Model PFX2411

CAPACITOR TESTER

PFX2411

12-ch tester for EDLC (Electric Double Layer Capacitor) test
Charge/discharge rating: 0 to 5.0000V/0 to 5.0000A/25W
Completely independent channels
Setting, operation and data collection by LAN
Capable of measuring voltage of reference electrode
Centralized management by exclusive application software
Data sampling at 1 ms or 100 ms

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Compliant with JIS D1401!

Electric double layer capacitors for use in hybrid electric vehicles
- Standards for charge/discharge characteristic tests

NEW

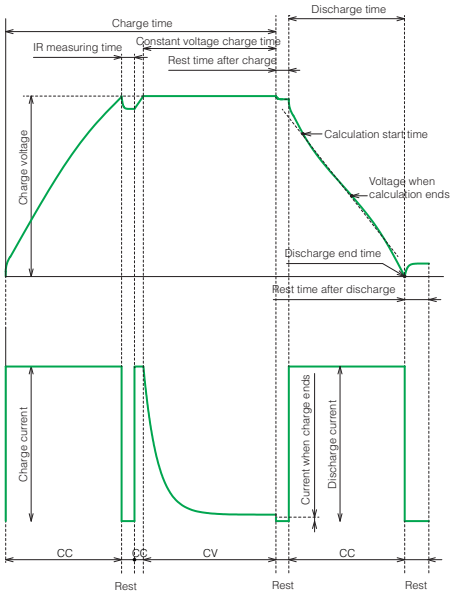
Capacitor Tester
PFX2411

- **Static electricity capacity measurement**
  (JIS C5160, JIS D1401 and others)
- **Internal resistance measurement**
  (JIS D1401 and others)
- **Charge/discharge efficiency measurement**
  (JIS D1401 and others)
- **Charge/discharge cumulative electricity measurement**

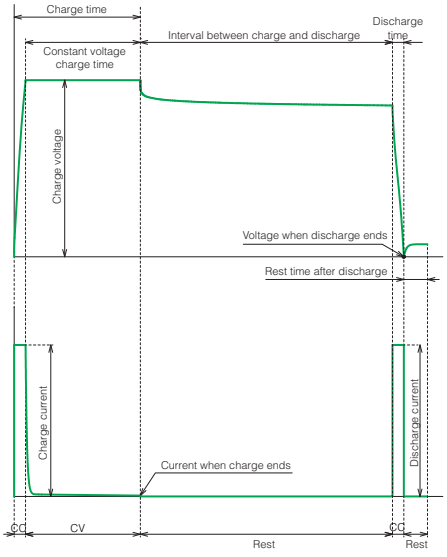
The PFX2411 is a multi-channel charge/discharge tester that 12 units of charge/discharge testers with the capacity of 5V/5A/25W are installed in one box.

Applicable tests

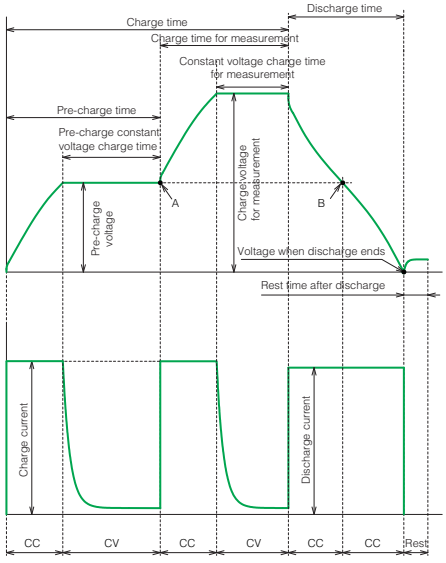
● Cycle Test



● Voltage Hold Test



● Charge-Discharge Efficiency Test



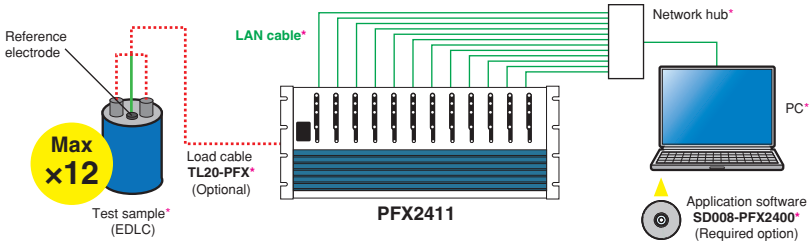
A: Measurement start point of charge/discharge efficiency test
B: Measurement end point of charge/discharge efficiency test

System Configuration

Exclusive application software, SD008-PFX2400 is required to run the PFX2411.For configuration of the system, in addition to the PFX2411 and SD008-PFX2400, you will need a PC, network hub, LAN cable and load cable (optional).

