse mode

Constant current pulse discharging mode for reproducing GSM and PDC burst patterns

● High and low current ranges

You can toggle between two current ranges - high range with 0.1-mA resolution and low range with 0.01-mA resolution. In the low range, reproducibility and accuracy can be implemented with 1-mA resolution, thus making product suitable for standby-mode current simulations for mobile devices.

● Pulse charging

Sophisticated charger simulations involving such types of pulses as constant current pulses and PWM pulses are possible.

Ideal for characteristic evaluations for notebook PCs, digital cameras, etc.

PFX2021 20V-10A 200W

● 20-value CP pulse discharging function

This function is intended for constant power load fluctuation simulations using a DC/DC converter.

● 20-value CC pulse discharging function

The constant current 20-value pulse discharging mode is offered as the standard discharging mode.

● V/F converter

Even changes in transient current during discharge can also be measured, enabling real-to-life measurement of capacity and electric energy.

● Power regeneration function

A power saving mode is supported whereby the energy lost internally during discharge can be reused as the operation power.

● Pulse charging

Sophisticated charger simulations involving such types of pulses as constant current pulses and PWM pulses are possible.

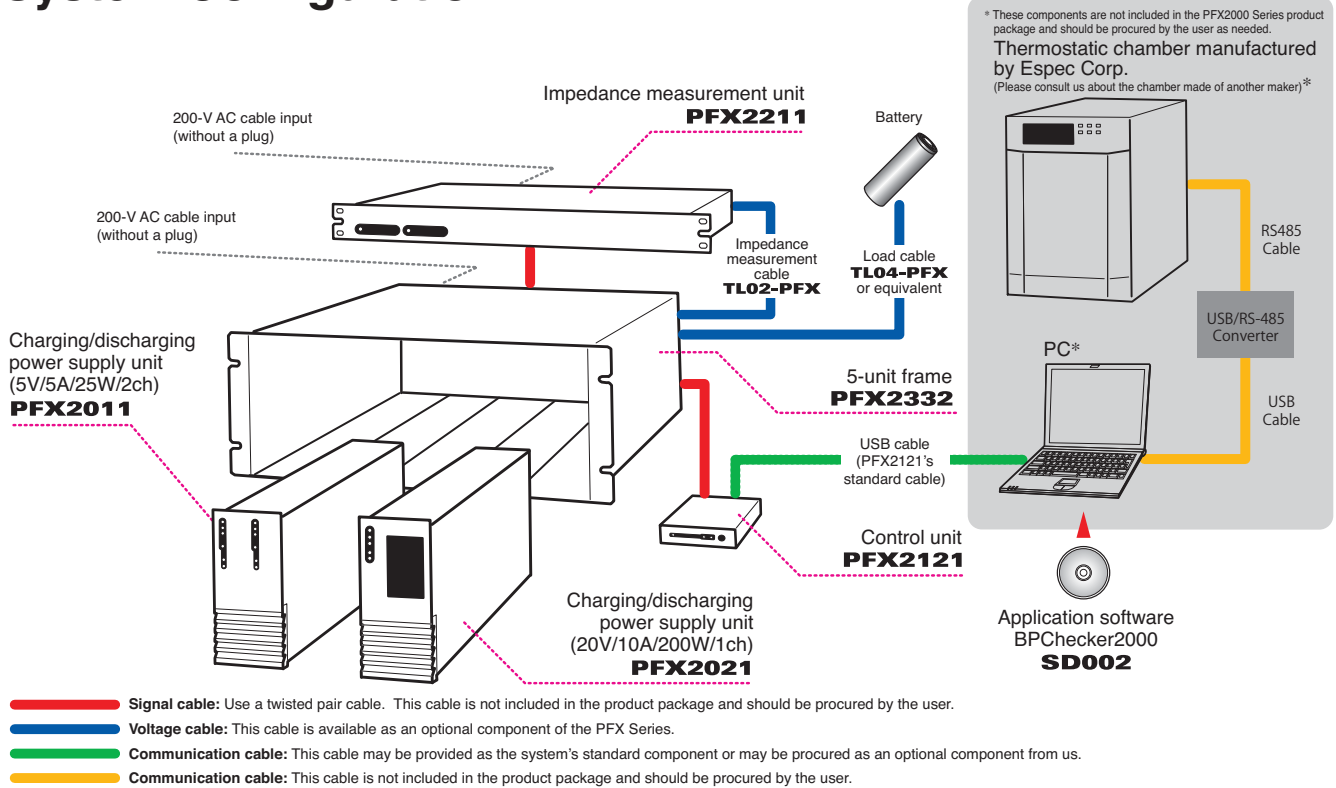## Main Specifications (Comparison between PFX2011 and PFX2021)

