

PHU Battery Function User Manual

PHU Series

USER MANUAL



ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

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Outline

Background

With the development of the battery industry, battery testing has received more and more attention. The PHU provides two battery functions for this, battery simulation and battery test.

In the battery function, there are five built-in battery models: lithium battery, lead-acid battery, 1.2V NiMH battery, 12V NiMH battery, and NiCd battery for users to use.

The five groups of preset battery models voltage and internal resistance ranges are as follows:

Battery models	Voltage range	Internal resistance ranges
b001 (Li Ion)	3.003~4.199V	0.062~0.083Ω
b002 (lead acid)	10.812~13.588V	0.085~0.607Ω
b003 (NiMH1.2V)	1.008~1.4V	0.073~0.122Ω
b004 (NiMH12V)	10.734~14.377V	0.086~1.607Ω
b005 (Ni Cd)	1.132~1.397V	0.154~0.906Ω



Note

This function can only be enabled after paid purchase, please contact GW Instek for purchase details.

Battery simulation

Background

In general testing with real batteries, charging/discharging the batteries to a specified state of charge takes too much time. Our battery simulation feature instantly specifies battery state of charge, avoiding lengthy battery preparation times.

Additionally, continuous cycling of real batteries for testing may result in shorter battery life and inaccurate test results. Using the battery

simulation function provides greater test consistency and repeatable test results.

Best of all, the battery emulation function is much safer than a real battery. The PHU provides overvoltage and over-current protection, which interrupts the output in the event of an abnormality in the test.

In the battery simulation function, the PHU will simulate battery discharge according to the battery model.

Battery Model

In terms of battery models, we provide five sets of preset models for lithium batteries, lead-acid batteries, 1.2V NiMH batteries, 12V NiMH batteries and NiCd batteries for use.

The five groups of preset battery models voltage and internal resistance ranges are as follows:

Battery models	Voltage range	Internal resistance ranges
b001 (Li Ion)	3.003~4.199V	0.062~0.083Ω
b002 (lead acid)	10.812~13.588V	0.085~0.607Ω
b003 (NiMH1.2V)	1.008~1.4V	0.073~0.122Ω
b004 (NiMH12V)	10.734~14.377V	0.086~1.607Ω
b005 (Ni Cd)	1.132~1.397V	0.154~0.906Ω

There are also five sets of battery models available for user customization.

Simulation Method

According to the battery simulation method, it is divided into dynamic and static:

- **Dynamic**
As the capacity is consumed, the SOC (State of charge) will decrease over time, and the corresponding ESR will be changed with the current SOC (State of charge), and the corresponding V_{oc} (open circuit voltage) will be output.

- Static
According to the current set SOC, output the corresponding V_{oc} (open circuit voltage).

Charge or Discharge

Background	In the charge/discharge function, you can perform charging and discharging tests on the battery. The output turns off automatically upon reaching a termination condition.
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Note

The discharge current is not adjustable, and the discharge process may take a long time.

Generate battery model

Background	In the modeling function, the PHU measures the battery open-circuit voltage, capacity (Ah), and current during the charging process, and calculates the equivalent resistance to generate a battery model.
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This model is also applicable for discharge simulation in Battery Simulation.



Note

Only the data from charging is suitable for generating a battery model, because the discharging current cannot be set.



Note

Before charging to generate a battery model, ensure that the battery has reached a fully discharged state.

