

# Charge/Discharge System Controller **PFX2500 Series**

### Maximum voltage: 60.0000 V

Maximum current: 50.0000 A (2511,2512) / 200.0000 A (2532)

Capable of seamless charging/discharging (high speed charging/discharging transfer control) (2512,2532) Capable of high-precision measurement of cumulative capacities and amount of power as well as voltage and current

Pattern charging/discharging capabilities by 10000 steps are installed (2512,2532)

Supporting temperature measurement and capable of monitoring temperatures during charging/discharging

High speed sampling with maximum 1 ms can be realized (2512,2532)

A 6 V range is newly installed and is capable of high-precision measurement (2512,2532)

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 (2512,2532)



## 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

PFX2512/2532 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.



▲ Configuration(example) \*PC is provided by users. Multi Range DC Power Supply PWR800L(upper left), DC Electronic load PLZ1004W(lower)



Item	PFX2532 NEW	PFX2512		
Rating	60 V / 200 A	60 V / 50 A		
Application software	BPChec	ker3000		
Communication interface	LA	۱N		
Monitoring data minimum time interval	0.1	S		
High speed data sampling	Selected form 1 ms/10 ms/100 ms. Maximum 6000 points for every profile.			
Charge/discharge mode	12 modes Charging: CC, CC-CV(Cell CV Voltage)*1 Discharging: CC, CP, CC-CV(Cell CV Voltage)*1, CP-CV(Cell CV Voltage)*1 Others: Pattern(CC, CP, Cell CV Voltage*2, I-V, Pause			
Test condition configuration	Individual Profile Setting (unlimited) for Charging/Discharging, etc Conditional branching function from charge/discharge results is available.			
Seamless charge/discharge	Less than 50 ms	for transfer time.		
Termination condition	Temperatur	e condition.		

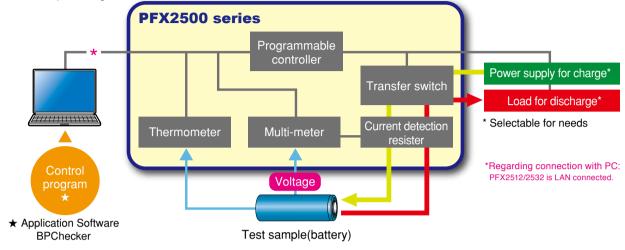
\*1 Can be set only when the optional OP02-PFX Volt/Thermometer Unit or OP03-PFX Voltmeter Unit is installed.
\*2 Can be set only when the optional OP02-PFX Volt/Thermometer Unit or OP03-PFX Voltmeter Unit is installed. Step time can be used in more than 500 ms.

### Complicated Systems Integrated into One

## FOR BATTERY TEST SYSTEM PFX2500 SERIES

PFX2512/2532 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. The DC power supply and electronic load that are applied configuration with PFX2512/2532, 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 18.

### 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.

### **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  $\mu$ V and 100  $\mu$ A, 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.

# 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).

### Up to 10000 Steps for Pattern Charge/Discharge

It is capable to set the CC/CP (with V, I limit) step values up to 10000. 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.

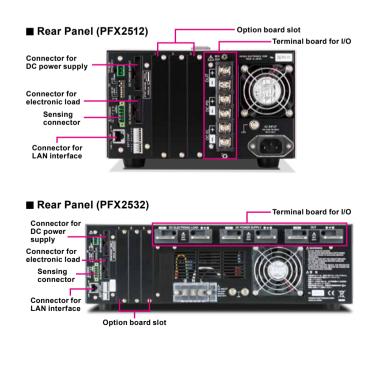
### Capable of Expanding Measurement Function

Measurement points, 4 points for voltage and 4 points for temperature, are able to be added by installing optional voltage/temperature Unit, 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.

By installing an Voltmeter Unit OP03-PFX in an option slot on the SL01-PFX<sup>\*1</sup>, you can increase the number of voltmeter measurement points. If OP03-PFX units are installed in all option slots of the SL01-PFX<sup>\*1</sup>, voltage measurement points can be expanded to 64 points.

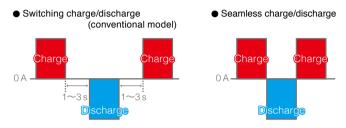
1 OP02-PFX cannot be installed.

When using the option "SD01-PFX", one of the internal expansion slot of PFX2353/2512 will be used.

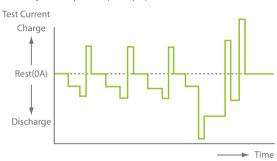


### Corresponding to Specification Test Pattern by Realizing Seamless Charge/Discharge

A certain time was required for transferring power supply and electronic load in the past. Seamless charge/discharge transfer has been realized at PFX2512/2532 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.



• EV/HEV cycle test pattern (example)

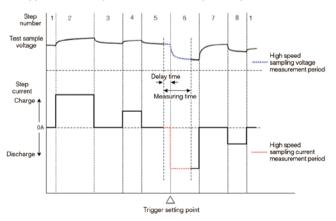


## Realized Maximum 1 ms High Speed Data Sampling

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.

- 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)
- ► 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)

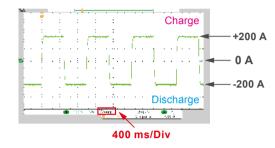


### [Pattern Charge/Discharge]

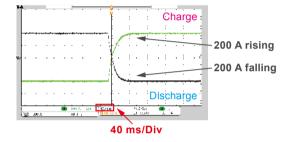
Setting condition

2 values CC pattern charge/discharge				
Step 1	CHG: 200 A 500 ms			
Step 2	DISCH: -200 A 500 ms			

#### Pattern current waveform (example)



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



## More Accurate Single Cell Evaluation with 6V Range

PFX2512/2532 equips Voltage Range transfer capability between 6 V and 60 V. A 6 V range was newly installed in PFX2512/2532 in order to perform evaluation more accurately even for a single cell. 6 V range accuracy =  $\pm$  (0.05 % of rdng + 0.04 % of f.s), 60 V range accuracy =  $\pm$  (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.

### **Applied to CAN interface**

PFX2512/2532 (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 PFX2512/2532, various electrical characteristic tests are able to be performed regardless battery manufacturer or customers.

I-V Characteristics Test
 Cycle Characteristics Test
 Charge/Discharge Rate Test

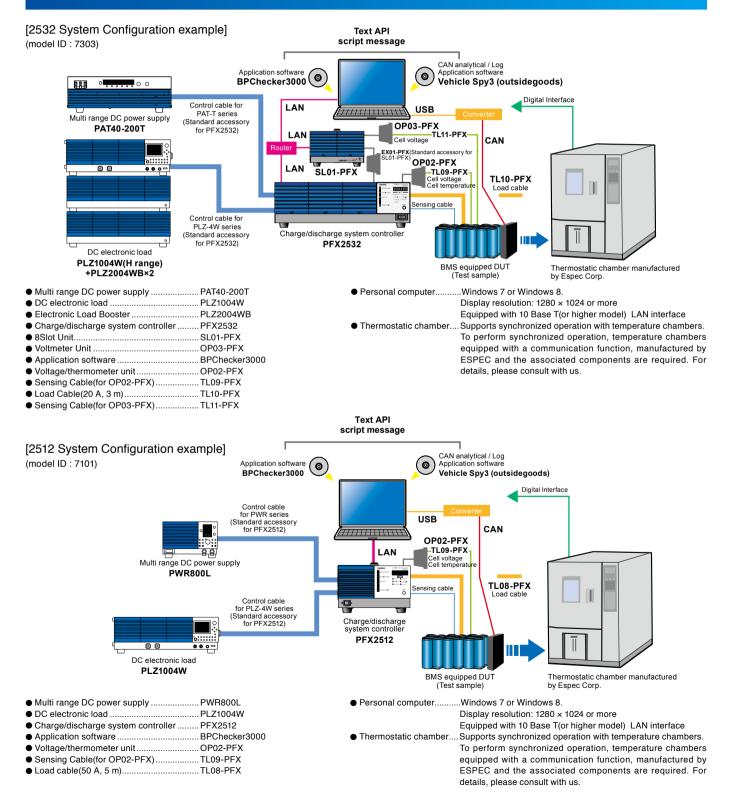
Temperature Characteristics Test

Charge/Discharge Efficiency Test

## FOR BATTERY TEST SYSTEM PFX2500 SERIES

- Capacitance Measurement Test
- Storage Characteristics Test
- Capacitance Change Test
- Actual Load Simulation Test
- BMS Validation Test

## **System Configuration**



# Comprehensive management from test condition setting to execution and data analysis on test results by PFX2512/2532 exclusive application software, BPChecker3000



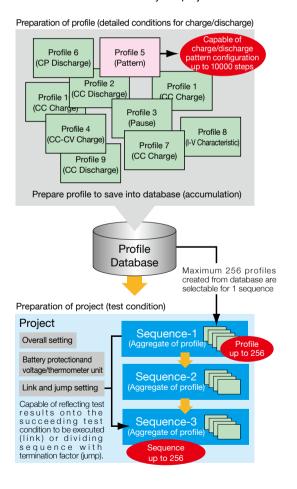
This software consists of four programs.

The application software, BPChecker3000 (SD007-PFX), equips with the new features of PFX2512/2532 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.

[Caution] BPChecker3000 is essential for PFX2512/2532 performance. PFX2512/2532 does not work with BPChecker2000.

## • 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

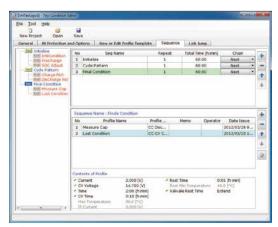
There is the pause function among profile types. Test is able to be paused by using this function.