Product	Model
Capacitor tester	PFX2411
Application software	SD008-PFX2400
Load cable	TL20-PFX
PC	Users are requested to prepare these items
Network hub	
LAN cable	

● System diagram



*Not included in the PFX2411. They are optional, or users are requested to prepare them separately.

● Rear panel

Centralized management by PC is capable of setting the test condition to execution of the test and to analysis of the test data

Application software

SD008-PFX2400

The SD008-PFX2400 package contains following application software.

● CPChecker2400

Using the PFX2400 series with this application software, you can create test conditions for the cycle test, voltage hold test and charge/discharge efficiency test and execute the tests.
An operation panel is provided independently for each channel, and individual test per channel can be executed. For setting the test conditions, selections for JIS D 1401 and JIS C 5160 are provided. You can easily set the capacitor test conditions based on the JIS. The test results are saved in text files (CSV format); so it can be used with other spreadsheet software.

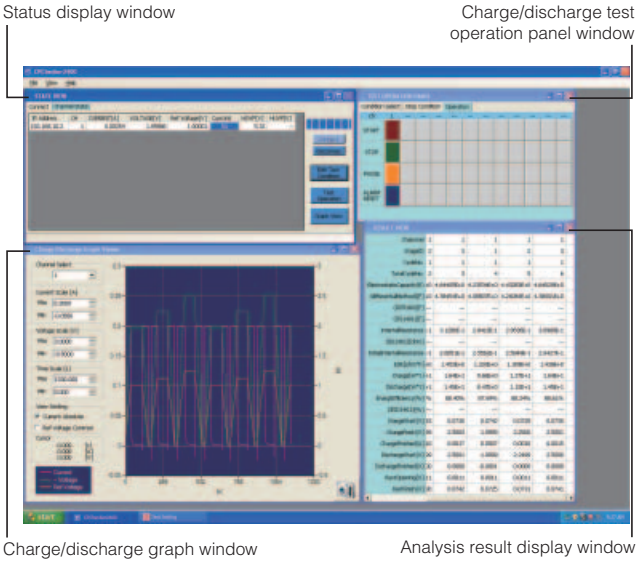
[Features]

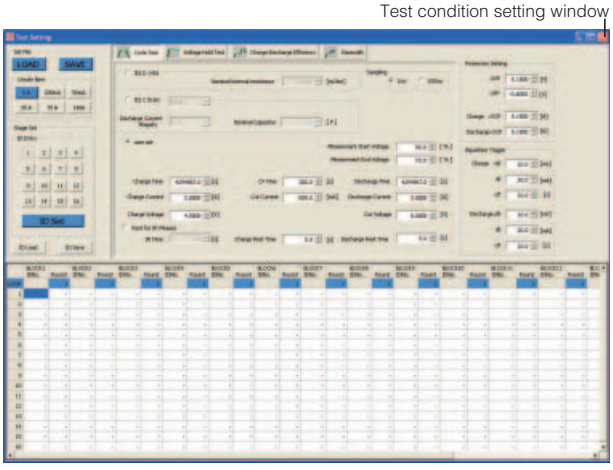
- **Data saving in 1 ms at the fastest** *1
- **Capable of controlling up to 96 channels** *2
- **Channel number setting**
- **Setting and saving the test conditions**
- **Start and stop of the test, pause and alarm reset**
- **Display of test results**
- **Creation and saving of test result files (CSV format)**
- **Monitoring of measured values (Charge/discharge currents, terminal voltage and reference electrode potential)**
- **Display of HOVP setting voltage**
- **Rest time extension function**

*1 The required data can be easily saved by high-speed import in sections with status change points and a large amount of data change and by data import trigger Δ T in sections with a small amount of data change.