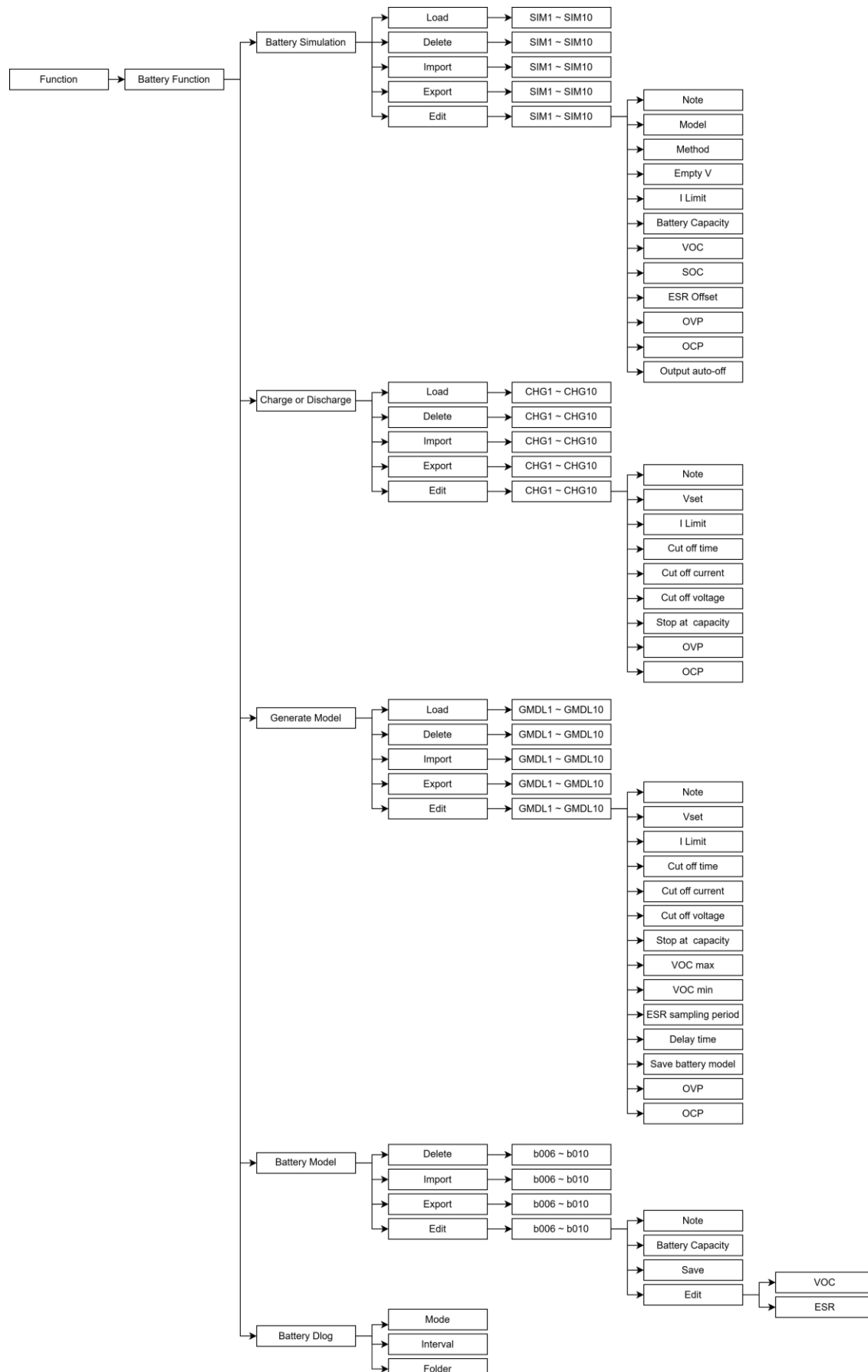


Note

An incomplete charging may not be able to provide the basis covering battery performance in all situations for generating a battery model.

Menu configuration

Menu structure



Menu configuration table

Battery Function	Path	
Battery Simulation	Menu/ Function/ Battery Function/ Battery Simulation	
Settings	Path	Content/ Setting Range
Load	Battery Function/ Battery Simulation	1~10
Delete	Battery Function/ Battery Simulation	1~10
Import	Battery Function/ Battery Simulation	1~10
Export	Battery Function/ Battery Simulation	1~10
Edit	Battery Function/ Battery Simulation	1~10
Edit Item	Menu/ Function/ Battery Function/ Battery Simulation/ Edit	
Settings	Path	Content/Setting Range
Model	Battery Function/ Battery Simulation/ Edit	1~10
Method	Battery Function/ Battery Simulation/ Edit	Dynamic / Static
Empty V	Battery Function/ Battery Simulation/ Edit	V _{oc_min} ~ V _{oc_max}
 Note	V _{oc_max} : The maximum value of the open circuit voltage in the selected battery model.	
	V _{oc_min} : The minimum value of the open circuit voltage in the selected battery model.	
I-Limit	Battery Function/ Battery Simulation/ Edit	(0.00 to 178.50) A(PHU 80-170)
		(0.00 to 73.50) A(PHU 200-70)
		(0.000 to 31.500) A(PHU 500-30)
		(0.000 to 21.000) A(PHU 750-20)
		(0.000 to 15.750) A(PHU 1000-15)
		(0.000 to 10.500) A(PHU 1500-10)
		(0.00 to 357.00) A(PHU 80-340)
		(0.00 to 147.00) A(PHU 200-140)
		(0.00 to 63.30) A(PHU 500-60)
		(0.000 to 42.000) A(PHU 750-40)
		(0.000 to 31.500) A(PHU 1000-30)
		(0.000 to 21.000) A(PHU 1500-20)
		(0.00 to 535.50) A(PHU 80-510)
		(0.00 to 220.50) A(PHU 200-210)
		(0.00 to 94.50) A(PHU 500-90)
		(0.00 to 63.00) A(PHU 750-60)
		(0.000 to 47.250) A(PHU 1000-45)
		(0.000 to 31.500) A(PHU 1500-30)
Battery capacity	Battery Function/ Battery Simulation/ Edit	0.001AH ~ 999999999.999AH
VOC (Open circuit voltage)	Battery Function/ Battery Simulation/ Edit	Empty V ~ V _{oc_max}
SOC (State of charge)	Battery Function/ Battery Simulation/ Edit	0.00% ~ 100.00%
ESR offset	Battery Function/ Battery Simulation/ Edit	-100.000Ω ~ 100.000Ω
 Note	Please use SHIFT button to change ESR offset polarity.	
OVP	Battery Function/ Battery Simulation/ Edit	(5.00 to 88.00) V(PHU 80-170)
		(5.00 to 220.00) V(PHU 200-70)
		(5.00 to 550.00) V(PHU 500-30)
		(5.0 to 825.0) V(PHU 750-20)
		(5.0 to 1100.0) V(PHU 1000-15)
		(5.0 to 1650.0) V(PHU 1500-10)
		(5.00 to 88.00) V(PHU 80-340)
		(5.00 to 220.00) V(PHU 200-140)
		(5.00 to 550.00) V(PHU 500-60)
		(5.0 to 825.0) V(PHU 750-40)
		(5.0 to 1100.0) V(PHU 1000-30)
		(5.0 to 1650.0) V(PHU 1500-20)
		(5.00 to 88.00) V(PHU 80-510)
		(5.00 to 220.00) V(PHU 200-210)
		(5.00 to 550.00) V(PHU 500-90)
		(5.0 to 825.0) V(PHU 750-60)
		(5.0 to 1100.0) V(PHU 1000-45)
		(5.0 to 1650.0) V(PHU 1500-30)