Unit model name	PFX2011	PFX2021
Number of output channels	2	1
Charging current range	0.0mA to 5000.0mA (high range)	0mA to 10000mA
	0.00mA to 500.00mA (low range)	
Charging voltage range	0.0000V to 5.0000V	0 to 20.000V
Charging mode	CC/CC-CV/PWM pulse	
Discharging current range	0.0mA to 5000.0mA (high range)	0mA to 10000mA
	0.00mA to 500.00mA (low range)	
Discharging voltage range	−0.5000V to 5.0000V	−2.000 to 20.000V
Maximum charging/discharging power	25.00W	200.00W
Discharging mode	CC/CP/CC8-value pulse	CC/CP/CC20-value pulse/CP20-value pulse
Measurement parameters	Voltage/current/capacity/electric energy/temperature/high voltage/low voltage	

Hot Plug Feature

When in standby mode, any charging/discharging power supply unit can be replaced without turning off the power of the unit frame.

System Configuration

200-V AC cable input (without a plug)

Impedance measurement unit
PFX2211

Battery

200-V AC cable input (without a plug)

Impedance measurement cable
TL02-PFX

Load cable
TL04-PFX
or equivalent

* These components are not included in the PFX2000 Series product package and should be procured by the user.

Thermostatic chamber manufactured by Espec Corp.
(Please consult us about the chamber made of another maker)*

RS485 Cable

USB/RS-485 Converter

Charging/discharging power supply unit (5V/5A/25W/2ch)
PFX2011

5-unit frame
PFX2332

PC*

USB Cable

USB cable
(PFX2121's standard cable)

Control unit
PFX2121

Charging/discharging power supply unit (20V/10A/200W/1ch)
PFX2021

Application software BPChecker2000
SD002

Signal cable: Use a twisted pair cable. This cable is not included in the product package and should be procured by the user.

Voltage cable: This cable is available as an optional component of the PFX Series.

Communication cable: This cable may be provided as the system's standard component or may be procured as an optional component from us.

Communication cable: This cable is not included in the product package and should be procured by the user.

System Implementation Examples

[all using PFX2011]

### Small-size system with 1 unit (2 channels)

For those of you considering starting with a small 1-unit configuration, the PFX2000 Series meets your specific need without burdening you with cost and other concerns. You can install additional units as more channels become necessary in the future.
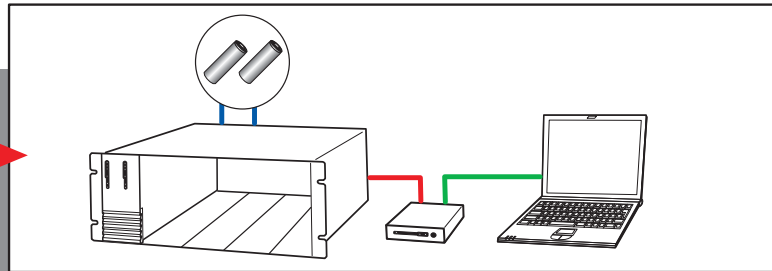
[Main components]
PFX2011×1
PFX2332×1
PFX2121×1
SD002×1