*2 The number of controllable channels varies by data acquisition intervals. The guideline for the capacity to control 96 channels is: 10 minutes for 1 cycle, Δ V: 0.5% of the set voltage, Δ I: 0.5% of the cut current and Δ T: 10 seconds. For details, please contact our sales department. Note that the number of channels that can be displayed on one screen without a scroll is 12 at the maximum.

▼ Example of screen





● IP Configuration Tool *3

The IP Configuration Tool is to set the IP address and channel number of the Capacitor Tester PFX2411. The IP address and channel number can be changed by this software.

▶ IP address:
192.168.0.0 to 192.168.255.254
▶ Channel number: 0 to 256

*3 When using only 1 unit of the PFX2400 series, IP Configuration Tool is not required. Even when IP Configuration Tool is not used, it is necessary to set the IP address and subnet mask of the personal computer with which CPChecker2400 is used according to the range of IP address of the PFX2400 series.

[Recommended Operating Environment]

■ **CPChecker2400**
- Personal computer installed with Microsoft Windows XP Service Pack 3 or later, Windows Vista or Windows 7
- Microsoft Windows Installer 3.1 (Installation may be required when the OS is XP. Included in the CD.)
- Microsoft .NET Framework 3.5 SP1 (Included in the CD.)
- Microsoft Chart Controls for Microsoft .NET Framework 3.5 (Included in the CD.)
- Memory: 2 GB or more
- Display resolution: 1280 x 1024 or higher
- Hard disk: 100 MB or more of free space
  (More free space may be required depending on the data contents to be saved.)
- CD-ROM drive
- Mouse or pointing device
- 10BASE-T or 100BASE-TX LAN port

■ **IP Configuration Tool**
- Personal computer installed with Microsoft Windows XP Service Pack 2 or later or Windows Vista
- Microsoft Windows Installer 3.1 (Installation may be required when the OS is XP. Included in the CD.)
- Microsoft .NET Framework 3.5 SP1 (Included in the CD.)
- Memory: 256 MB or more
- Display resolution: 1024 x 768 or higher
- CD-ROM drive
- Mouse or pointing device
- 10BASE-T or 100BASE-TX LAN port

■ **Other required items**
- PFX2411
- LAN cable
- Switching hub (Requires more channels than the number of units to be controlled.)
- Adobe Reader 6 or later (Required to display the operation guide in PDF format.)

Specifications

Charge function		
Charge method	Constant current - Constant voltage	After constant current charge, constant voltage charge is executed
	Constant current	Charge when CV time is set to zero
	Constant power	Constant power wattage value (Wattage)
	Step	Charge with current or voltage in steps
Charge end condition	Current	Charge end by discharge start current
	Voltage	Capacitor voltage
	Time	Specified time from charge start (Charge Time)
Rest end condition	Time	Specified time from rest start
	Synchronization command during rest extension	When rest continuation is checked, reset using the Start button

Discharge function		
Discharge method	Constant current	Constant current value (Current)
	Constant current - Constant voltage	After constant current discharge, constant voltage discharge is executed
	Constant power	Constant power wattage value (Wattage)
Discharge end condition	Time	Specified time from discharge start (Discharge Time)
	Voltage	Capacitor voltage
Rest end condition	Time	Specified time from rest start
	Synchronization command during rest extension	When rest continuation is checked, reset using the Start button.

Measurement function		
Voltage	Measuring time	Measurement once every 1 ms or 100 ms
Current	Measuring time	Measurement once every 1 ms or 100 ms
Reference electrode voltage	Measuring time	Measurement once every 1 ms or 100 ms
Time		Time elapsed since test start
Cycle count		Absolute cycle count

Protection function		
Overvoltage (overcharge) protection	Software OVP	Reset by output off and reset command of the applicable channel
	Hardware OVP	
Overcurrent protection	Software OCP	Reset by output off and reset command of the applicable channel
Overheat protection (OHP)		Operated when the heat sink temperature is 90C°±5C° Reset by output off and reset command of the applicable channel
Overdischarge protection	Software UVP	Reset by output off and reset command of the applicable channel
Input external alarm		Stop test at HI level