		(5.00 to 187.00) A(PHU 80-170)
		(5.00 to 77.00) A(PHU 200-70)
		(5.000 to 33.000) A(PHU 500-30)
		(5.000 to 22.000) A(PHU 750-20)
		(5.000 to 16.500) A(PHU 1000-15)
		(5.000 to 11.000) A(PHU 1500-10)
		(5.00 to 374.00) A(PHU 80-340)
		(5.00 to 154.00) A(PHU 200-140)
OCF	Battery Function/ Battery Simulation/ Edit	(5.00 to 66.00) A(PHU 500-60)
		(5.000 to 44.000) A(PHU 750-40)
		(5.000 to 33.000) A(PHU 1000-30)
		(5.000 to 22.000) A(PHU 1500-20)
		(5.00 to 561.00) A(PHU 80-510)
		(5.00 to 231.00) A(PHU 200-210)
		(5.00 to 99.00) A(PHU 500-90)
		(5.00 to 66.00) A(PHU 750-60)
		(5.000 to 49.500) A(PHU 1000-45)
		(5.000 to 33.000) A(PHU 1500-30)
Output auto-off	Battery Function/ Battery Simulation/ Edit	Disable / Enable
 Note	If Output Auto-Off is enabled, the output turns off automatically when the discharge reaches $V_{oc} = \text{Empty V.}$	
Charge or Discharge	Menu/ Function/ Battery Function/ Charge or Discharge	
Settings	Path	Content/Setting Range
Load	Battery Function/ Charge or Discharge	1~10
Delete	Battery Function/ Charge or Discharge	1~10
Import	Battery Function/ Charge or Discharge	1~10
Export	Battery Function/ Charge or Discharge	1~10
Edit	Battery Function/ Charge or Discharge	1~10
Edit Item	Menu/ Function/ Battery Function/ Charge or Discharge/ Edit	
Settings	Path	Content/Setting Range
		(0.00 to 84.00) V(PHU 80-170)
		(0.00 to 210.00) V(PHU 200-70)
		(0.00 to 525.00) V(PHU 500-30)
		(0.0 to 787.5) V(PHU 750-20)
		(0.0 to 1050.0) V(PHU 1000-15)
		(0.0 to 1575.0) V(PHU 1500-10)
		(0.00 to 84.00) V(PHU 80-340)
		(0.00 to 210.00) V(PHU 200-140)
V _{set} Target voltage value for Charge or Discharge.	Battery Function/ Charge or Discharge / Edit	(0.00 to 525.00) V(PHU 500-60)
		(0.0 to 787.5) V(PHU 750-40)
		(0.0 to 1050.0) V(PHU 1000-30)
		(0.0 to 1575.0) V(PHU 1500-20)
		(0.00 to 84.00) V(PHU 80-510)
		(0.00 to 210.00) V(PHU 200-210)
		(0.00 to 525.00) V(PHU 500-90)
		(0.0 to 787.5) V(PHU 750-60)
		(0.0 to 1050.0) V(PHU 1000-45)
		(0.0 to 1575.0) V(PHU 1500-30)
		(0.00 to 178.50) A(PHU 80-170)
		(0.00 to 73.50) A(PHU 200-70)
		(0.000 to 31.500) A(PHU 500-30)
		(0.000 to 21.000) A(PHU 750-20)
		(0.000 to 15.750) A(PHU 1000-15)
		(0.000 to 10.500) A(PHU 1500-10)
I-Limit	Battery Function/ Charge or Discharge / Edit	(0.00 to 357.00) A(PHU 80-340)
		(0.00 to 147.00) A(PHU 200-140)
		(0.00 to 63.30) A(PHU 500-60)
		(0.000 to 42.000) A(PHU 750-40)
		(0.000 to 31.500) A(PHU 1000-30)
		(0.000 to 21.000) A(PHU 1500-20)
		(0.00 to 535.50) A(PHU 80-510)

		(0.00 to 220.50) A(PHU 200-210) (0.00 to 94.50) A(PHU 500-90) (0.00 to 63.00) A(PHU 750-60) (0.000 to 47.250) A(PHU 1000-45) (0.000 to 31.500) A(PHU 1500-30)
Cut off time	Battery Function/ Charge or Discharge / Edit	0 ~ 86400 Seconds 0: INF
Cut off current	Battery Function/ Charge or Discharge / Edit	0~ 0.100A (The output will be turned off when the charge is lower than the set value)
Cut off voltage	Battery Function/ Charge or Discharge / Edit	(0.00 to 84.00) V(PHU 80-170) (0.00 to 210.00) V(PHU 200-70) (0.00 to 525.00) V(PHU 500-30) (0.0 to 787.5) V(PHU 750-20) (0.0 to 1050.0) V(PHU 1000-15) (0.0 to 1575.0) V(PHU 1500-10) (0.00 to 84.00) V(PHU 80-340) (0.00 to 210.00) V(PHU 200-140) (0.00 to 525.00) V(PHU 500-60) (0.0 to 787.5) V(PHU 750-40) (0.0 to 1050.0) V(PHU 1000-30) (0.0 to 1575.0) V(PHU 1500-20) (0.00 to 84.00) V(PHU 80-510) (0.00 to 210.00) V(PHU 200-210) (0.00 to 525.00) V(PHU 500-90) (0.0 to 787.5) V(PHU 750-60) (0.0 to 1050.0) V(PHU 1000-45) (0.0 to 1575.0) V(PHU 1500-30)
Stop at Capacity	Battery Function/ Charge or Discharge / Edit	0.001AH ~ 999999999.999AH
OVP	Battery Function/ Charge or Discharge / Edit	(5.00 to 88.00) V(PHU 80-170) (5.00 to 220.00) V(PHU 200-70) (5.00 to 550.00) V(PHU 500-30) (5.0 to 825.0) V(PHU 750-20) (5.0 to 1100.0) V(PHU 1000-15) (5.0 to 1650.0) V(PHU 1500-10) (5.00 to 88.00) V(PHU 80-340) (5.00 to 220.00) V(PHU 200-140) (5.00 to 550.00) V(PHU 500-60) (5.0 to 825.0) V(PHU 750-40) (5.0 to 1100.0) V(PHU 1000-30) (5.0 to 1650.0) V(PHU 1500-20) (5.00 to 88.00) V(PHU 80-510) (5.00 to 220.00) V(PHU 200-210) (5.00 to 550.00) V(PHU 500-90) (5.0 to 825.0) V(PHU 750-60) (5.0 to 1100.0) V(PHU 1000-45) (5.0 to 1650.0) V(PHU 1500-30)
OCP	Battery Function/ Charge or Discharge / Edit	(5.00 to 187.00) A(PHU 80-170) (5.00 to 77.00) A(PHU 200-70) (5.000 to 33.000) A(PHU 500-30) (5.000 to 22.000) A(PHU 750-20) (5.000 to 16.500) A(PHU 1000-15) (5.000 to 11.000) A(PHU 1500-10) (5.00 to 374.00) A(PHU 80-340) (5.00 to 154.00) A(PHU 200-140) (5.00 to 66.00) A(PHU 500-60) (5.000 to 44.000) A(PHU 750-40) (5.000 to 33.000) A(PHU 1000-30) (5.000 to 22.000) A(PHU 1500-20) (5.00 to 561.00) A(PHU 80-510) (5.00 to 231.00) A(PHU 200-210)