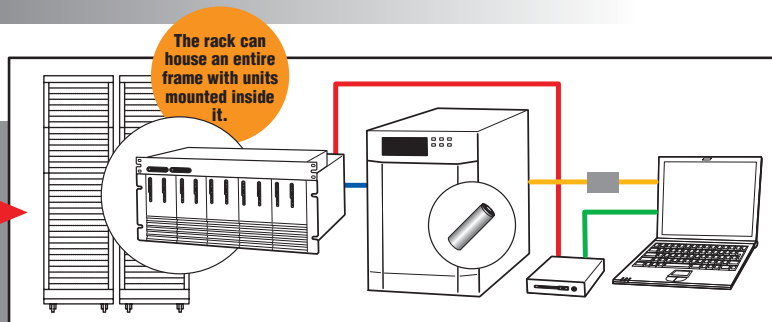### Mid-size system with 1 or 2 frames (max. 20 channels)

A battery characteristic comparison test typically requires at least one or more fully loaded frames, the number of which depends on how many samples are used.

×10
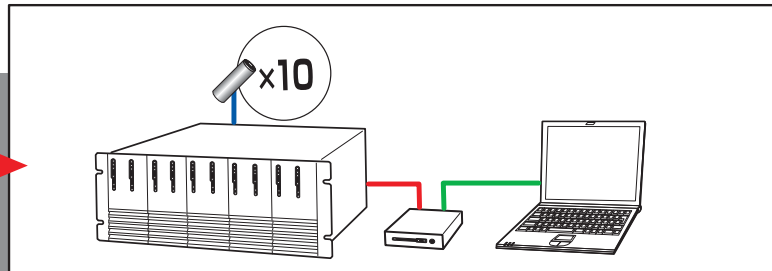
[Main components]
PFX2011×5
PFX2332×1
PFX2121×1
SD002×1

Large-size system with up to 24 frames (max. 240 channels)

This system uses multiple thermostatic chambers (max. 6 chambers) in combination. Since channels can be assigned freely to each thermostatic chamber, the efficiency in channel usage can be improved.

The rack can house an entire frame with units mounted inside it.

[Main components]
PFX2011×120
PFX2332×24
PFX2211×2
PFX2121×2
SD002×1

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4

Features

Pulse Charging/Discharging Function

A pulse charging mode is supported to assist you in R&D efforts on sophisticated charger simulations and charging methods. Also, PFX2021 has a 20-value CP and CC pulse discharging function. These features enable you to perform discharging simulations for packaged batteries used in notebook PCs and digital cameras.

Diverse Charging/Discharging Termination Conditions

A number of conditions, such as voltage, time, and temperature, can be specified as the charging and discharging termination conditions.

Highly Accurate Measurement Capability

A 24-bit A/D converter is adopted for measuring voltage and current values, thus enabling highly accurate measurement. Also, a built-in, temperature-controlled reference voltage circuit ensures highly stable operation. A 16-bit D/A converter and a high-speed A/D converter are fully utilized for pulse charging and discharging, thereby making it possible to generate complex current waveforms, measure the voltage at any given point, and evaluate the pulse current. In addition, a V/F converter specifically designed for average current measurement is employed to provide faithful measurement of average pulse currents (PFX2021 only). The transient state of the pulse current can also be measured exactly. Error in current measurement resulting from the unbalance between the first and last transitions

is minimized.

Temperature Measurement Function

The system features a simple temperature measurement function that uses a thermister (which comes with PFX2332) as a thermometer, making it possible to measure temperature on a channel-by-channel basis. Also, in addition to allowing over temperature protection (OTP) to be set as a protection function, the system permits you to specify dT/dt (temperature rise per unit time) and MaxTemp (maximum temperature) as the charging termination conditions.