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Ing / Disd	h mode	Step	Curre	Time's]	Tripper	+	End Condition/Limit			
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Capaci	NY TALL	2	-2.000	10.0	61	-	Total Time [h:min]	1:00		
(CC R	atio) [Ah]	3	0.000	10.0	12	+	Z Loop Count	1	*	
Desit.	(3)qm	4	3.500	10.0	13		Limit/Max Voltage	14.750		
(LastS)	tep)	5	5.200	2.0	E1 -	+	Limit Voltage [V]			
4	1.0 -	6	-4.000	10.0	E	10	Max Voltage [V]	1.000		
Rest		7	2.000	5.0	12	198	Min Voltage (V)	11.000		
Time [hat		8	4.000	8.0	10		Upper Limit Current (A)	8.005		
		9	-5.000	10.0	- 22		Under Limit Current [A]	0.000		
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▲ Preparation of profile

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#### ▲ Setting total project



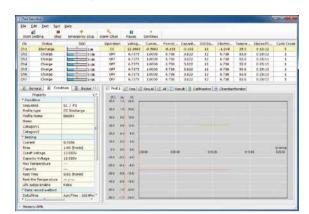
Sequence setting



## **Test Executive**

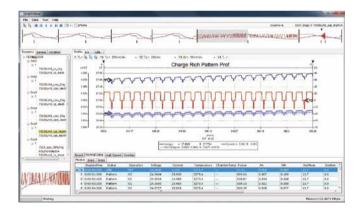
This program executes charge/discharge tests according to the test condition file created using the Test Condition Editor.

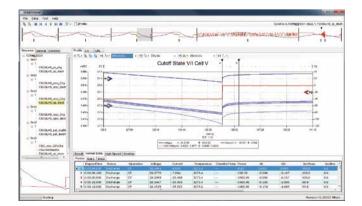
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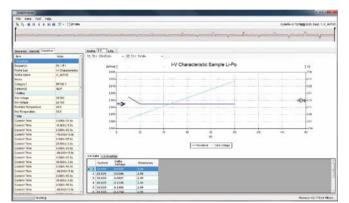


## **Graph Viewer**

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 7, Windows8.2
 Memory: 4 OB

- Memory: 4 G B or more
   HD drive: 1 GB 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

### Rated Output

		PFX2512	PFX2532
Number of output		1 ch	1 ch
Charging current ra	nge *1	0.000 A to 50.000 A	0.000 A to 200.000 A
Charging voltage	60 V range	0.000 V to 60.000 V	0.000 V to 60.000 V
range *1	6 V range	0.000 V to 6.000 V	0.000 V to 6.000 V
Discharge current ra	Discharge current range *1		0.000 A to 200.000 A
Discharge voltage	60 V range	0.000 V to 60.000 V	0.000 V to 60.000 V
range *1 *2	6 V range	0.000 V to 6.000 V	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

			PFX2512	PFX2532
Static				
Constant	Range *1		0.000 A to 50.000 A	0.000 A to 200.000 A
current charge/	Accuracy	*2	*3	*3
discharge	Resolutio	n	1 mA	1 mA
	Range *1	60 V range	0.000 V to 60.000 V	0.000 V to 60.000 V
Constant	Range	6 V range	0.000 V to 6.000 V	0.000 V to 6.000 V
voltage charging	Accuracy	*2	*3	*3
5 5 5	Resolutio	n	1 mV	1 mV
Constant	Range *1		0.000 A to 20.000 V	0.000 A to 20.000 V
cell voltage Charge/	Accuracy	*2	*3	*3
discharge*9	Resolutio	n	1 mV	1 mV
Constant	Range *1		0.10 W to 3000.00 W	1 W to 12000 W
power	Accuracy	*2 *4	± (0.5 % of set + 1 W) *7	± (0.5 % of set + 1 W) *7
discharging	Resolutio	n *5	10 mW	1 W
Pulse				
	Range		_	-
	Accuracy		-	-
Constant	Resolutio	n	-	_
current	Number o	of settings	-	_
discharging		Range	-	_
	Time width	Accuracy	-	-
		Resolution	-	-
	Range	60 V range	-	-
		6 V range	-	-
	Accuracy		-	-
Constant	Resolution	60 V range	-	-
power		6 V range	-	-
discharging	Number of settings		-	-
		Range	-	-
	Time	Accuracy	-	-
	width	Resolution	-	-
Pattern *8	1	1		
	Range *1		-50.000 A to 50.000 A	-200.000 A to 200.000 A
	Accuracy	*2	*3	*3
	Resolutio	n	1 mA	1 mA
Pattern			10000 values	10000 values
constant	Number o	of settings	(Maximum number	(Maximum number
current			of steps)	of steps)
	-	Range	0.1 s to 9999.9 s (Time width for 1 step)	0.1 s to 9999.9 s (Time width for 1 step)
	Time width	Accuracy*2	± (0.05 % of set + 10 ms)	± (0.05 % of set + 10 ms)
		Resolution	100 ms	100 ms
	Range *1		-3000.00 W to 3000.00 W	-12000 W to 12000 W
	Accuracy	*2	± (0.5 % of set + 1 W) *7	± (0.5 % of set + 10 W) *7
	Resolutio		10 mW	1 W
Pattern			10000 values	10000 values
constant power	Number o	-	(Maximum number of steps)	(Maximum number of steps)
	1	Range	0.1 s to 9999.9 s	0.1 s to 9999.9 s

Resolution 100 ms 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

0.1 s to 9999.9 s

Accuracy\*2 ± (0.05 % of set + 10 ms) ± (0.05 % of set + 10 ms)

0.1 s to 9999.9 s

Time

width

\*3 External equipment is controlled so as to Measurement Value being equal to Set Value by the software control.

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 entities the generative of the set of the set power value through software calculation.

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). \*9 Can be set only when the optional Volt / Thermometer Unit OP02-PFX or OP03-PFX Voltmeter Unit is installed.

Unless specified otherwise, the specifications are for the following settings and conditions. \* The warm-up time is 30 minutes. \* TYP (typical) values do not guarantee the performance. \* "reading" Indicates the readout value. \* "set" Indicates the setting value. \* "rating" Indicates the rated. \* "Static" General term to indicate CC charge, CC-CV charge, CC discharge, CC-CV discharge, CP discharge, and CP-CV discharge \* "Pattern" General term to indicate pattern charge/discharge and I-V characteristics charge/discharge

### Measurement Accuracy

	surem	ent Acc	-	
Statia			PFX2512	PFX2532
Static	Range *1		0.0000 A to 50.0000 A	0.0000 A to 200.0000 A
Charge / discharge current	Accuracy	*2 *3	± (0.15 % of reading + 0.02 % of rating)	± (0.2 % of reading + 0.1 % of rating)
measurement	Resolutio	n	0.1 mA	1 mA
	10001010	60 V range	-6.0000 V to 60.0000 V *4	-6.0000 V to 60.0000 V *4
	Range	6 V range	-1.0000 V to 6.0000 V *5	-1.0000 V to 6.0000 V *5
Voltage measurement	Accuracy	60 V range	± (0.05 % of reading + 0.02 % of rating)	± (0.05 % of reading + 0.02 % of rating)
measurement	*2 *3 *6	6 V range	± (0.05 % of reading + 0.04 % of rating)	± (0.05 % of reading + 0.04 % of rating)
	Resolutio	n *6	0.1 mV	0.1 mV
	Range		0.000 W to 3000.000 W	0.0 W to 12000.0 W
Power measurement	Accuracy		Software calculation (voltage measurement 5 current measurenent)	Software calculation (voltage measurement 5 current measurenent)
	Resolutio	n	1 mW	100 mW
	Range		0.000 Ah to 2000.000 Ah	0.000 Ah to 2000.000 Ah
Capacity calculation	Accuracy	*2 *3		measuring accuracy e accuracy
	Resolutio	n	1 mAh	1 mAh
Time *7	Accuracy	*2 *8	±10 ppm (TYP values)	±10 ppm (TYP values)
Pulse	1			
Charge /	Range		-	-
discharge	Accuracy		-	-
current	Resolution		-	-
	Measured	value	-	-
	Range		-	-
	Accuracy		-	-
Battery voltage	Resolution		-	-
vollage	Management	High voltage	-	-
	Measurement	Low voltage Arbitrary	-	-
Capacity	Range		-	-
calculation	Accuracy		-	-
	Resolutio	n	-	-
Time	Accuracy		-	-
Pattern			1	
	Range *1		-50.0000 A to 50.0000 A	-200.0000 A to 200.0000 A
Charge / discharge	Accuracy *2		± (0.2 % of reading + 0.03 % of rating)	± (0.2 % of reading + 0.1 % of rating)
current	Resolutio	n	0.1 mA	1 mA
	Measured		Average current, Update a data per period of 1 s	Average current, Update a data per period of 1 s
	Range	60 V range	-6.0000 V to 60.0000 V *4	-6.0000 V to 60.0000 V *4
Voltage		6 V range 60 V range	-1.0000 V to 6.0000 V *5 ± (0.05 % of reading + 0.02 % of rating)	-1.0000 V to 6.0000 V *5 ± (0.05 % of reading + 0.02 % of rating)
measurement	Accuracy *2 *6	6 V range	± (0.05 % of reading + 0.04 % of rating)	± (0.05 % of reading + 0.04 % of rating)
	Resolutio	n *6	0.1 mV	0.1 mV
	Range		-3000.000 W to 3000.000 W	-12000.000 W to 12000.000 W
Power measurement	Accuracy	*2	Software calculation (voltage measurement 5 current measurement)	Software calculation (voltage measurement 5 current measurement)
	Resolutio	n	1 mW	10 mW
	Range	-	-2000.000 Ah to 2000.000 Ah	-2000.000 Ah to 2000.000 Ah
Capacity calculation	Accuracy	*2	Rely on the current measuring accuracy and the time accuracy	Rely on the current measuring accuracy and the time accuracy
	Resolutio	n	1 mAh	1 mAh
Time *7	Accuracy	*2 *8	±10 ppm (TYP values)	±10 ppm (TYP values)

\*1 Measurable range: PFX2512/ -52.500 A to 52.500 A (TYP value) However, accuracy outside of the range is not assured. PFX2532/ -210.000 Å to 210.000 Å (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 the elapsed time (Cutoff condition) when charging / discharging or resting. \*8 Monthly error: approximately 30 seconds.