Display function (status monitor)		
Power status	Power	Test is under execution, or test execution is possible. POWER/STANDBY LED illuminates (green).
	Standby	On standby, or system stop is possible. POWER/STANDBY LED illuminates (orange).
Charge/ discharge status	Charge	Charging. CHARGE/DISCHARGE/REST LED illuminates (red).
	Discharge	Discharging. CHARGE/DISCHARGE/REST LED illuminates (green).
	Rest	Resting. CHARGE/DISCHARGE/REST LED illuminates (orange).
Control status	CC	Constant current is applied. CC/CV LED illuminates (red).
	CV	Constant voltage is applied. CC/CV LED illuminates (green).
	CP	Constant power is applied. CC/CV LED illuminates (orange).
Alarm	Alarm	Alarm is detected; the protection function operates. ALARM/ WARNING LED illuminates (red).
	Warning	Warning for alarm detection; prior warning before the protection function operates. ALARM WARNING LED illuminates (orange).

Rate output	
Number of outputs	12 ch
Charge current range	0.0000A to 5.0000A
Charge voltage range	0.0000V to 5.0000V
Charge power range	0.01W to 25.00W
Discharge current range	0.0000A to 5.0000A
Discharge voltage range	-0.5000V to 5.0000V
Discharge power range	0.01W to 25.00W
Maximum charge/discharge power	25.0 W

Setting accuracy		
Current setting	Range	0.0000A to 5.0000A
	Accuracy	± (0.07 % of set + 1 mA)
	Resolution	100 μ A
	Ripple	1.5 mArms or less (between 10 Hz and 500 kHz)
Voltage setting	Range	0.0000V to 5.0000V
	Accuracy *1	± (0.07 % of set + 1.5 mV)
	Resolution	100 μ V
	Ripple *1	3 mVrms or less (between 10 Hz and 500 kHz)

*1 Under the charging state.

Setting accuracy		
Power setting	Range	0.01W to 25.00W
	Accuracy	± (0.1 % of set + 10mW) (When the capacitor voltage is above 0.5 V)
	Resolution	10mW

Measurement accuracy		
Current measurement	Range	0.00000A to 5.00000A
	Accuracy *2 *3	± (0.07 % of rdng + 1 mA)
	Resolution	10 μ A
	Sampling time	1 ms/ 100 ms
Voltage measurement	Range	-0.50000V to 5.00000V
	Accuracy *2 *3	± (0.07 % of rdng + 1.5 mV)
	Resolution	10 μ V
	Sampling time	1 ms/ 100 ms
Reference electrode voltage measurement	Range	-0.50000V to 5.00000V
	Accuracy *2 *3	± (0.07 % of rdng + 1.5 mV)
	Resolution	10 μ V
	Sampling time	1 ms/ 100 ms

*2 Ambient temperature: 18 to 28°C *3 Measurable range: The range indicated above

Protection function			
Overvoltage (Overcharge) protection	Hardware OVP	Setting range	0.10V to 6.00V
		Setting resolution	10 mV
		Setting accuracy	± 300 mV
		Operating time	Within 100 ms
	Software OVP	Setting range	-0.6000V to 5.1000V
		Setting resolution	100 μ V
		Setting accuracy	± (0.07 % or rdng + 1.5 mV)
		Operating time	Within 100 ms
Undervoltage (Overdischarge) protection	Software UVP	Setting range	-0.6000V to 5.1000V
		Setting resolution	100 μ V
		Setting accuracy	± (0.07 % or rdng + 1.5 mV)
		Operating time	Within 100 ms
Overcurrent protection	Software OCP	Setting range	-0.0000A to 5.1000A
		Setting resolution	100 μ A
		Setting accuracy	± (0.07 % or rdng + 1 mV)
		Operating time	Within 100 ms
	Built-in fuse		7 A
Overheat protection (inside the equipment)	OHP	Operating temperature	Operated when the built-in heat sink temperature is 90°C±5°C
AC input overcurrent protection			By the fuse in the AC input section
Input outside alarm	Allowable input voltage		12 V
	Input level		HI level : 2 V to 12 V LOW level : OPEN or 0 V to 1 V
	Minimum pulse width		50 ms