Enhanced System Reliability

Various protection functions including overvoltage (overcharge) protection (OVP), undervoltage (overdischarge) protection (UVP), and overheat protection (OHP), as well as a watchdog timer (system monitoring), are provided to enhance the system reliability. In particular, the OVP and UVP functions support a dual protection mechanism offering software-based and hardware-based protections. Furthermore, the system uses a MOS FET to switch states in the charge/discharge/dwell cycle, making it reliable enough to endure long consecutive operation.

Power Regeneration Function

If a preset amount of energy is lost internally during a discharge test, the power regeneration function reuses the lost energy as the operation power. This function contributes to making the system smaller, achieving power savings, and reducing waste heat. (For PFX2021 only)

Battery Voltage Detection Terminal with High Input Resistance

The battery voltage detection terminal has high input resistance (10 GΩ). Since there is very little leak current, it is almost unlikely that the battery will dry out during a test dwell.

Two Independent Channels Built in One Unit

The two channels are completely independent of one another, and a different set of test conditions can be set for each of them. (For PFX2011 only)

Hot Plug Feature

When in standby mode, any charging/discharging power supply unit can be replaced without turning off the power of the unit frame.

## Frames Interconnected via a TP-BUS

The 5-unit frames are interconnected to one another and connected to the control unit via a TP-BUS. To disconnect a unit frame from the TP-BUS does not require turning off the power of any other frame connected.

Control Unit Supporting Multiple Channels

The control unit PFX2121 can control a large number of channels, supporting up to 120 channels per unit (when all the controlled power supply units are PFX2011). Also, it has a USB port for connection with a PC. You do not need to prepare a separate interface board if the PC you want to connect supports the USB interface. Two control units can be connected to a single PC.
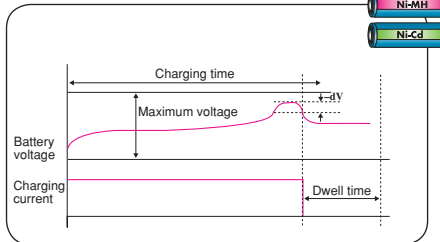

Conceptual Diagrams of Charging Mode Operation
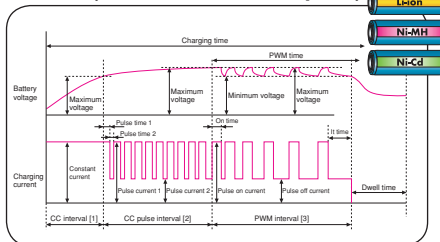
CC-CV (constant current-constant voltage)
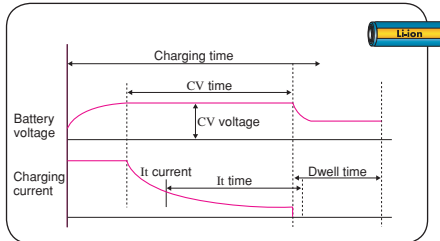
[Termination conditions] Time, CV time, current, and temperature

CC (constant current)

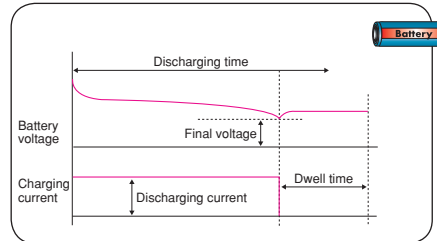[Termination conditions] Time, voltage, −ΔV, temperature, and ΔT/Δt

CC PWM (constant current PWM pulse)

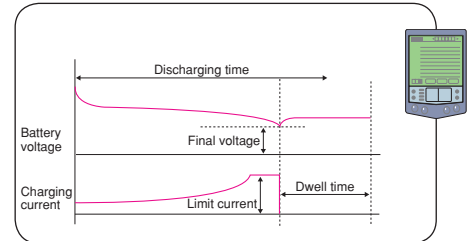[Termination conditions] Time and off time