### Measurement Accuracy

			PFX2512	PFX2532	
High speed sa	mpling				
	Range *3		-50.0000 A to 50.0000 A	-200.0000 A to 200.0000 A	
		1 ms sampling	± (0.2 % of reading + 0.5 % of rating)	± (0.4 % of reading + 0.5 % of rating)	
Current	Accuracy *1 *3 *4	10 ms sampling	± (0.15 % of reading + 0.05 % of rating)	± (0.3 % of reading + 0.1 % of rating)	
measurement		100 ms sampling	± (0.15 % of reading + 0.02 % of rating)	± (0.2 % of reading + 0.1 % of rating)	
		1 ms sampling			
	Resolution	10 ms sampling	0.1 mA	1 mA	
		100 ms sampling			
	Banga	60 V range	-6.0000 V to 60.0000 V	-6.0000 V to 60.0000 V	
	Range	6 V range	-1.0000 V to 6.0000 V	-1.0000 V to 6.0000 V	
	Accuracy *1 *3 *4	1 ms sampling *2	± (0.1 % of reading + 0.1 % of rating)	± (0.1 % of reading + 0.1 % of rating)	
		10 ms sampling *2	± (0.1 % of reading + 0.05 % of rating)	± (0.1 % of reading + 0.05 % of rating)	
Voltage measurement		100 ms sampling	60 V range: ± (0.05 % of reading + 0.02 % of rating)	60 V range: ± (0.05 % of reading + 0.02 % of rating)	
		Too ms sampling	6 V range: ± (0.05 % of reading + 0.04 % of rating)	6 V range: ± (0.05 % of reading + 0.04 % of rating)	
	-	1 ms sampling			
	Resolution	10 ms sampling	0.1 mV	0.1 mV	
	-	100 ms sampling			

\*1 Ambient temperature at 18 °C to 28 °C

\*2 Common with 6 V/60 V ranges
\*3 Accuracy outside of the rating output range is not assured.
\*4 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 (SEMITEC Corporation) is used for temperature detecting element						
	PFX2512	PFX2532				
Resistor (temperature) measuring	Resistor (temperature) measuring section *1					
Measurement range	-40.0 °C te	o 100.0 °C				
Measurement resolution	0.1	°C				
Management and the state	± 0.5 °C (measurement temperature at 0 °C to 40.0 °C)					
Measurement accuracy *2 *3	± 1 °C (measurement temperature at -20 °C to 80 °C)					
Reference (thermistor 103AT-2)						
Part name	Thermistor (103AT-2 by	SEMITEC Corporation)				
R25	10.0 kΩ, Nominal zero-po	wer resistor value at 25 °C				
Operating temperature range	-50.0 °C t	o 110.0 °C				
Temperature accuracy *3	± 0.5 °C (measurement tem	perature at 0 °C to 40.0 °C)				
Tolerance	± 1	%				
Constant-B	3435 K ± 1 % (measurem	ent temperature at 25 °C)				

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

### Protection Functions

	PFX2512	PFX2532	
Overvoltage (overcharge) protection	Software OVP, Hardware OVP		
Undervoltage (overdischarge) protection	Software UVP, Hardware UVP		
Overcurrent protection	Software OCP *1, Hardware OCP Load shorting protection		
Capacity (overcharge/ overdischarge) protection	Software OAH *2		
Overtemperature (DUT) protection	Software OTP		
Vibration alarm			

\*1 For the software OCP, the application software automatically sets a value obtained by adding 5 A to the preset current. \*2 The application software calculates the value by multiplying the nominal capacity by the preset

percentage and sets the capacity

## FOR BATTERY TEST SYSTEM PFX2500\SERIES

### General Specifications

	al opecifica	lions			
		PFX2512	PFX2532		
Nominal inp	ut rating	100 Vac to 240 \	/ac, 50 Hz/60 Hz		
Input voltage	e range	90 Vac to 250 Vac			
Power cons	umption		Amax installed: 80 VAmax		
Operating te humidity ran		0 °C to 40 °C, 20 % rh to 85 % rh (No condensation)			
Storage tem range	perature/humidity	-10 °C to 60 °C, 0 % rh to 9	90 % rh (No condensation)		
Operating e	nvironment	Indoors, Overvo	Itage category		
Altitude		Up to 2	2000 m		
Isolation voltage	Across the I/O terminals and chassis	± 80 Vmax	± 70 Vmax		
Insulation	Primary and chassis				
resistance	Primary and across the I/O terminals	500 Vdc, 30 MΩ or gr	eater, 70 % rh or less		
Withstand	Primary and chassis				
voltage	Primary and across the I/O terminals	1500 Vac, No abnorr	nalities over 1 minute		
Safety *1		Complies with the requirements of the following directive and standard. Low Voltage Directive 2014/35/EU EN61010-1 (Class I *2, Pollution degree 2)	Complies with the requirements of the following directive and standards. Low Voltage Directive 2014/35/EU EN 61010-1 (Class I *2, Pollution degree 2)		
Electromagnetic compatibility(EMC) *1		Complies with the requirements of the following directive and standard. EMC Directive 2014/30/EU EN61326-1 (Class A *3) EN55011 (Class A *3, Group 1 *4) EN61000-3-2 EN61000-3-3 Applicable under the following conditions The maximum length of all cabling and wiring connected to the PFX2512 is less than 5 m.	Complies with the requirements of the following directive and standards. EMC Directive 2014/30/EU EN 61326-1 (Class A *3) EN 55011 (Class A *3, Group 1 *4) EN 61000-3-3 Applicable under the following conditions The maximum length of all cabling and wiring connected to the PFX2532 is less than 3 m.		
External dim	iensions	Refer to the dimensions			
Weight	Deverse	Approx. 7 kg (15.43 lb)	Approx. 17 kg (37.48 lb)		
	Power cord Cable with crimp terminal	1 pc 4 pcs (Red: 2 pcs, White: 2 pcs) 45 cm each (17.72 inch)	1 pc -		
	I/O terminal cover set	-	Three terminal covers, six cable ties for locking		
	I/O terminal M8 screw set	-	6 sets		
	Load input terminal cover set	-	Cover, four auxiliary bands		
Accessories	26-core flat cable	1 pc	1 pc		
	20-core flat cable 26-core cable (for PAT-T)	1 pc -	1 pc 1 pc		
	Sensing connector	1 pc	1 pc		
	Sensing connector cover set	-	One cover set, one cable tie for locking		
	Thermistor	1 pc	1 pc		
	Lock lever	2 pcs	2 pcs		
	LAN cable (2 m)	1 pc	1 pc		
	Operation manual	1 сору	1 сору		

\*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.

<sup>44</sup> 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.

# For evaluation of secondary batteries! Solution for battery test achieved with our DC power supply and electronic load!!

## Charge/Discharge test system can be configured for up to 60V and 50A

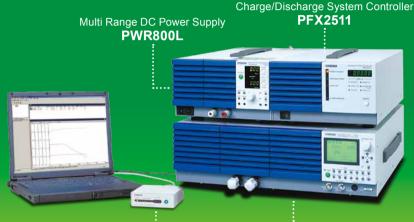
#### PFX2511 is a high performance Charge/ Discharge system controller that takes measurements in combination with our DC power supply and electronic load.

In recent years, voltage (number of stacks) and capacity (Ah value) of secondary batteries have become varied, and support for such diversity is required of characteristic evaluations and test equipment. However, the general-purpose test equipment supports measurements and evaluations of large-capacity batteries. We were left with no choice but prepare a DC power supply, electronic load, digital multi-meter, recorder, temperature measuring device and such equipment and order a custom-designed system to control them or make it on our own (while worrying about the reliability).

Based on our abundant experience with battery evaluation systems, we have packed PFX2511 with our technology of Charge/Discharge control and high-precision measurement required for electronic characteristic evaluation of batteries. If you already have our power supply and electronic load, you can easily configure a high-precision battery test system.

#### System configuration (example) ▼

The example system configuration consists of the charge/ discharge system controller "PFX2511", the DC power supply "PWR800L", and the Electronic load "PLZ1004W". The dimention of the system may differ depends on the configuration of the selected models. (the PC show in the picture is not included.)The PFX2121 (communication control unit) is also required.



Communication control unit PFX2121 : DC Electronic load PLZ1004W

# Charge/Discharge System Controller





Application examples for secondary batteries



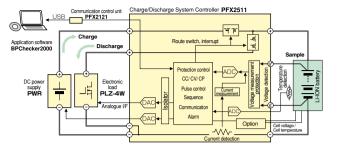
Item	PFX2511	
Rating	60 V / 50 A	
Application software	BPChecker2000 (free version attached, 2-CH without limitation of function from qualifiedversion)	
Communication interface	TP-BUS (PFX2121 is required for PC connection)	
Monitoring data minimum time interval	1 s (up to 30 channels), 2 s (more than 30 channels)	
High speed data sampling	X	
Charge/discharge mode	6 modes Charging: CC, CC-CV Discharging: CC, CP, CC-Pulse, CP-Pulse	
Test condition configuration	Maximum 20 patterns are divided into individual loop setting and total repeat setting with charging a discharging as a pair.	
Seamless charge/discharge	imes (Approx. 2 seconds for charge/discharge transfer time: Depending on the number of channels)	
Termination condition	Fixed time	

### Flexible configuration of the system achieved with the conventional power supply and electronic load

## FOR BATTERY TEST SYSTEM PFX2500 SERI

PFX2511 is used as a charge and discharge test system combined with the selected DC power supply (charging) and electronic load (discharging). This allows flexible configuration of the system.