Interface	
Ethernet（LAN）	10BASE-T, 100BASE-TX
Connector	RJ45

General specifications		
Nominal input rating		100 Vac to 240 Vac, 50 Hz/60 Hz
Input voltage range		90 Vac to 250 Vac
Power consumption	Per 1 ch	Approx. 100 VA (Charge at 5V/5A)
	12 chs total	2000 VA or less (Charge at 5V/5A for all channels)
Operating temperature and humidity range		0°C to +40°C, 20 %rh to 85 %rh (without condensation)
Storage temperature and humidity range		-20°C to +60°C, 90 %rh or less (without condensation)
Operating environment		Indoor. Overvoltage category II
Altitude		Up to 2000m
Isolation voltage	Input/output terminal ↔ Chassis	± 50 Vmax
Insulation resistance	AC input ↔ Chassis	100 MΩ or greater
	DC output ↔ Chassis	20 MΩ or greater
Withstand voltage	AC input ↔ Chassis	No malfunction at 1500 Vac for 1 minute
Leak current		3.5 mA or less
Momentary interruption overload capacity		Approx. 50 ms
Safety *4		Compliant with the requirements in the following standard: IEC61010-1 Class I Pollution degree 2
Dimensions (maximum)/weight		430（485）W× 195H× 410（455） Dmm/Approx. 23kg
Accessories		1 power cable, 12 output connectors and 1 operation manual

*4 Not applicable to custom-made products or modified products.

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●Distributor/Representative

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Capacitor Tester
PFX2421

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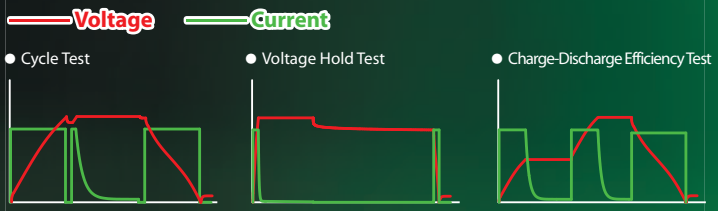
Compliant with IEC 62576(2009) / JIS D1401 !
For testing the high-capacity Electric Double Layer Capacitor(EDLC) !

5V/35A/175W×4ch Introducing the large capacity model !

Compliant with IEC 62576(2009) / JIS D1401

The PFX2421 can perform following tests.



The Charge-Discharge mode for the diverse applications

Charging method (Constant Current - Constant Voltage / Constant Current / Constant Power / Step)
Discharge method (Constant Current - Constant Voltage / Constant Current / Constant Power / Step)

High-speed data sampling

Adopting the LAN communication interface realizes the simultaneous data sampling of the current and voltage.

Fully independent operations on all channels

The absolute independence of operations on all channels allow you to conduct the combined testing of the different characteristics of EDLC's.

Energy-saving designs

Controls to keep steady of the internal loss while in the charging state, and it realizes the low power consumption.

Extended range of the AC input

It can be used at the location from the benchtop to the production line wherever the input power supply of 100Vac to 240Vac is provided.

The dedicated software applies to the wide versatility of testings.

The test pattern of the "JIS D 1401" and "JIS C 5160" has been provided in the software, so you can easily set and execute the test conditions of the capacitor complied to the JIS standard. Moreover, the condition can be edited easily such as the complex test pattern other than standard tests. The test result is saved in the text file (CSV format), and it is capable of the plotting graph, and the analysis of result.

NEW

The capacitor tester PFX2421 is a charge/discharge tester exclusively designed for testing the EDLC (Electric double layer Capacitor). The product is composed of 4 channels of charge/discharge test unit with the capacity of 5V/35A/175W. In recent years, the EDLC (Electric double layer Capacitor) has increased in capacity and it can be used as a energy storage device for starting up the engine of hybrid electrical vehicle and assisting the power under the acceleration, the EDLC (Electric double layer Capacitor) is expected to become as a device of new energy source, it helps to improve the fuel economy and also reducing the exhaust level. The PFX2421 applies to meet the high level and specilized in requirement related to the "energy storage technology", "power management (optimizing energy)" for those issues faced by the EDLC (Electric double layer Capacitor) to become widely used.