		(5.00 to 99.00) A(PHU 500-90)
		(5.00 to 66.00) A(PHU 750-60)
		(5.000 to 49.500) A(PHU 1000-45)
		(5.000 to 33.000) A(PHU 1500-30)
Generate model	Menu/ Function/ Battery Function/ Generate model	
Settings	Path	Content/Setting Range
Load	Battery Function/ Generate model	1~10
Delete	Battery Function/ Generate model	1~10
Import	Battery Function/ Generate model	1~10
Export	Battery Function/ Generate model	1~10
Edit	Battery Function/ Generate model	1~10
Edit Item	Menu/ Function/ Battery Function/ Generate model/ Edit	
Settings	Path	Content/Setting Range
		(0.00 to 84.00) V(PHU 80-170)
		(0.00 to 210.00) V(PHU 200-70)
		(0.00 to 525.00) V(PHU 500-30)
		(0.0 to 787.5) V(PHU 750-20)
		(0.0 to 1050.0) V(PHU 1000-15)
		(0.0 to 1575.0) V(PHU 1500-10)
		(0.00 to 84.00) V(PHU 80-340)
		(0.00 to 210.00) V(PHU 200-140)
		(0.00 to 525.00) V(PHU 500-60)
		(0.0 to 787.5) V(PHU 750-40)
		(0.0 to 1050.0) V(PHU 1000-30)
		(0.0 to 1575.0) V(PHU 1500-20)
		(0.00 to 84.00) V(PHU 80-510)
		(0.00 to 210.00) V(PHU 200-210)
		(0.00 to 525.00) V(PHU 500-90)
		(0.0 to 787.5) V(PHU 750-60)
		(0.0 to 1050.0) V(PHU 1000-45)
		(0.0 to 1575.0) V(PHU 1500-30)
		(0.00 to 178.50) A(PHU 80-170)
		(0.00 to 73.50) A(PHU 200-70)
		(0.000 to 31.500) A(PHU 500-30)
		(0.000 to 21.000) A(PHU 750-20)
		(0.000 to 15.750) A(PHU 1000-15)
		(0.000 to 10.500) A(PHU 1500-10)
		(0.00 to 357.00) A(PHU 80-340)
		(0.00 to 147.00) A(PHU 200-140)
		(0.00 to 63.30) A(PHU 500-60)
		(0.000 to 42.000) A(PHU 750-40)
		(0.000 to 31.500) A(PHU 1000-30)
		(0.000 to 21.000) A(PHU 1500-20)
		(0.00 to 535.50) A(PHU 80-510)
		(0.00 to 220.50) A(PHU 200-210)
		(0.00 to 94.50) A(PHU 500-90)
		(0.00 to 63.00) A(PHU 750-60)
		(0.000 to 47.250) A(PHU 1000-45)
		(0.000 to 31.500) A(PHU 1500-30)
Cut off time	Battery Function/ Generate Model / Edit	0~ 86400 Seconds 0 : INF
Cut off current	Battery Function/ Generate Model / Edit	0~ 0.100A (The output will be turned off when the charge is lower than the set value)

Cut off voltage	Battery Function/ Generate Model / Edit	(0.00 to 84.00) V(PHU 80-170)
		(0.00 to 210.00) V(PHU 200-70)
		(0.00 to 525.00) V(PHU 500-30)
		(0.0 to 787.5) V(PHU 750-20)
		(0.0 to 1050.0) V(PHU 1000-15)
		(0.0 to 1575.0) V(PHU 1500-10)
		(0.00 to 84.00) V(PHU 80-340)
		(0.00 to 210.00) V(PHU 200-140)
		(0.00 to 525.00) V(PHU 500-60)
		(0.0 to 787.5) V(PHU 750-40)
		(0.0 to 1050.0) V(PHU 1000-30)
		(0.0 to 1575.0) V(PHU 1500-20)
		(0.00 to 84.00) V(PHU 80-510)
		(0.00 to 210.00) V(PHU 200-210)
		(0.00 to 525.00) V(PHU 500-90)
		(0.0 to 787.5) V(PHU 750-60)
Battery V_{oc_max} (SOC = 100%)	Battery Function/ Generate Model / Edit	(0.0 to 1050.0) V(PHU 1000-45)
		(0.0 to 1575.0) V(PHU 1500-30)
		0.001AH ~ 999999999.999AH
		(0.00 to 84.00) V(PHU 80-170)
		(0.00 to 210.00) V(PHU 200-70)
		(0.00 to 525.00) V(PHU 500-30)
		(0.0 to 787.5) V(PHU 750-20)
		(0.0 to 1050.0) V(PHU 1000-15)
		(0.0 to 1575.0) V(PHU 1500-10)
		(0.00 to 84.00) V(PHU 80-340)
		(0.00 to 210.00) V(PHU 200-140)
		(0.00 to 525.00) V(PHU 500-60)
		(0.0 to 787.5) V(PHU 750-40)
		(0.0 to 1050.0) V(PHU 1000-30)
		(0.0 to 1575.0) V(PHU 1500-20)
		(0.00 to 84.00) V(PHU 80-510)
Battery V_{oc_min} (SOC = 0%)	Battery Function/ Generate Model / Edit	(0.00 to 210.00) V(PHU 200-210)
		(0.00 to 525.00) V(PHU 500-90)
		(0.0 to 787.5) V(PHU 750-60)
		(0.0 to 1050.0) V(PHU 1000-45)
		(0.0 to 1575.0) V(PHU 1500-30)
		(0.00 to 84.00) V(PHU 80-170)
		(0.00 to 210.00) V(PHU 200-70)
		(0.00 to 525.00) V(PHU 500-30)
		(0.0 to 787.5) V(PHU 750-20)
		(0.0 to 1050.0) V(PHU 1000-15)
		(0.0 to 1575.0) V(PHU 1500-10)
		(0.00 to 84.00) V(PHU 80-340)
		(0.00 to 210.00) V(PHU 200-140)
		(0.00 to 525.00) V(PHU 500-60)
		(0.0 to 787.5) V(PHU 750-40)
		(0.0 to 1050.0) V(PHU 1000-30)
		(0.0 to 1575.0) V(PHU 1500-20)
		(0.00 to 84.00) V(PHU 80-510)
		(0.00 to 210.00) V(PHU 200-210)
		(0.00 to 525.00) V(PHU 500-90)
		(0.0 to 787.5) V(PHU 750-60)
		(0.0 to 1050.0) V(PHU 1000-45)
		(0.0 to 1575.0) V(PHU 1500-30)