System Conceptual Diagram



### **Easy configuration** The selected equipment can be assigned for the system!

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 PFX2511, can be used for the system. This allows you to have a test system at low cost.

\* For details, please refer to the list of applied configuration and options on page 18

### **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.

### **Protection Functions** for Safety Operation

Several protective functions are required to improve the safety of charge and discharge test of secondary batteries. PFX2511 is 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 PFX2511 and it equips with a function to ensure connection between the DUT (batteries) and the DC power supply/electronic load as well as a highspeed 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).

**System Configuration** 

## **Precise Measurement**

The high-precision measurement circuit is equipped in the PFX2511. 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)

## **Pulse discharge function**

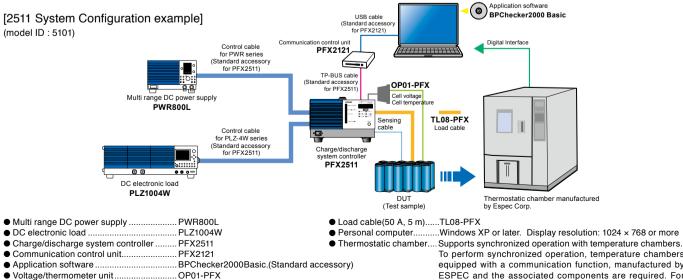
It allows discharge test that simulates a change of dynamic load current in cellular phones, digital cameras, laptop computers, etc. Capacity calculation is performed with the actual measurements from the pulse current and the maximum and minimum voltages in the cycle are also measured.

### **Capable of complex control of** charge and discharge

The unit can perform complex control of charge and discharge required for testing (controls time and measurement of voltage, current, temperature, capacity and power). Even when controlling remotely, a change of the display with the switches on the front panel allows you to view and check the details of the test.

### **Protection function for the DUT** cable connection

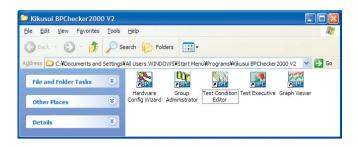
It detects such as an imcomplete connection of the DUT, an abnormality of wirings, the potential difference when it exceeds a regulated value of the DUT cable and the voltage sensing line, and it protects connecting equipment and the DUT (battery) from being damaged.



Sensing Cable.....TL09-PFX

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.

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



## Program Structure

### Test Condition Editor

E

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.

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[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

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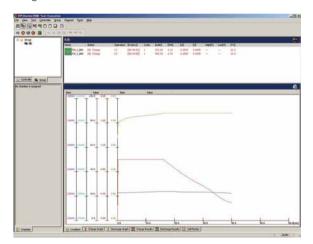
- Mouse: Required
   Display resolution: 1024 × 768 or more Printer: Compatible with windows
- No. of USB ports: More free USB ports than the number of control units to be used
   The thermostatic chambers that can be controlled via Espec Corp.'s protocol converter/USB-RS485
- VISA library: NI-VISA 3.3 or later, Agilent I/O Libraries Suite 15.0 or later , or KI-VISA 3.1.3 or later

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.

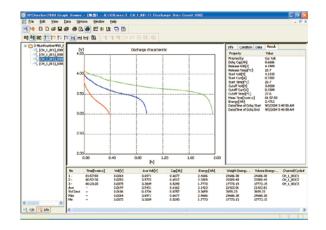
### Test Executive

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 processina.

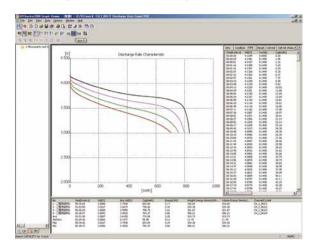


## FOR BATTERY TEST SYSTEM PFX2500 SERIES

## Test sample data taken by the application software BPChecker2000

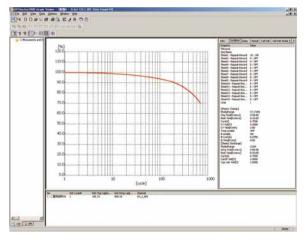
## **Discharge Rate Characteristics Test**

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



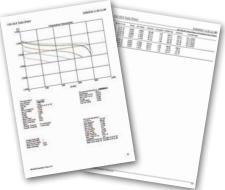
## Cycle Life Test

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



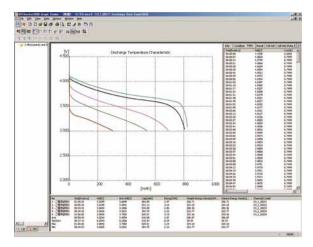
## **Report Output**

Plotted images can be printed out by Graph Viewer.



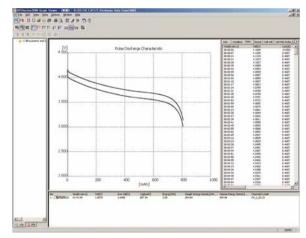
## Discharge Temperature Characteristics Test