Capacitor Tester PFX2421

● PFX2400 Series line-up

Model	Specifications
PFX2411	5V/5A/25W×12ch
PFX2421 NEW	5V/35A/175W× 4ch
SD008-PFX2400	Application software for PFX2400 Series

● Option

- Load cable for PFX2411 [TL20-PFX]
- Load cable for PFX2421 [TL21-PFX] will be available soon

Specifications

Charging Function		
Mode	CC	Constant current charge
	CC-CV	Constant voltage charge after the setting voltage is reached in CC charge
	CP	Constant power charge
	Step	Combination of the CC,CC-CV,CP charge in step forms
Cutoff condition	CV Time	Cutoff by the specified time after CV operation
	Voltage	Cutoff by the voltage
	Current	Cutoff by the current in CV operation
	Charge Time	Cutoff by the specified time after charging starts
Rest end condition	Rest Time	Cancel by the specified time after rest time starts
	Synchronization	Cancel by the rest-hold function

Discharging Function		
Mode	CC	Constant current discharge
	CC-CV	Constant voltage discharge after the setting voltage is reached in CC discharge
	CP	Constant power discharge
	Step	Combination of the CC,CC-CV,CP discharge in step forms
Cutoff condition	CV Time	Cutoff by the specified time after CV operation
	Voltage	Cutoff by the voltage
	Current	Cutoff by the current in CV operation
	Discharge Time	Cutoff by the specified time after discharging starts
Rest end condition	Rest Time	Cancel by the specified time after rest time starts
	Synchronization	Cancel by the rest-hold function

Measurement function		
Voltage	Measuring time	Measurement once every 1 ms or 100 ms
Current	Measuring time	
Time		Time elapsed since test start
Cycle count		Absolute cycle count

Protection function		
Overvoltage (overcharge) protection	Software OVP	Reset by output off and reset command of the applicable channel
	Hardware OVP	
Overcurrent protection	Software OCP	Reset by output off and reset command of the applicable channel
Overheat protection (OHP)		Operated when the heat sink temperature is 90C°±5C° Reset by output off and reset command of the applicable channel
Undervoltage (Overdischarge) protection	Software UVP	Reset by output off and reset command of the applicable channel
	Hardware UVP	
Input external alarm		Stop test at HI level（2V to 12V）

Display function (status monitor)		
Power status	Power	Test is under execution, or test execution is possible. POWER/STANDBY LED illuminates (green).
	Standby	On standby, or system stop is possible. POWER/STANDBY LED illuminates (orange).
Charge/ discharge status	Charge	Charging. CHARGE/DISCHARGE/REST LED illuminates (red).
	Discharge	Discharging. CHARGE/DISCHARGE/REST LED illuminates (green).
	Rest	Resting. CHARGE/DISCHARGE/REST LED illuminates (orange).
Control status	CC	Constant current is applied. CC/CV/CP LED illuminates (red).
	CV	Constant voltage is applied. CC/CV/CP LED illuminates (green).
	CP	Constant power is applied. CC/CV/CP LED illuminates (orange).
Alarm	Alarm	Alarm is detected; the protection function operates. ALARM/ WARNING LED illuminates (red).
	Warning	Warning for alarm detection; prior warning before the protection function operates. ALARM WARNING LED illuminates (orange).

Rate output	
Number of outputs	4 ch
Charge current range	0.000 A to 35.000 A
Charge voltage range	0.0000 V to 5.0000 V
Charge power range	0.1W to 175.0W
Discharge current range	0.000 A to 35.000 A
Discharge voltage range	-0.5000 V to 5.0000 V
Maximum charge/discharge power	175.0 W

Setting accuracy		
Current setting	Range	0.000 A to 35.000 A
	Accuracy	± (0.15 % of set + 15 mA)
	Resolution	1mA
	Ripple	20 mArms or less (between 10 Hz and 500 kHz)
Voltage setting	Range	0.0000V to 5.0000V
	Accuracy *1	± (0.07 % of set + 1.5 mV)
	Resolution	100 μ V
	Ripple *1	3 mVrms or less (Bandwidth: 10Hz to 500kHz)

*1 Under the charging state.