OVP	Battery Function/ Generate Model / Edit	(5.00 to 88.00) V(PHU 80-170)
		(5.00 to 220.00) V(PHU 200-70)
		(5.00 to 550.00) V(PHU 500-30)
		(5.0 to 825.0) V(PHU 750-20)
		(5.0 to 1100.0) V(PHU 1000-15)
		(5.0 to 1650.0) V(PHU 1500-10)
		(5.00 to 88.00) V(PHU 80-340)
		(5.00 to 220.00) V(PHU 200-140)
		(5.00 to 550.00) V(PHU 500-60)
		(5.0 to 825.0) V(PHU 750-40)
		(5.0 to 1100.0) V(PHU 1000-30)
		(5.0 to 1650.0) V(PHU 1500-20)
		(5.00 to 88.00) V(PHU 80-510)
		(5.00 to 220.00) V(PHU 200-210)
		(5.00 to 550.00) V(PHU 500-90)
OCP	Battery Function/ Generate Model / Edit	(5.0 to 825.0) V(PHU 750-60)
		(5.0 to 1100.0) V(PHU 1000-45)
		(5.0 to 1650.0) V(PHU 1500-30)
		(5.00 to 187.00) A(PHU 80-170)
		(5.00 to 77.00) A(PHU 200-70)
		(5.000 to 33.000) A(PHU 500-30)
		(5.000 to 22.000) A(PHU 750-20)
		(5.000 to 16.500) A(PHU 1000-15)
		(5.000 to 11.000) A(PHU 1500-10)
		(5.00 to 374.00) A(PHU 80-340)
		(5.00 to 154.00) A(PHU 200-140)
		(5.00 to 66.00) A(PHU 500-60)
		(5.000 to 44.000) A(PHU 750-40)
		(5.000 to 33.000) A(PHU 1000-30)
		(5.000 to 22.000) A(PHU 1500-20)
ESR sampling period	Battery Function/ Generate Model / Edit	(5.00 to 561.00) A(PHU 80-510)
		(5.00 to 231.00) A(PHU 200-210)
		(5.00 to 99.00) A(PHU 500-90)
		(5.00 to 66.00) A(PHU 750-60)
		(5.000 to 49.500) A(PHU 1000-45)
Delay time	Battery Function/ Generate Model / Edit	(5.000 to 33.000) A(PHU 1500-30)
		10 second.
		30 second.
		60 second.
		120 second.
Save battery model	Battery Function/ Generate Model / Edit	600 second.
		0.10 ~ 3.600 second
		6~10
Battery Model	Menu/ Function/ Battery Function/ Battery Model	
Settings	Path	Content/Setting Range
Delete	Battery Function/ Battery Model	6~10
Import	Battery Function/ Battery Model	6~10
Export	Battery Function/ Battery Model	6~10
Edit	Battery Function/ Battery Model	6~10
Edit Item	Menu/ Function/ Battery Function/ Battery Model / Edit	
Settings	Path	Content/Setting Range
VOC (Open circuit voltage)	Battery Function/ Battery Model / Edit	(0.00 to 84.00) V(PHU 80-170)
		(0.00 to 210.00) V(PHU 200-70)
		(0.00 to 525.00) V(PHU 500-30)
		(0.0 to 787.5) V(PHU 750-20)
		(0.0 to 1050.0) V(PHU 1000-15)
		(0.0 to 1575.0) V(PHU 1500-10)
		(0.00 to 84.00) V(PHU 80-340)
		(0.00 to 210.00) V(PHU 200-140)
		(0.00 to 525.00) V(PHU 500-60)
		(0.0 to 787.5) V(PHU 750-40)

		(0.0 to 1050.0) V(PHU 1000-30)
		(0.0 to 1575.0) V(PHU 1500-20)
		(0.00 to 84.00) V(PHU 80-510)
		(0.00 to 210.00) V(PHU 200-210)
		(0.00 to 525.00) V(PHU 500-90)
		(0.0 to 787.5) V(PHU 750-60)
		(0.0 to 1050.0) V(PHU 1000-45)
		(0.0 to 1575.0) V(PHU 1500-30)
ESR	Battery Function/ Battery Model / Edit	0Ω ~ 100.000Ω
Battery Dlog	Menu/ Function/ Battery Function/ Battery Dlog	
Settings	Path	Content/Setting Range
Mode	Battery Function/ Battery Dlog	Disable/ USB storage/ Remote
Interval	Battery Function/ Battery Dlog	0.10 ~ 3.600 second
Folder	Battery Function/ Battery Dlog	0000~9999

Function introduction

Battery simulation

Overview

In this application, the PHU will discharge according to the battery model.

The form of the battery model is as shown in the figure below:

	A	B	C
1	PHU_SERIES		
2	Capacity=3.100AH		
3	SOC(%)	Open Voltage	ESR(ohm)
4	0	3.003	0.083
5	1	3.493	0.074
6	2	3.494	0.073
7	3	3.572	0.068
8	4	3.634	0.068
9	5	3.683	0.067
10	6	3.722	0.067
11	7	3.753	0.067
12	8	3.768	0.067
13	9	3.776	0.066
14	10	3.783	0.066
15	11	3.79	0.066
16	12	3.797	0.066
17	13	3.804	0.066
18	14	3.812	0.066
19	15	3.82	0.066
20	16	3.829	0.066
21	17	3.837	0.066
22	18	3.845	0.066
23	19	3.853	0.066
24	20	3.86	0.065
25	21	3.867	0.065
26	22	3.873	0.065

The battery model contains the following parameters:

- Capacity
- SOC: State of charge
- Open circuit voltage

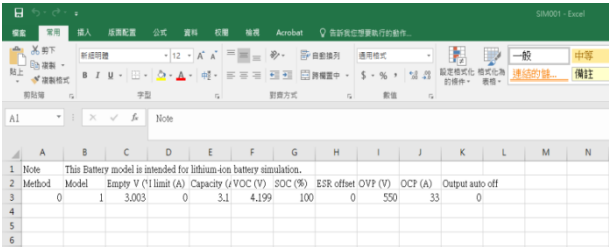
- ESR: battery resistance

There are two methods to simulate battery discharge, dynamic or static.