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



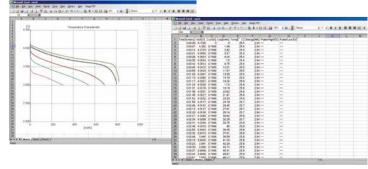
## Pulse Discharge Test

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



## **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

### Rated Output

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

\*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

Static         Range *1         0.000 A to 50.000 A           Constant charge/ discharge         Range *1         0.000 A to 50.000 A           Constant constant constant collage charging         Range *1         60 V range         0.000 V to 60.000 V           Constant collage charging         Range *1         60 V range         -           Accuracy *2         *3           Resolution         1 mV           Constant cell voltage charging         Range *1         -           Accuracy *2         -           Resolution         -           Accuracy *2         -           Resolution         -           Accuracy *2         -           Resolution         -           Accuracy *2 *4         *3           Resolution *5         100 mW           Power         Resolution         1 mA           Accuracy *2 *4         *3           Resolution         1 mA           Number of settings         20 values           Time width         Range         5.0 ms to 65 000.0 ms           Accuracy *2 *4         *3         60 V range         -           Accuracy *2 *4         *3         60 V range         -           Constant power         R				PFX2511
Current charge/ discharge         Accuracy *2         *3           Constant voltage charging         Range *1         60 V range         0.000 V to 60.000 V           Constant voltage charge/ discharge         Range *1         6 V range         -           Accuracy *2         *3           Resolution         1 mV           Constant discharge/ discharge/ discharging         Range *1         -           Resolution         -           Accuracy *2         -           Resolution         -           Resolution         -           Resolution *5         100 mW           Pulse         -           Constant discharging         Range *1         0.000 A to 50.000 A           Accuracy *2 *4         *3           Resolution         1 mA           Number of settings         20 values           Time width         Accuracy *2 *6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs         60 V range         -           Pattern         -         -         -           Accuracy *2 *6         ±(0.05 % of set + 0.05 ms)         -           Resolution         -         -         -           Accuracy *2 *6         ±(0.05 % of set + 0.0	Static			
Charge/ discharge         Accuracy*2         -3           Constant voltage charging         Range *1         60 V range         0.000 V to 60.000 V           Accuracy*2         *3	Constant	Range *1		0.000 A to 50.000 A
discharge         Resolution         1 mA           Constant voltage charging         Range *1         60 V range         0.000 V to 60.000 V           Accuracy *2         *3           Resolution         1 mV           Constant cell voltage Charge/ discharge/ discharge/ discharging         Range *1         -           Resolution         -           Constant discharge/ discharging         Range *1         0.1 W to 3 000.0 W           Accuracy *2         -           Constant discharging         Range *1         0.100 k to 50.000 A           Accuracy *2 *4         *3           Resolution *5         100 mW           Pulse         -           Constant discharging         Range *1         0.000 A to 50.000 A           Accuracy *2         *3           Resolution         1 mA           Constant discharging         Range *1         0.000 A to 50.000 A           Accuracy *2         *3           Resolution         1 mA           Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs         60 V range         -           Pattern         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         -<		Accuracy *2		*3
Constant voltage charging         Range *1         6 V range         -           Accuracy *2         *3           Resolution         1 mV           Constant cell voltage Charge *7         Range *1         -           Accuracy *2         -           Accuracy *2         -           Accuracy *2         -           Constant gloscharging         Range *1         -           Resolution         -           Pulse         Range *1         0.1 W to 3 000.0 W           Accuracy *2 *4         *3           Resolution *5         100 mW           Pulse         Range *1         0.000 A to 50.000 A           Accuracy *2 *4         *3           Resolution         1 mA           Number of settings         20 values           Range *1         0.000 A to 50.000 A           Accuracy *2 *4         *3           Resolution         1 mA           Number of settings         20 values           Range *1         60 V range         -           Accuracy *2 *4         *3           Resolution         100 µs           60 V range         -           Accuracy *2 *4         *3           Resolution		Resolution		1 mA
Range *1         6 V range         -           Accuracy *2         *3           Resolution         1 mV           Constant cell vollage Charge/ discharge*7         Range *1         -           Resolution         -         -           Accuracy *2         -         -           Resolution         -         -           Mischarging         Range *1         0.1 W to 3 000.0 W           Accuracy *2 *4         *3         -           Resolution *5         100 mW         -           Pulse         Range *1         0.000 A to 50.000 A           Accuracy *2         *3         -           Resolution         1 mA         -           Number of settings         20 values           Range *1         60 V range         -           Accuracy *2 *4         *3         -           Constant power         Range *1         60 V range         -           Accuracy *2 *4			60 V range	0.000 V to 60.000 V
Voltage charging         Accuracy *2         *3           Resolution         1 mV           Constant cell voltage *7         Range *1         -           Accuracy *2         -           Accuracy *2         -           Accuracy *2         -           Resolution         -           Accuracy *2         -           Resolution         -           Resolution         -           Resolution         -           Resolution *5         100 mW           Pulse         Range *1         0.000 A to 50.000 A           Accuracy *2         *3           Resolution *5         100 mW           Pulse         Range *1         0.000 A to 50.000 A           Accuracy *2         *3           Resolution         1 mA           Number of settings         20 values           Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs         60 V range         -           Accuracy *2*4         *3         -           Accuracy *2*4         *3         -           Resolution         100 µs         60 V range         -           Number of settings         <		Range *1	-	-
Resolution         1 mV           Constant cell voltage (charge' 7)         Range *1         -           Constant power discharging         Range *1         -           Constant power discharging         Range *1         0.1 W to 3 000.0 W           Pulse         Range *1         0.1 W to 3 000.0 W           Pulse         Accuracy *2 *4         *3           Constant current         Range *1         0.000 A to 50.000 A           Maccuracy *2 *4         *3           Resolution         1 mA           Number of settings         20 values           Resolution         1 mA           Number of settings         20 values           Range *1         60 V range         0.1 W to 3 000.0 W           60 V range         -         -           Accuracy *2 *4         *3         -           Resolution         60 V range         -           Accuracy *2 *4         *3         -           Resolution         60 V range         -           Accuracy *2 *4         *3         -           Resolution         60 V range         -           Number of settings         20 values         -           Resolution         100 µs         -		Accuracy *2	•	*3
Constant cell voltage (charge/ discharge *7         Range *1         -           Accuracy *2         -           Resolution         -           Constant power discharging         Range *1         0.1 W to 3 000.0 W           Accuracy *2 *4         *3           Resolution *5         100 mW           Pulse	ondrging	Resolution		1 mV
cell voltage (charge)*7         Accuracy*2         -           Accuracy*2         -         -           Resolution         -         -           Constant power discharging         Range*1         0.1 W to 3 000.0 W           Accuracy*2*4         *3           Resolution *5         100 mW           Pulse         -           Constant current         Range*1         0.000 A to 50.000 A           Accuracy*2         *3           Resolution         1 mA           Number of settings         20 values           Range*1         60 V range         0.1 W to 3 000.0 W           Accuracy*2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           60 V range         0.1 W to 3 000.0 W           6V range         -           Accuracy*2*4         *3           Resolution         60 V range           Number of settings         20 values           Range*1         60 V range           Number of settings         20 values           Range         5.0 ms to 65 000.0 ms           Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         -           Number of settings         -	Constant			
Constant power discharges         Resolution         -           Constant power discharging         Range *1         0.1 W to 3 000.0 W           Accuracy*2*4         *3           Resolution *5         100 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           Accuracy*2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           60 V range         0.1 W to 3 000.0 W           60 V range         -           Accuracy*2*4         *3           Resolution         60 V range           Number of settings         20 values           Resolution         60 V range           Number of settings         20 values           Resolution         60 V range           Number of settings         20 values           Resolution         60 V range           Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Pattern         Accuracy         -           Constant current	cell voltage			
Constant power         Range *1         0.1 W to 3 000.0 W           Accuracy *2 *4         *3           Resolution *5         100 mW           Pulse				
Constant discharging         Accuracy *2 *4         *3           Pulse         Range *1         0.000 A to 50.000 A           Accuracy *2         *3           Constant current         Resolution         1 mA           Number of settings         20 values           Time width         Range         5.0 ms to 65 000.0 ms           Time width         Recuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           60 V range         0.1 W to 3 000.0 W           6 V range         -           Accuracy *2*4         *3           Constant power         60 V range         100 µw           Resolution         60 V range         -           Number of settings         20 values           Range *1         60 V range         -           Number of settings         20 values           Resolution         60 V range         -           Number of settings         20 values           Range         5.0 ms to 65 000.0 ms           Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         -         -           Accuracy         -         -           Accuracy         -	0			0.1 W to 3.000.0 W
Resolution *5         100 mW           Pulse         Range *1         0.000 A to 50.000 A           Accuracy *2         *3           Constant current         Resolution *5         1 mA           Number of settings         20 values           Time width         Accuracy *2*6         ± (0.05 % of set + 0.05 ms)           Resolution         100 mW           Constant current         Range *1         60 V range           Accuracy *2*4         *3           Constant power         60 V range         0.1 W to 3 000.0 W           Resolution         60 V range         -           Accuracy *2*4         *3         -           Resolution         60 V range         -           Accuracy *2*4         *3         -           Resolution         60 V range         -           Number of settings         20 values           Resolution         8 Arage         5.0 ms to 65 000.0 ms           Time width         Accuracy *2*6         ± (0.05 % of set + 0.05 ms)           Resolution         100 µs         -           Pattern         Range         -           Constant current         Range         -           Number of settings         -		0	*4	
Pulse         Range *1         0.000 A to 50.000 A           Accuracy *2         *3           Constant current         Resolution         1 mA           Number of settings         20 values           Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Accuracy *2*4         *3           Constant power         60 V range         0.1 W to 3 000.0 W           Resolution         100 µs           60 V range         0.1 W to 3 000.0 W           6 V range         -           Accuracy *2 *4         *3           Resolution         60 V range           Resolution         60 V range           Number of settings         20 values           Resolution         60 V range           Number of settings         20 values           Resolution         100 µs           Pattern         Range           Resolution         -           Resolution         -           Resolution         -           Resolution         -           Resolution         -           Resolution         -           Range         -           Accuracy <td></td> <td></td> <td></td> <td>-</td>				-
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 65 000.0 ms           Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           60 V range         0.1 W to 3 000.0 W           61 V range         -           Accuracy *2*4         *3           Resolution         100 µs           60 V range         0.1 W to 3 000.0 W           6 V range         -           Accuracy *2*4         *3           Resolution         60 V range           Number of settings         20 values           Resolution         6 V range           Number of settings         20 values           Resolution         100 µs           Pattern         Range         5.0 ms to 65 000.0 ms           Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Pattern         Range         -           Constant         Range         -           Number of settings         -         -           Accuracy	Pulse	resolution	~	
Accuracy *2         *3           Resolution         1 mA           Number of settings         20 values           Time width         Range         5.0 ms to 65 000.0 ms           Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           60 V range         0.1 W to 3 000.0 W           60 V range         -           Accuracy *2 *4         *3           Resolution         60 V range           Accuracy *2 *4         *3           Resolution         60 V range           Accuracy *2 *4         *3           Resolution         60 V range           Number of settings         20 values           Resolution         6 V range           Number of settings         20 values           Range         5.0 ms to 65 000.0 ms           Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Pattern         Range         -           Constant current         Range         -           Number of settings         -         -           Accuracy         -         -           Accuracy         -         -	. 0100	Range *1		0.000 A to 50.000 A
Resolution         1 mA           current discharging         Number of settings         20 values           Time width         Range         5.0 ms to 65 000.0 ms           Time width         Accuracy *2*6         ±(0.05% of set + 0.05 ms)           Range *1         60 V range         0.1 W to 3 000.0 W           Accuracy *2*4         *3           Accuracy *2*4         *3           Accuracy *2*4         *3           Resolution         60 V range         -           Accuracy *2*4         *3           Mumber of settings         20 values           Resolution         60 V range         -           Number of settings         20 values           Range         5.0 ms to 65 000.0 ms           Time width         Accuracy *2*6         ±(0.05% of set + 0.05 ms)           Resolution         100 µs         Pattern           Pattern         Range         -           constant current         Range         -           Number of settings         -         -           Accuracy         -         -           Accuracy         -         -           Accuracy         -         -           Accuracy         - <t< td=""><td></td><td></td><td></td><td></td></t<>				
Number of settings         20 values           discharging         Range         5.0 ms to 65 000.0 ms           Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Range *1         60 V range         0.1 W to 3 000.0 W           Accuracy *2*4         *3           Accuracy *2*4         *3           Accuracy *2*4         *3           Mumber of settings         20 values           Number of settings         20 values           Number of settings         20 values           Number of settings         20 values           Range         5.0 ms to 65 000.0 ms           Time width         Accuracy *2*6           Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Pattern         Accuracy           Pattern         Range         -           Resolution         -           Resolution         -           Resolution         -           Resolution         -           Range         -           Accuracy         -           Resolution         -           Range         -	Constant			
Range         5.0 ms to 65 000.0 ms           Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Range *1         60 V range         0.1 W to 3 000.0 W           Accuracy *2 *4         *3           Accuracy *2 *4         *3           Accuracy *2 *4         *3           Mumber of settings         20 values           Number of settings         20 values           Time width         Range         5.0 ms to 65 000.0 ms           Accuracy *2 *6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Pattern         Range         -           Pattern         Range         -           Resolution         -         -           Resolution         -         -           Resolution         -         -           Accuracy         -         -			ettinas	
Resolution         100 µs           Range *1         60 V range         0.1 W to 3 00.0 W           6 V range         -           Accuracy *2 *4         *3           Resolution         60 V range         100 mW           power         60 V range         -           Mesolution         60 V range         -           Number of settings         20 values           Time width         Range         5.0 ms to 65 000.0 ms           Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Pattern         Range         -           Resolution         100 µs           Pattern         Range         -           Resolution         -         -           Resolution         -         -           Number of settings         -         -           Time width         Accuracy         -           Accuracy         -         -     <				
Resolution         100 µs           Range *1         60 V range         0.1 W to 3 000.0 W           6 V range         -           Accuracy *2 *4         *3           60 V range         100 mW           60 V range         -           Accuracy *2 *4         *3           60 V range         100 mW           60 V range         -           Resolution         60 V range           Number of settings         20 values           Resolution         8           Time width         Range           Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Pattern         Range         -           Resolution         -           Resolution         -           Resolution         -           Resolution         -           Number of settings         -           Accuracy         -           Range         -           Accuracy         -           Resolution         -           Range         -           Accuracy         -           Accuracy         -           Accuracy         -		Time width	Accuracy *2*6	±(0.05 % of set + 0.05 ms)
Range *1         6         V range         -           Accuracy *2 *4         *3           Accuracy *2 *4         *3           Resolution         60 V range         100 mW           6 V range         -           Mumber of settings         20 values           Time width         Range         5.0 ms to 65 000.0 ms           Time width         Range         5.0 ms to 65 000.0 ms           Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Resolution         100 µs           Pattern         Accuracy         -           Accuracy         -           Range         -           Accuracy         -           Resolution         100 µs           Pattern         -           Resolution         -           Number of settings         -           Time width         Range         -           Accuracy         -         -           Range         -         -           Accuracy         -         -           Range         -         -           Accuracy         -         -           Accuracy         -         -           Accuracy <td></td> <td></td> <td></td> <td>100 µs</td>				100 µs
Resolution         60 V range         -           Accuracy *2 *4         *3           Resolution         60 V range         100 mW           Mumber of settings         20 values           Number of settings         20 values           Pattern         Range         5.0 ms to 65 000.0 ms           Pattern         Range         5.0 ms to 65 000.0 ms           Pattern         Range         -           Resolution         100 µs           Pattern         Range         -           Resolution         -           Range         -           Time width         Accuracy           Accuracy         -           Range         -           Accuracy         -           Accuracy         -           Accuracy         -           Range         -           Accuracy         -           Accuracy         -           Accuracy         -     <		<b>D</b>	60 V range	0.1 W to 3 000.0 W
Constant power discharging     Resolution     60 V range     100 mW       Resolution     6 V range     -       Number of settings     20 values       Time width     Range     5.0 ms to 65 000.0 ms       Accuracy *2*6     ±(0.05 % of set + 0.05 ms)       Resolution     100 µs       Pattern     Range     -       Accuracy     -       Resolution     -       Time width     Range       Accuracy     -       Resolution     -       Range     -       Accuracy     -       Resolution     -       Resolution     -       Range     -       Accuracy     -       Resolution     -       Number of settings     -       Number of settings     -       Number of settings     -       Number of settings     -		Range 1	6 V range	-
Resolution         6 V range         -           discharging         Number of settings         20 values           Time width         Range         5.0 ms to 65 000.0 ms           Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Pattern         Range         -           Pattern         Range         -           Resolution         100 µs         -           Pattern         Resolution         -           Resolution         -         -           Number of settings         -         -           Time width         Range         -           Accuracy         -         -           Resolution         -         -           Range         -         -           Accuracy         -         -           Resolution         -         -           Resolution         -         -           Number of settings         -         -           Number of settings <t< td=""><td></td><td>Accuracy *2</td><td>*4</td><td>*3</td></t<>		Accuracy *2	*4	*3
power discharging         6 V range         -           Number of settings         20 values           Range         5.0 ms to 65 000.0 ms           Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Range         -           Pattern         Accuracy *2*6           Pattern         Accuracy *2*6           Range         -           Accuracy         -           Accuracy         -           Accuracy         -           Resolution         -           Number of settings         -           Time width         Range           Time width         Range           Range         -           Range         -           Range         -           Accuracy         -           Resolution         -           Range         -           Accuracy         -           Resolution         -           Resolution         -           Resolution         -           Resolution         -           Resolution         -           Number of settings         -           Time width         Accuracy         -	Constant	Resolution	60 V range	100 mW
Range         5.0 ms to 65 000.0 ms           Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Pattern         Resolution         100 µs           Pattern         Accuracy         -           Accuracy         -         -           Accuracy         -         -           Accuracy         -         -           Resolution         -         -           Number of settings         -         -           Time width         Range         -           Number of settings         -         -           Range         -         -           Accuracy         -         -           Accuracy         -         -           Accuracy         -         -           Resolution         -         -           Number of settings         -         -           Power         Time wi		Resolution	6 V range	_
Time width         Accuracy *2*6         ±(0.05 % of set + 0.05 ms)           Pattern         Resolution         100 µs           Pattern         -         -           Pattern         Range         -           Resolution         -         -           Resolution         -         -           Resolution         -         -           Number of settings         -         -           Time width         Range         -           Accuracy         -         -           Range         -         -           Time width         Resolution         -           Resolution         -         -           Range         -         -           Accuracy         -         -           Resolution         -         -           Resolution         -         -           Number of settings         -         -           Time width         Range         -           Accuracy         -         -	discharging	Number of s	ettings	
Resolution         100 µs           Pattern         -           Pattern         -           Pattern         -           Resolution         -           Resolution         -           Number of settings         -           Time width         Range         -           Accuracy         -           Range         -           Accuracy         -           Range         -           Accuracy         -           Resolution         -           Range         -           Accuracy         -           Resolution         -           Resolution         -           Resolution         -           Resolution         -           Resolution         -           Resolution         -           Number of settings         -           Time width         Range         -           Time width         Accuracy         -			Range	5.0 ms to 65 000.0 ms
Range         -           Accuracy         -           Pattern         Resolution         -           Resolution         -         -           Number of settings         -         -           Time width         Range         -           Accuracy         -         -           Range         -         -           Range         -         -           Accuracy         -         -           Range         -         -           Accuracy         -         -           Resolution         -         -           Resolution         -         -           Range         -         -           Accuracy         -         -           Resolution         -         -           Number of settings         -         -           Time width         Range         -           Time width         Accuracy         -		Time width		±(0.05 % of set + 0.05 ms)
Range         -           Accuracy         -           Accuracy         -           Resolution         -           Number of settings         -           Time width         Range         -           Accuracy         -           Range         -           Time width         Range         -           Accuracy         -         -           Range         -         -           Accuracy         -         -           Resolution         -         -           Accuracy         -         -           Resolution         -         -           Resolution         -         -           Number of settings         -         -           Number of settings         -         -           Time width         Range         -           Accuracy         -         -			Resolution	100 µs
Accuracy         –           Pattern constant current         Number of settings         –           Time width         Range         –           Time width         Accuracy         –           Range         –         –           Range         –         –           Accuracy         –         –           Range         –         –           Accuracy         –         –           Accuracy         –         –           Resolution         –         –           Resolution         –         –           Number of settings         –         –           Number of settings         –         –           Time width         Range         –           Time width         Accuracy         –	Pattern			
Pattern constant current       Resolution       –         Number of settings       –         Time width       Range       –         Time width       Accuracy       –         Range       –       –         Accuracy       –       –         Resolution       –       –         Number of settings       –       –         Time width       Range       –         Accuracy       –       –		Range		-
Number of settings         -           current         Range         -           Time width         Accuracy         -           Range         -         -           Accuracy         -         -           Range         -         -           Accuracy         -         -           Accuracy         -         -           Accuracy         -         -           Accuracy         -         -           Resolution         -         -           Number of settings         -         -           Time width         Range         -           Accuracy         -         -		Accuracy		
current         Range         -           Time width         Accuracy         -           Accuracy         -         -           Range         -         -           Accuracy         -         -           Resolution         -         -           Number of settings         -         -           Time width         Accuracy         -	constant	Resolution		
Pattern constant power Pattern Time width Resolution Resolutio Resolution Resolution Resolution Res		Number of s	ettings	
Range         -           Accuracy         -           Resolution         -           Accuracy         -           Resolution         -           Resolution         -           Number of settings         -           Time width         Accuracy         -	current		Range	
Range         –           Accuracy         –           Resolution         –           vower         Number of settings           Time width         Accuracy		Time width	Accuracy	-
Accuracy         -           Pattern         Resolution         -           constant power         Number of settings         -           Time width         Accuracy         -			Resolution	-
Resolution         –           constant power         Number of settings         –           Time width         Range         –           Accuracy         –		Range		-
Number of settings         -           power         Range         -           Time width         Accuracy         -		Accuracy		-
power Range – Time width Accuracy –	Pattern	Resolution		-
Time width Accuracy –		Number of s	ettings	-
	power		Range	-
Resolution –		Time width	Accuracy	-
			Resolution	_