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Conceptual Diagrams of Discharging Mode Operation
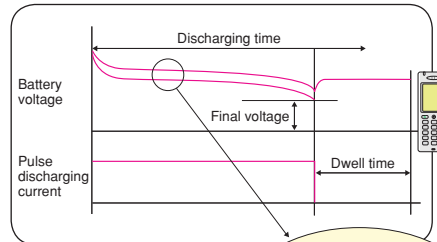
CC (constant current)

[Termination conditions] Time and voltage

CP (constant power)
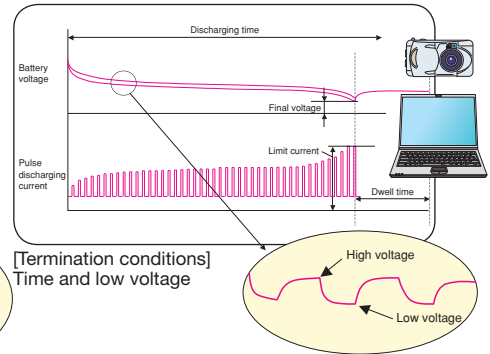
[Termination conditions] Time and voltage

CC pulse (constant current 8-value/20-value pulse)*

[Termination conditions] Time and low voltage

* The above diagram applies to the 8-value pulse of PFX2011. The 20-value pulse is supported only for PFX2021.

CP pulse (constant power 20-value pulse) * For PFX2021 only

[Termination conditions] Time and low voltage

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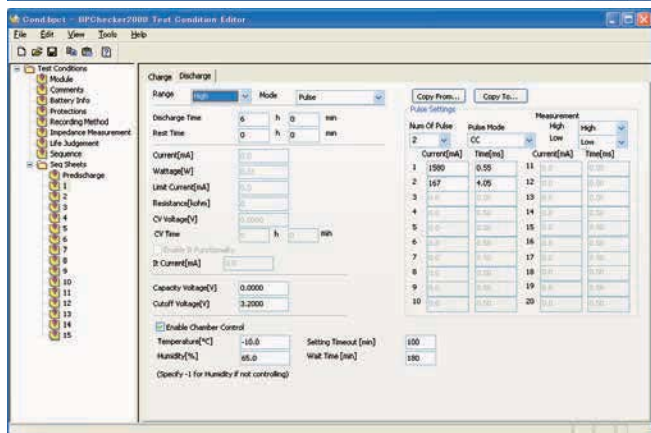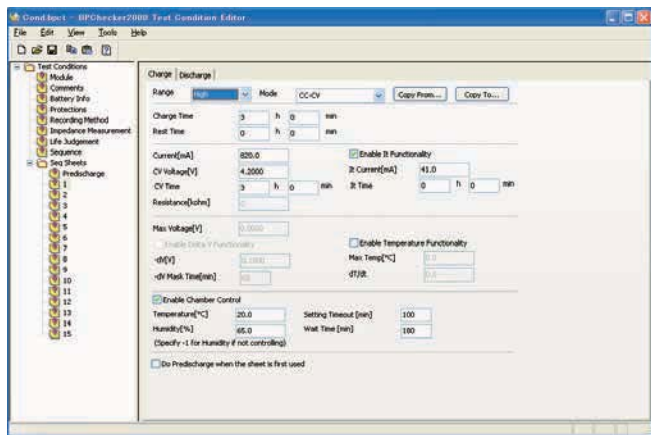Email: sales@calright.com http://www.calright.com

5

Application Software

SD002 BPChecker2000

BPChecker2000 is an application software package specifically designed for the PFX2000 Series system.

BPChecker2000 enables you to set conditions for battery charging/discharging characteristic tests, run the tests, and analyzes test results using a PC. Capable of controlling two 120-channel control units (PFX2121) via the PC's USB ports, BPChecker2000 can exert control over up to 240 charging/discharging power supply channels. By adding an impedance measurement unit (PFX2211), you can measure impedance of up to 120 charging/discharging power supply channels that are connected to the same control unit. Furthermore, if your PC supports the GPIB communication environment, you can have Espec Corp.'s thermostatic chambers externally controlled so that tests can be conducted in synchronization with the temperature inside the chambers.