- Dynamic: As the capacity is consumed, the SOC (State of charge) will decrease with time, and the corresponding ESR will be changed with the current SOC, and the corresponding V_{oc} (open circuit voltage) will be output.
- Static: According to the current set SOC, output the corresponding V_{oc} (open circuit voltage).

File

The battery simulation provides ten editable configuration files, as listed below:



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Note	This Battery model is intended for lithium-ion battery simulation.												
2	Method	Model	Empty V (V) limit (A)	Capacity (Ah) (VOC (V)	SOC (%)	ESR offset	OVP (V)	OCP (A)	Output auto off					
3		0	1	3.003	0	3.1	4.199	100	0	550	33	0		
4														
5														
6														

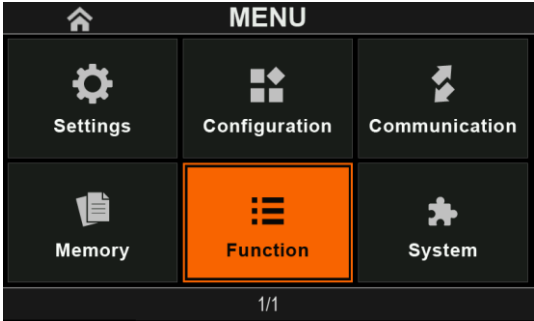
This file supports deletion, import, export, and editing. It can also be directly loaded and executed.



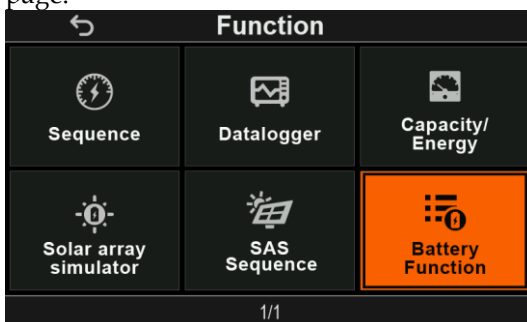
For the parameter setting ranges, please refer to the Menu Configuration Table.

Panel operation

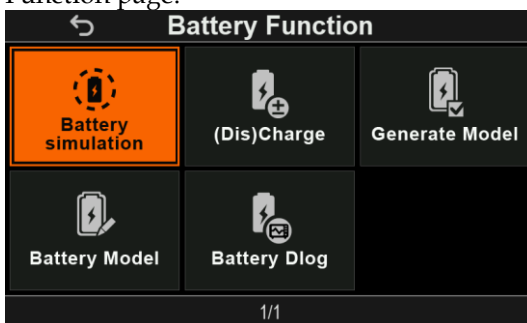
1. Press the menu button and enter the “Function” icon.



2. Choose the “Battery Function” in the Function page.



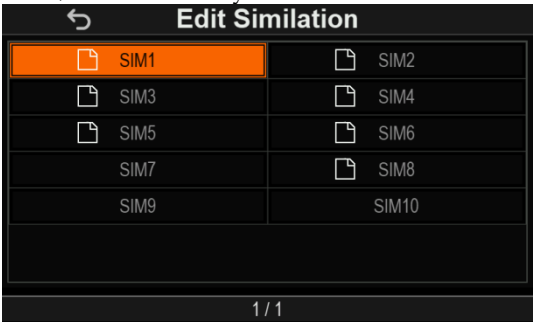
3. Choose the “Battery Simulation” in the Battery Function page.



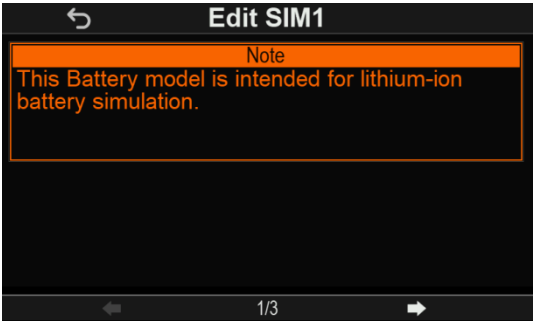
4. You will see options for deletion, import, export, and editing of the file. The file can also be directly loaded and executed. Here, we first enter the editing page.



5. Next, select the file you want to edit.

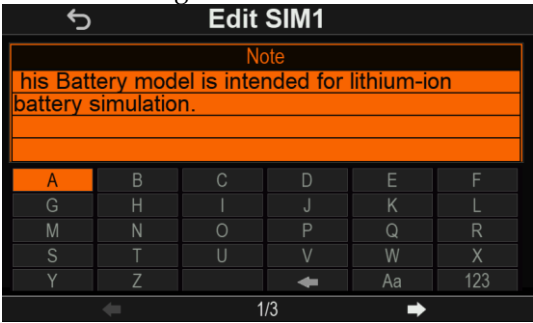


6. After entering the file, the first page will appear as follows:



Here, the “Note” can be used to annotate the purpose of this file.

7. Press the voltage knob to edit.



Rotate the Current knob to select the position you want to modify.

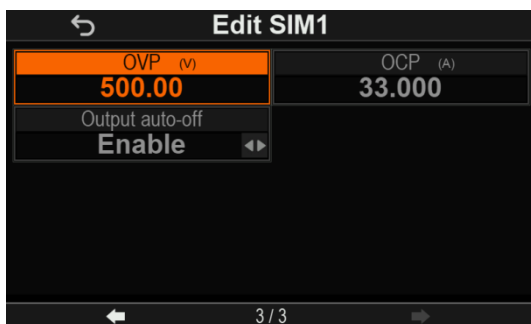
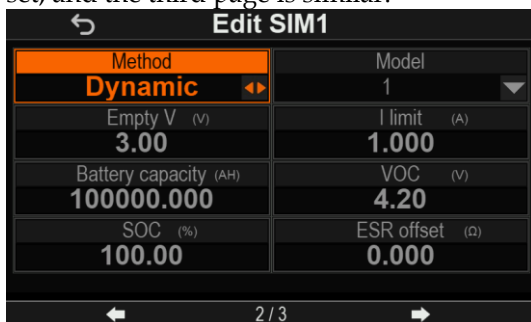
Rotate the Voltage knob to choose the letter to set.