\*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 Can be set only when the optional Volt / Thermometer Unit OP02-PFX or OP03-PFX Voltmeter Unit is installed.

Unless specified otherwise, the specifications are for the following settings and conditions. \* The warm-up time is 30 minutes. \* TYP (typical) values do not guarantee the performance. \* "reading" Indicates the readout value. \* "set" Indicates the setting value. \* "rating" Indicates the rated. \* "Static" General term to indicate CC charge, CC-CV charge, CC discharge, CC-CV discharge, CP discharge, and CP-CV discharge \* "Pattern" General term to indicate pattern charge/discharge and I-V characteristics charge/discharge

#### Measurement Accuracy

o			PFX2511
Static			
Charge / discharge	Range		0.0000 A to 50.0000 A
current	Accuracy *1 *2		± (0.15 % of reading + 0.02 % of rating)
measurement	Resolution		0.1 mA
	Range	60 V range	-6.0000 V to 60.0000 V
	Range	6 V range	-
Voltage measurement	Accuracy	60 V range	± (0.05 % of reading + 0.02 % of rating)
incuburement	*1 *2 *3	6 V range	-
	Resolution *	3	0.1 mV
	Range		-
Power measurement	Accuracy		-
measurement	Resolution		-
	Range		0.000 Ah to 2000.000 Ah
Capacity calculation	Accuracy *1	*2	Depends on the current measurement accuracy and the time accuracy
	Resolution		1 mAh
Time *4	Accuracy *1	*5	±10 ppm (TYP values)
Pulse			
	Range		0.0000 A to 50.0000 A
Charge /	Accuracy *1	*2	±(0.2 % of reading + 0.03 % of rating)
discharge	Resolution		0.1 mA
current	Measured va	lue	Average current; updated every 500 ms (consecutive measurements)
	Range		0.0000 V to 60.0000 V
	Accuracy *1	*2	±(0.05 % of reading + 0.02 % of rating)
	Resolution		0.1 mV
Battery voltage		High voltage	Indicates the maximum battery voltage in one cycle of the pulse setting.
	Measurement	Low voltage	Indicates the minimum battery voltage in one cycle of the pulse setting.
		Arbitrary	At the specified pulse point
	Range		0.000 Ah to 2 000.000 Ah
Capacity calculation	Accuracy *1 *2		Rely on the current measuring accuracy and the time accuracy
	Resolution		1 mAh
Time *4	Accuracy *1	*5	±10 ppm (TYP values)
Pattern			-
	Range		-
Charge /	Accuracy		-
discharge current	Resolution		-
	Measured value		-
	_	60 V range	_
	Range	6 V range	-
Voltage		60 V range	-
measurement	Accuracy	6 V range	-
	Resolution		_
	Range		_
Power	Accuracy		_
measurement	Resolution		_
	Range		
Capacity			_
calculation	Accuracy		_
Timo	Resolution		_
Time	Accuracy		-

\*1 Ambient temperature at 18 °C to 28 °C.