Setting accuracy		
Power setting	Range	0.1W to 175.0W
	Accuracy	± (0.1 % of set + 100mW) (When the capacitor voltage is above 0.5 V)
	Resolution	100mW

Measurement accuracy		
Current measurement	Range	0.000A to 35.000 A
	Accuracy *2 *3	± (0.15 % of rdng + 15 mA)
	Resolution	1mA
	Sampling time	1 ms/ 100 ms
Voltage measurement	Range	-0.50000V to 5.00000V
	Accuracy *2 *3	± (0.07 % of rdng + 1.5 mV)
	Resolution	100 μ V
	Sampling time	1 ms/ 100 ms

*2 Ambient temperature: 18 to 28°C *3 Measurable range: The range indicated above

Protection function			
Overvoltage (Overcharge) protection *4	Hardware OVP	Setting range	0.10V to 6.00V
		Setting resolution	10 mV
		Setting accuracy	± 300 mV
		Operating time	Within 100 ms
	Software OVP	Setting range	-0.6000V to 5.1000V
		Setting resolution	100 μ V
		Setting accuracy	± (0.07 % or rdng + 1.5 mV)
		Operating time	Within 100 ms
Undervoltage (Overdischarge) protection *4	Hardware UVP	Setting range	-1.8V to 4.00V
		Setting resolution	10mV
		Setting accuracy	±300mV
		Operating time	Within 100 ms
	Software UVP	Setting range	-0.6000V to 5.1000V
		Setting resolution	100 μ V
		Setting accuracy	± (0.07 % or rdng + 1.5 mV)
		Operating time	Within 100 ms
Overcurrent protection	Software OCP	Setting range	0.000 A to 35.7000 A
		Setting resolution	1mA
		Setting accuracy	± (0.15 % of rdng + 15 mA)
		Operating time	Within 100 ms
	Built-in fuse		10 A×4
Overheat protection (inside the equipment)	OHP	Operating temperature	Operated when the built-in heat sink temperature is 90°C±5°C
AC input overcurrent protection			By the fuse in the AC input section
Input outside alarm	Allowable input voltage		+12 V
	Input level		HI level : 2 V to 12 V
			LOW level : OPEN or 0 V to 1 V
	Minimum pulse width		50 ms

*4 The capacitance of the connected sample (capacitor)'s should be more than 0.5F. When the data sampling acquires at 1ms, the time duration of the discharge current (from starting til the cutoff) should be more than 0.1sec. And when the data sampling acquires at 100ms, the time duration of the discharge current (from starting til the cutoff) should be more than 10sec.

Interface	
Ethernet（LAN）	10BASE-T, 100BASE-TX Auto select
Connector	RJ45

General specifications		
Nominal input rating		100 Vac to 240 Vac, 50 Hz/60 Hz
Input voltage range		90 Vac to 250 Vac
Power consumption	Per 1 ch	Approx. 500 VA (Charge at 5V / 35A)
	12 chs total	2000 VA or less (Charge at 5V / 35A for all channels)
Operating temperature and humidity range		0°C to +40°C, 20 %rh to 85 %rh (without condensation)
Storage temperature and humidity range		-20°C to +60°C, 90 %rh or less (without condensation)
Operating environment		Indoor. Overvoltage category II
Altitude		Up to 2000m
Isolation voltage	Input/output terminal ↔ Chassis	± 50 Vmax
Insulation resistance	AC input ↔ Chassis	100 MΩ or greater
	DC output ↔ Chassis	20 MΩ or greater
Withstand voltage	AC input ↔ Chassis	No malfunction at 1500 Vac for 1 minute
Leak current		3.5 mA or less
Momentary interruption overload capacity		Approx. 10 ms
Safety *5		Compliant with the requirements in the following standard: EN 61010-1 Class I Pollution degree 2
Dimensions (maximum)/weight		430(440)W × 173(190)H × 520(580)Dmm / Approx. 27kg
Accessories		Power code : 1pc., OUTPUT terminal cover : 4pcs., Output terminal screws (for M8) : 8sets, Output terminal screws (for M4) : 8sets, Operation manual : 1pc.

*5 Not applicable to custom-made products or modified products.

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