Note

The blank space indicates the currently selected position for changes.

8. After editing, press ESC to save and return to the Step 6 page.
9. Rotate the Voltage knob to access the second page. This page displays the parameters to be set, and the third page is similar.

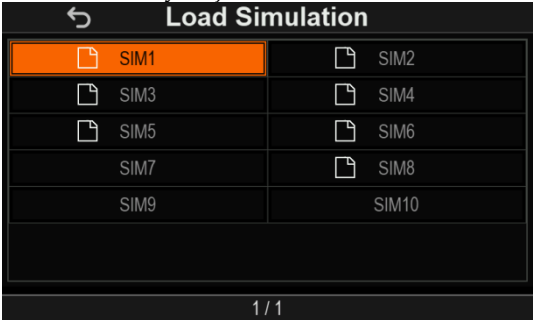


For the parameter setting ranges, please refer to the Menu Configuration Table.

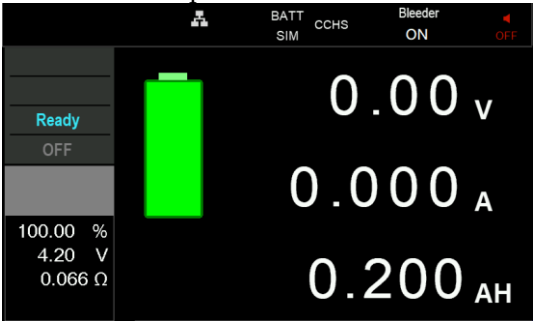
10. After completing all parameter settings, press ESC to return to the Step 4 page and select Load.



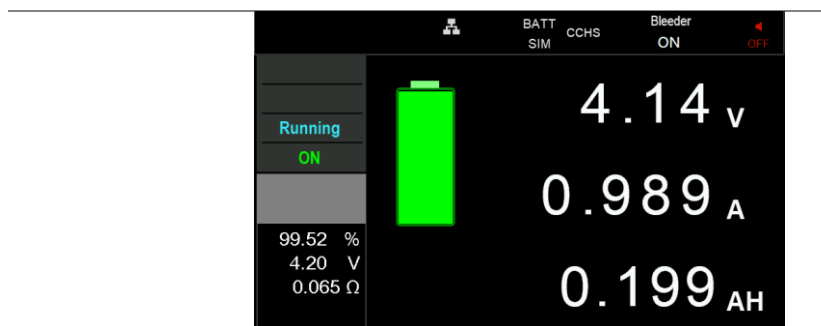
11. Select the file you just edited.



12. The execution screen appears as shown below.
Wait for the output.



13. Press the **Output** to start execution.



Note

If Output Auto-Off is enabled, the output turns off automatically when the discharge reaches V_{oc} V_{oc} = Empty V.

Meter

The values displayed on the right side of this page, from top to bottom, are:

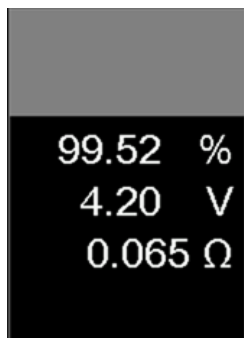
- The voltage value measured at that moment.
- The current value measured at that moment.
- Remaining capacity of the simulated battery.



The values displayed at the bottom left of this page, from top to bottom, are:

- The SOC at that moment.
- The VOC corresponding to the selected model at that moment.
- The ESR corresponding to the selected model at

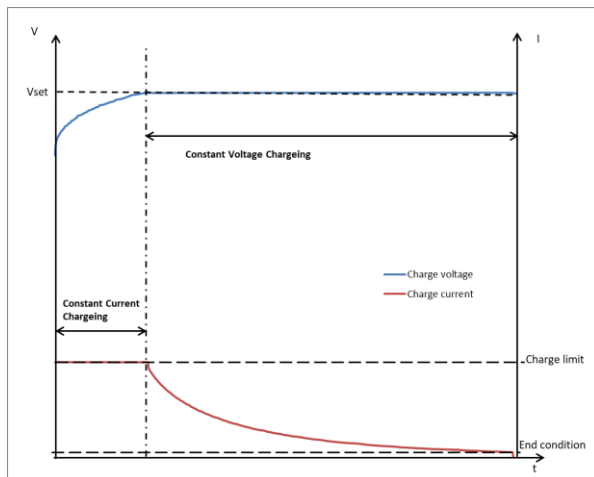
that moment.



Charge or Discharge

Charge

In this application, the PHU performs a charging test on the battery, with the charging split into two parts, as shown in the figure below.



Constant current stage: In the initial stage, the PHU charges the battery with the Charge limit, and the output voltage continues to increase to nearly equal to V_{set} .

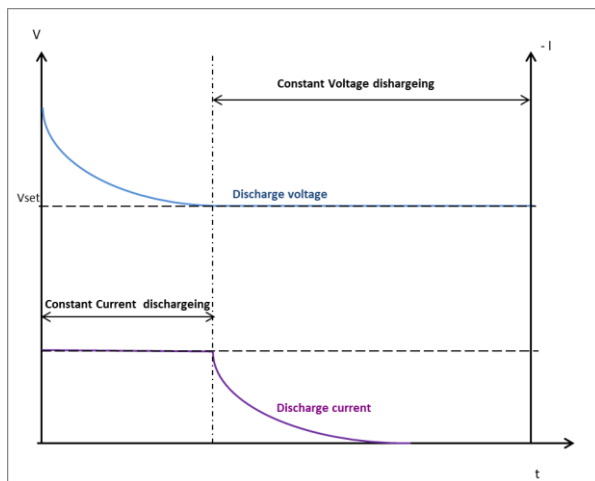
Constant voltage stage: When the charging voltage

reaches the V_{set} value, the PHU charges the battery with constant voltage, and the charging current gradually decreases.