● Program Structure   BPChecker2000 consists of the five programs described below.

Test Condition Editor

This program lets you create and edit all conditions related to charging/discharging testing. A total of 15 sheets of test condition data can be created, with each sheet specifying both charging and discharging conditions. It is also possible to set the number of times (repeats) that an individual sheet is to be repeated to form a particular charging/discharging cycle, as well as the number of times (loops) that the entire set of sheets is to be repeated.


Test Executive

This program executes charging/discharging tests according to the test condition file created with 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 charging/discharging trends.
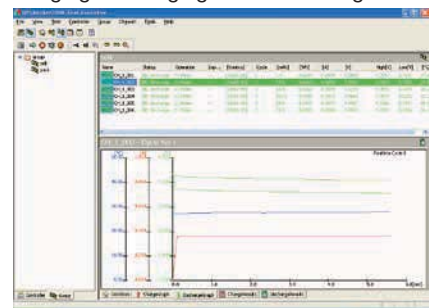
Graph Viewer

This program displays the test data, created with Test Executive, in a graph on the screen and lets you print it. It offers a graphic representation of the charging/discharging data of each cycle. You can display up to 99 sets of data overlaid one another and perform statistical processing.
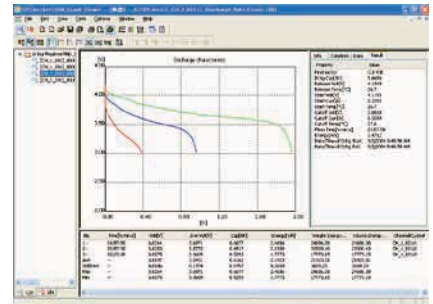
Hardware Configuration Wizard

This program detects the charging/discharging power supply units connected to the control unit and lets you configure the connection environment of other hardware devices (impedance measurement unit, thermostatic chamber, etc.).

Group Administrator

This program creates and deletes groups for performing the tests.

[Recommended Operating Environment]
- CPU: Pentium IV 1 GHz or faster- OS: Windows 2000 Professional (SP4 and Update Rollup1) or XP Professional (SP2 or later, x86), Vista (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: 1280 × 1024 or more
- Printer: Compatible with Windows
- No. of USB ports: More free USB ports than the number of control units to be used

[Thermostatic Chamber Control]
- 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