\*2 Measurable range: within the range listed in the table.

ŧ9 Common with 6 V/60 V ranges.

\*4 Accuracy of the elapsed time (cutoff condition) when charging/discharging or resting. \*5 Monthly error: approximately 30 seconds.

## FOR BATTERY TEST SYSTEM PFX2500 SERIES

### Measurement Accuracy

			PFX2511		
High speed sar	High speed sampling				
	Range		-		
		1 ms sampling	-		
	Accuracy	10 ms sampling	-		
Current measurement		100 ms sampling	-		
modellomont		1 ms sampling	-		
	Resolution	10 ms sampling	-		
		100 ms sampling	-		
	Range	60 V range	-		
	Range	6 V range	-		
		1 ms sampling	-		
	Accuracy	10 ms sampling	-		
Voltage measurement	Accuracy	100 ms sampling	-		
			-		
		1 ms sampling	-		
	Resolution	10 ms sampling	_		
		100 ms sampling	_		

### Temperature measurement

* The thermistor 103AT-2 (SEMITEC Corporation) is used for temperature detecting eleme		
	PFX2511	
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)	
measurement accuracy 2 3	± 1 °C (measurement temperature at -20 °C to 80 °C)	
Reference (thermistor 103AT-2)		
Part name	Thermistor (103AT-2 by SEMITEC Corporation)	
R25	10.0 kΩ, 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
Overvoltage (overcharge) protection	Software OVP, Hardware OVP
Undervoltage (overdischarge) protection	Software UVP, Hardware UVP
Overcurrent protection	Software OCP *1, Hardware OCP Load shorting protection
Capacity (overcharge/overdischarge) protection	Software OAH *2
Overtemperature (DUT) protection	Software OTP
Vibration alarm	

\*1 For the software OCP, the application software automatically sets a value obtained by adding 5 A to the preset current. \*2 The application software calculates the value by multiplying the nominal capacity by

the preset percentage and sets the capacity.

### General Specifications

	•		
		PFX2511	
Nominal input r	ating	100 Vac to 240 Vac, 50 Hz/60 Hz	
Input voltage ra	nge	90 Vac to 250 Vac	
Power consum	otion	60 VAmax OP01-PFX 3 boards installed: 80 VAmax	
Operating temp humidity range	erature/	0 °C to 40 °C, 20 % rh to 85 % rh (No condensation)	
Storage temper	ature/humidity range	-10 °C to 60 °C, 0 % rh to 90 % rh (No condensation)	
Operating envir	onment	Indoors, Overvoltage category II	
Altitude		Up to 2000 m	
Isolation voltage	Across the I/O terminals and chassis	± 80 Vmax	
Inculation	Primary and chassis		
Insulation resistance	Primary and across the I/O terminals	500 Vdc, 30 M $\Omega$ or greater, 70 % rh or less	
Withstand	Primary and chassis		
voltage	Primary and across the I/O terminals	1500 Vac, No abnormalities over 1 minute	
Safety *1		Complies with the requirements of the following directive and standard. Low Voltage Directive 2006/95/EC EN61010-1 (Class I *2, Pollution degree 2)	
Electromagnetic compatibility(EMC) *1		Complies with the requirements of the following directive and 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)	
	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 (39.37 inch))	
Accessories	Sensing connector	1 pc	
	Thermistor	1 pc	
	Lock lever	2 pcs	
	Operation manual	1 сору	
	BPChecker2000 Setup guide	1 сору	
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.

## PFX2500 Series Optional

#### Voltage/thermometer unit [OP01-PFX] [OP02-PFX] 2512

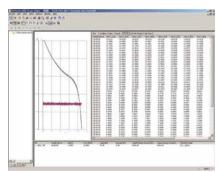
When monitoring the status of each cell of the battery pack is required, install the optional voltage/thermometer unit OP01-PFX/OP02-PFX. By installing OP01-PFX on PFX2511 and by installing OP02-PFX on PFX2512/2532, voltages/ temperatures for four cells are able to be monitored/logged with one sheet, respectively. (Up to 3 boards can be installed.)



Voltage/thermometer unit [OP01-PFX] [OP02-PFX]

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\*1 and cell low voltage\*

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.

## 8Slot Unit [SL01-PFX]



The 8Slot Unit SL01-PFX is connected to the PFX2512/2532 Charge/ Discharge System Controller to expand the voltage measurement points. For this connection, an EX01-PFX connection board is installed into the PFX2512/2532. It enables highly accurate evaluation of cell voltage disparity measurements, which is indispensable for evaluation testing of large capacity battery modules. If Voltmeter Units OP03-PFX are installed in all SL01-PFX slots, voltage measurement points can be expanded to 64 points. Further, by installing Volt/Thermometer Units OP02-PFX in the PFX2512/2532, you can increase the number of measurement points to 72.

### ■ Voltage/thermometer unit OP01-PFX/OP02-PFX Specifications

		OP01-PFX	OP02-PFX	
Cell measuremen	t function			
Static/Pattern (OF				
Cell voltage		Average voltage of the every 500 ms	Average voltage of the every 100 ms	
Cell temperature		Temperature measurement fun temperature detecting elem	ction to make thermocouple as nent, 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 meas	surement			
Static/Pattern (OF	P02-PFX only)			
Number of measure	ment terminals	4	ļ	
Measurable range	e *1	-2.0000 V to	20.0000 V	
Accuracy *2		± (0.05 % of rdng	g + 0.02 % of f.s)	
Measurement res	olution	0.1	mV	
Measurement va	lue	Average voltage of the every 500 ms	Average voltage of the every 100 ms	
Measurement Inte	erval	500 ms	100 ms	
Pulse				
Number of measurement terminals		4	-	
Measurable range	e *1	-2.0000 V to 20.0000 V	-	
Accuracy *2		± (0.05 % of rdng + 0.02 % of f.s)	-	
Measurement res	olution	0.1 mV	-	
Measurement	High voltage	Maximum voltage in one cycle	-	
valu *3	Low voltage	Maximum voltage in one cycle	-	
Measurement Inte	erval *4	1 ms	-	
Cell temperature	measurement *	5		
Number of measure	ement terminals	4	ļ.	
Thermocouple typ	be	K type		
Measurable range	e *6	-100.0 °C to 400.0 °C		
Accuracy *2 *7		± 1.5 °C (TYP values)		
Reference junction	accuracy *2 *8	± 0.5 °C (TYP values)		
Resolution		0.1	°C	
Measurement inte	erval	1	s	
voltage, low volt *4 The application *5 The temperature *6 Depending on y	ature at 18 °C to 2 ynchronized with age, and user-sp software records scale conforms to	28 °C. h the BPChecker2000 pulse setti ecified). data every second. [Data recording JIS C 1602-1995 (ITS-90). (ITS-90 is e's specifications (thermocouple cl	g time] BPChecker2000 : 1 s to an international temperature scale.)	

the usable temperature range will vary. When the voltage that the thermocouple calibrator produces is measured.

\*0

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

#### 8Slot Unit SL01-PFX Specifications

	SL01-PFX		
Number of slots	8	3	
Compatible boards *1	Voltmeter Un	it OP03-PFX	
Interface	LAN(Ethernet) PC connection	Sync connector EX01-PFX connection	
Input voltage range	90 Vac to 250 V	ac, 50 Hz/60 Hz	
Power consumption	when 8 OP03-PFXs a	re installed: 80 VAmax	
Operating temperature and humidity range	0°C to 40°C, 20 %rh to 85 %rh (no condensation)		
Dimensions	214.5 W × 155 H × 440 Dmm		
weight	Approx. 5 kg (11.02 lb)		
	Power cord/100 V System (1 pc.)		
	Power cord/200 V System (1 pc.)		
	EX01-PFX (1 pc.) extension board (for installing in a PFX2512/2532 slot)		
Accessories	LAN cable (1 pc.) 2m Straight type		
	14-core flat cable (1 pc.)		
	Ferrite core for 14-core flat cable (1 pc.)		
	Lock lever (2 pcs.)		
	Handling of the product (1 copy)		

\*1 OP02-PFX cannot be installed

## Voltmeter Unit [OP03-PFX]

By installing an Voltmeter Unit OP03-PFX in an option slot on the SL01-PFX, you can increase the number of voltmeter measurement points. If OP03-PFX units are installed in all option slots of the SL01-PFX, voltage measurement points can be expanded to 64 points.