Specifications

		PFX2011	PFX2021
Rated output			
Number of output channels		2	1
Charging current range		0.0mA to 5000.0mA (high range), 0.00mA to 500.00mA (low range)	0mA to 10000mA
Charging voltage range		0.0000V to 5.0000V	0.000 to 20.000V
Discharging current range		0.0mA to 5000.0mA (high range), 0.00mA to 500.00mA (low range)	0mA to 10000mA
Discharging voltage range		−0.5000V to 5.0000V	−2.000V to 20.000V
Maximum charging/discharging power		25W	200W
Setting accuracy			
Constant current charging/discharging	Range	0.0mA to 5000.0mA (high range), 0.00mA to 500.00mA (low range)	0mA to 10000mA
	Accuracy*1	±(0.05% + 1.0mA) (high range), ±(0.05% + 0.1mA) (low range)	±(0.15% + 2.0mA)
	Resolution	0.1mA (high range), 0.01mA (low range)	1mA
	Ripple*2	1mArms (high/low range)	3mArms
Constant voltage charging	Range	0.0000V to 5.0000V	0.000V to 20.000V
	Accuracy*3	±(0.03% + 1mV)	±(0.10% + 3.0mV)
	Resolution	0.1mV	1mV
	Ripple*2	2mVrms	5mVrms
Constant power discharging	Range	0.01W to 25.00W (high range), 0.001W to 2.500W (low range)	0.02W to 200.00W
	Accuracy*4	±(0.1% + 10mW) (high range), ±(0.1% + 2mW) (low range)	±(0.50% + 20.0mW)
	Resolution*5	10mW (high range), 1mW (low range)	10mW
Pulse constant current discharging	Range	0.0mA to 5000.0mA (high range), 0.00mA to 500.00mA (low range)	0mA to 10000mA
	Resolution	0.1mA (high range), 0.01mA (low range)	1mA
	Accuracy*1	±(0.07% + 1mA) (high range), ±(0.07% + 0.1mA) (low range)	±(0.15% + 3mA)
	Number of settings	8 values	20 values
	Response*6	50μs (TYP)	70μs (TYP)
Pulse constant power discharging	Range	— —	0.02 W to 200.00 W
	Resolution	— —	10 mW
	Accuracy	— —	±(0.5 %+20.0 mW)
	Number of settings	— —	20 values
	Update rate	— —	2 ms (typical)
Pulse time width	Range*7	0.50ms to 65000.00msec	
	Resolution	10μs	
	Accuracy	±(0.05% + 0.05ms)	
Measurement accuracy			
Current measurement	Range	0.0mA to 5000.0mA (high range), 0.00mA to 500.00mA (low range)	0.0mA to 10000.0mA
	Accuracy*8	±(0.04% + 0.8mA) (high range), ±(0.04% + 0.08mA) (low range)	±(0.15% + 1.5mA)
	Resolution	0.1mA (high range), 0.01mA (low range)	0.1mA
Voltage measurement	Range	−0.5000V to 5.0000V	−2.0000V to 20.0000V
	Accuracy*8	±(0.02% + 1mV)	±(0.10% + 2.0mV)
	Resolution	0.1mV	
Pulse charging/ discharging current	Measurement value*9	Average current	
	Range	0.0mA to 5000.0mA (high range), 0.00mA to 500.00mA (low range)	0.0mA to 10000.0mA
	Accuracy	±(0.1% + 1mA) (high range), ±(0.1% + 0.1mA) (low range)	±(0.20% + 3.0mA)
	Resolution	0.1mA (high range), 0.01mA (low range)	0.1mA
Pulse battery voltage	Measurement point	High/low, any given point	
	Range	−0.5000V to 5.0000V	−2.0000V to 20.0000V
	Accuracy	±(0.05% + 1mV)	±(0.15% + 2mV)
General specifications			
Power consumption*10	At rated output	400VA Max	800VA Max
	With no load	60VA Max	50VA Max

*1: Measured within the rated range with respect to the set current.
*2: Maximum value at 10 Hz to 500 kHz
*3: Measured within the rated range with respect to the set voltage.
*4: Measured with respect to the set power when the battery voltage is not less than 0.5 V (PFX2011) or 2 V (PFX2021).
*5: Voltage operation range (guaranteed value) for constant power discharging - 0.5 to 5 V (PFX2011) or 2 - 20 V (PFX2021)
*6: At 10% to 90% of the pulse current waveform when the rated current is set; shorted at the end of the 7-meter load cable.
*7: The pulse time width is measured by the mesial magnitude of the pulse.
*8: Measured within the rated range with respect to the measured value.
*9: Average current measured at intervals of 500 ms
*10: Power consumption per unit

● Order information

Model name	Product name
PFX2011	Charging/discharging power supply unit (2 channels)
PFX2021	Charging/discharging power supply unit (1 channel)
PFX2332	5-unit frame
PFX2121	Control unit (max. 120 channels)
PFX2211	Impedance measurement unit
SD002	Application software BPChecker

■ Impedance measurement cable
TL02-PFX (1M)...........* Cable length: 1 m
TL02-PFX (3M)...........* Cable length: 3 m
TL02-PFX (5M)...........* Cable length: 5 m
■ Load cable (7 m)
TL04-PFX ....* Cable kit for PFX2011
TL06-PFX ....* Assembled product for PFX2011
TL05-PFX ....* Cable kit for PFX2021
TL07-PFX ....* Assembled product for PFX2021

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