#### Voltmeter Unit OP03-PFX Specifications

	OP03-PFX
Cell voltage measurement	
Number of measured terminals	8
Measurement range *1	-2.0000 V to 20.0000 V
Measurement accuracy *2	±(0.05 % of reading + 0.02 % of rating)
Resolution	0.1 mV
Measured value	Average voltage every 100 ms
Measurement interval	100 ms

\*1 You can apply a voltage from -20 V to 22 V.
\*2 Ambient temperature at 18°C to 28°C.

## Load Cable Set [TL08-PFX]

Load cable(with voltage current, and temperatur sensing cable.)

- Rating: 50 A Length: Approx. 5 m
- Thermistor installed
- Maximum operating temperature: 105 °C

## Sensing Cable Set [TL09-PFX]

Lead wire for voltage/thermometer unit

- K type thermocouple for 4 cells
- Length: Approx. 5 m

## FOR BATTERY TEST SYSTE PFX2500 SERI

### Cable Set [TL10-PFX]

This is a cable set for connecting the PFX2532 to configure a charge/ discharge system.

- Rated current: 200 A DUT cable: Approx. 3 m
- DC power supply connection cable: Approx. 60 cm
- Electronic load connecion cable: Approx. 60 cm
- Voltage sensing cable with the thermistor
- CE compliant product
- Maximum operating temperature: 75 °C (Connection cable/ DUT cable)

### Cell Voltage Sensing Cable Set [TL11-PFX] 2512

Sensing cable set (for OP03-PFX)

- This product supports eight voltage measurement points.
- Length: Approx. 5 m
- Maximum operating temperature: 105 °C
- No-finished end on the side of test materials

Cell Voltage Sensing Cable Set [TL12-PFX]

Sensing cable set (for OP03-PFX)

- This product supports eight voltage measurement points.
- Length: Approx. 3 m Maximum operating temperature: 105 °C
- No-finished end on the side of test materials
- CE compliant product



- Rack mount system 2511
- We also provide a rack mounting service.
- Svstem rack: KRC363L
- \* The picture shown below is an example of the rack mount system

### Coordination between BPChecker3000 and Vehicle Spy3

PFX2512/2532 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

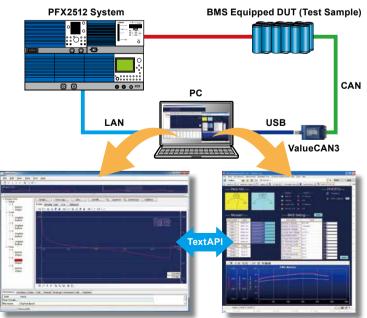
\*Our company will perform Vehicle Spy3 customization upon accepting the presentation of BMS specifications by customers. Please consult us separately since BMS specifications are different by every customer. In addition, please contact the following for inquiry related to Application Software, [Vehicle 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



BPChecker3000 Graph Viewer

Vehicle Spy3 (Graphical Panel) Image may differ depending on BMS specifications

### 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		Dowor oupply for oborgo	Electropic load for discharge	
PFX2511	PFX2512	Power supply for charge	Electronic load for discharge	
5101 7101		PWR800L	PLZ1004W	
5102 7102		PWR800L	PLZ1004W *1	
5103 7103		PWR1600L	PLZ1004W × 2	
5104 7104		PWR800L	PLZ334W	
5105*4 7105*4		PAT60-67T	PLZ1004W + 2004WB	
5106 7106		PWR1600L	PLZ1004W	
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	5112 7112 PAS10-35		PLZ334W	

Model ID		Electronic load for discharge	
PFX2532	Power supply for charge		
7301	PWR1600L (two units in parallel)	LZ1004W *2 + PLZ2004WB	
7302	PAT60-133T	PLZ1004W *2 + PLZ2004WB(2 units in parallel)*3	
7303	PAT40-200T	PLZ1004W *2 + PLZ2004WB(2 units in parallel)*3	

[As of the end of February, 2016]

\*1 M range \*2 H range

\*3 Can be replaced with the Kikusui SR Large Capacity Electronic Load Smart Rack System PLZ5004W.

\*4 Additional adjustment fee is required.

#### 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]

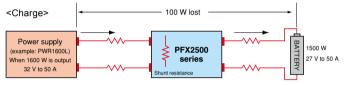
#### Note on selecting electronic load for discharge (minimum operating voltage for discharge)

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 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]



<Discharge>



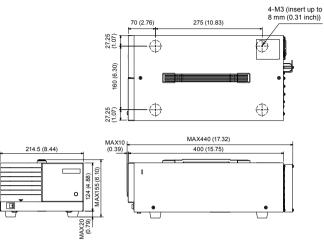
#### • List of the applied configuration with PFX2500 series \* If you wish to have a combination other than the models below, please contact with us.

Power supply Estimated output		Innut	Remark	Annoo10000			
for charging	Voltage (V)	Current (A)	Power limit (W)	Input	Remark	Appearance	
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	PWR Sereis	
PWR800L	0 to 60	0 to 50	700	AC100/200 V 13/6.5 A	supply with wide variable ranges of voltage and current. One unit serves as multiple		
PWR1600L	0 to 60	0 to 50	1400	AC100/200 V 26/13 A	units of a single range DC power supply.		
PAT60-133T	0 to 60	0 to 133	8000		8 kw high-capacity type		
PAT40-200T	0 to 40	0 to 200	8000		o kw nigh-capacity type	PAT-T Sereis	
Electronic load	Electronic load Estimated output		- Input	Remark	Appearance		
for discharging	Voltage (V)	Current (A)	Power limit (W)	input	Remark	Appearance	
PLZ164W	6 to 60	0 to 33	165	AC 90 to 250 V 80 VA			
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	By adding a bias power supply, the minimum discharge voltage can be lowered.		
PLZ2004WB	8 to 60	0 to 50	2000	AC 90 to 250 V 200 VA	For details, please contact with us.		
PLZ164WA	4.5 to 60	0 to 33	165	AC 90 to 250 V 450 VA		PLZ-4W Series	
PLZ664WA	4.5 to 60	0 to 50	660	AC 90 to 250 V 1500 VA			

## **Outline Drawing**

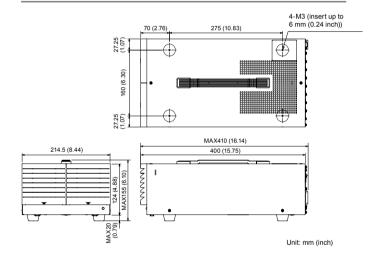
## FOR BATTERY TEST SYSTEM PFX2500 SERIES

### [PFX2511/PFX2512]

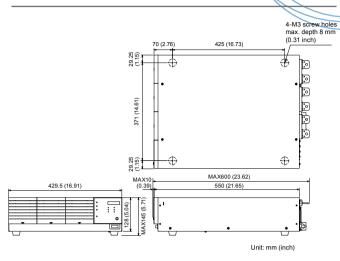


Unit: mm (inch)

[SL01-PFX]



### [PFX2532]



## **Order Information**

Model	Description	Remark
PFX2511	Charge/discharge system controller	60V/50A
PFX2512	Charge/discharge system controller	60V/50A Seamless charge/discharge
PFX2532	Charge/discharge system controller	60V/200A Seamless charge/discharge

#### Optional

Model	Description	PFX2511	PFX2512	PFX2532	Remark
PFX2121	Communication control unit *1	•			PFX2511 exclusive
TL08-PFX	Load cable (with voltage current, and temperatur sensing cable)	•	•		50A 5m Supplied with sensing cable. Heat resistant up to 105 °C
TL09-PFX	Sensing cable set (voltage sensing cable and thermocouple)	•	•	•	K type thermocouple for 4 cells, heat resistant up to $105^\circ\text{C}$
TL10-PFX	Cable Set			•	200A 3m(Between the PFX2532) 60cm of the connecting cables between devices.
TL11-PFX	Cell Voltage Sensing Cable Set		•	•	OP03-PFX exclusive. This product supports 8 voltage measurement points. approx. 5 m
TL12-PFX	Cell Voltage Sensing Cable Set		•	•	OP03-PFX exclusive. CE compliant product. This product supports 8 voltage measurement points. approx. 3 m
OP01-PFX	Voltage/thermometer unit	•			PFX2511 exclusive. Up to 3 boards can be mounted.
OP02-PFX	Voltage/thermometer unit		•	•	PFX2512, PFX2532 exclusive. Up to 3 boards can be mounted.
OP03-PFX	Voltage unit		•	•	SL01-PFX exclusive. Up to 8 boards can be mounted.
SL01-PFX	8Slot Unit		•	•	PFX2512, PFX2532 exclusive.
KRC363L	19 inch Cabinet rack	•	•	•	Overall height:1835mm The length for maximum surface: 950mm
KRA3	Rack adapter	•	•	•	EIA standards.
KRA150	Rack adapter	•	•	•	JIS standards.
SD002	Application software BPChecker2000 Full Edition	•			PFX2511 exclusive. The 2-channel version is supplied with PFX2511.
SD007-PFX	Application software BPChecker3000 *2		•	•	PFX2512, PFX2532 exclusive.

\*1 Essential product for the actuation of PFX2511. \*2 Essential product for the actuation of PFX2512, PFX2532.



### **KIKUSUI ELECTRONICS CORPORATION**

1-1-3, Higashiyamata, Tsuzuki-ku, Yokohama, 224-0023, Japan Phone: (+81) 45-593-7570, Facsimile: (+81) 45-593-7571, www.kikusui.co.jp

KIKUSUI AMERICA, INC.1-877-876-2807 www.kikusuiamerica.com 2975 Bowers Avenue, Suite 307, Santa Clara, CA 95051 Phone : 408-980-9433 Facsimile : 408-980-9409

KIKUSUI TRADING (SHANGHAI) Co., Ltd. www.kikusui.cn Room308,Building 2, No.641,Tianshan Road, Shanghai City, China Phone : 021-5887-9067 Facsimile : 021-5887-9069

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Printed in Japan