When the charging current drops to the end condition, charging is complete. At this time, the battery open circuit voltage is approximately equal to V_{set} .

Discharge

In this application, the PHU performs a discharging test on the battery, with the discharging split into two parts, as shown in the figure below.



Constant current stage: In the initial stage, the PHU discharges the battery in constant current mode. The sink current cannot be set. The output voltage continues to decrease to approximately equal to V_{set} .

Constant voltage stage: When the discharge voltage drops to V_{set} , the PHU discharges the battery in constant voltage mode, and the discharge current gradually decreases.

The discharge is complete when the discharge current drops to the termination condition. At this

time, the battery open circuit voltage is approximately equal to V_{set} .



The discharge current is not adjustable, and the discharge process may take a long time.

Termination Conditions

The PHU provides four termination conditions:

- 1. Cut off time (sec)
- 2. Cut off current (A)
- 3. Cut off voltage (V)
- 4. Stop at Capacity (AH)

The output turns off upon reaching any termination condition.

File

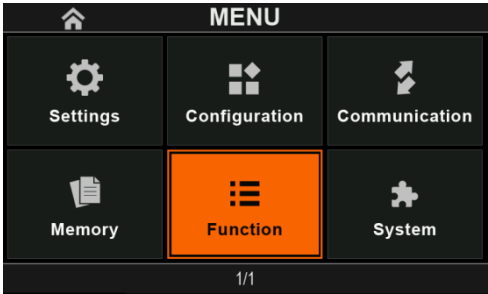
The Charge provides ten editable configuration files, as listed below:

新電機									
檔案 常用 插入 版面配置 公式 資料 校閱 檢視 開發人員 Acrobat 查詢您想要執行的動作...									
新電機									
B I U ... 字體 對齊方式 數值									
H13									
A B C D E F G H									
1	Note	Used for lithium battery charge testing.							
2	Vset (V)	I limit (A)	Cut off time (sec)	Cut off current (A)	Cut off voltage (V)	Stop at Capacity (AH)	OVF (V)	OCP (A)	
3	4	2	10	0	5	10.003	50	30	
4									
5									
6									

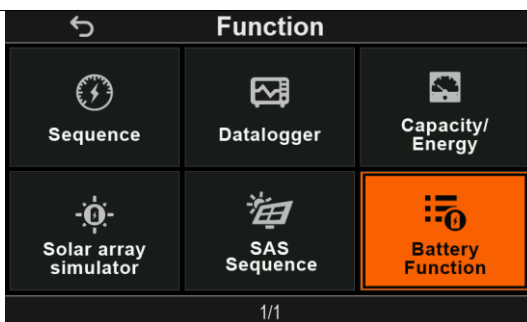
This file supports deletion, import, export, and editing. It can also be directly loaded and executed.

Panel operation

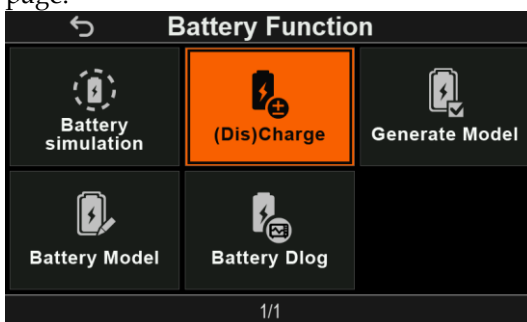
- 1. Press the menu button and enter the “Function” icon.



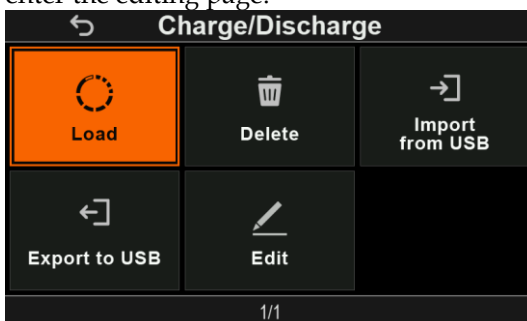
- 2. Choose the “Battery Function” in the Function page.



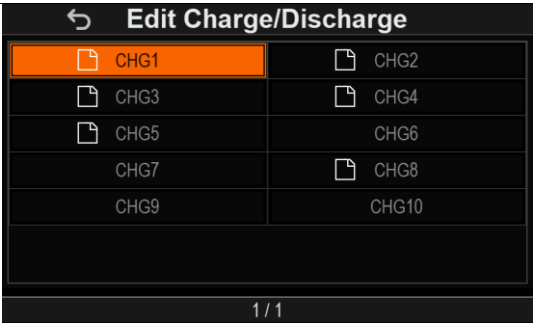
3. Choose the “Charge” in the Battery Function page.



4. You will see options for deletion, import, export, and editing of the file. The file can also be directly loaded and executed. Here, we first enter the editing page.



5. Next, select the file you want to edit.

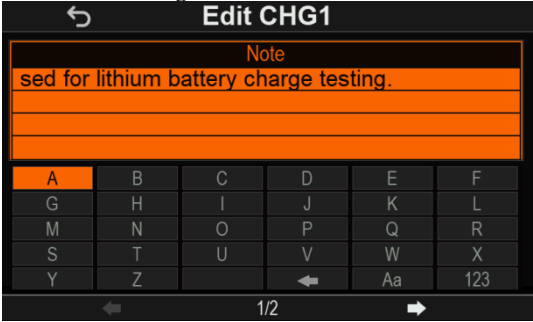


6. After entering the file, the first page will appear as follows:



Here, the “Note” can be used to annotate the purpose of this file.

7. Press the voltage knob to edit.



Rotate the Current knob to select the position you want to modify.

Rotate the Voltage knob to choose the letter to

set.



Note

The blank space indicates the currently selected position for changes.

8. After editing, press ESC to save and return to the Step 6 page.
9. Rotate the Voltage knob to access the second page. This page displays the parameters to be set.

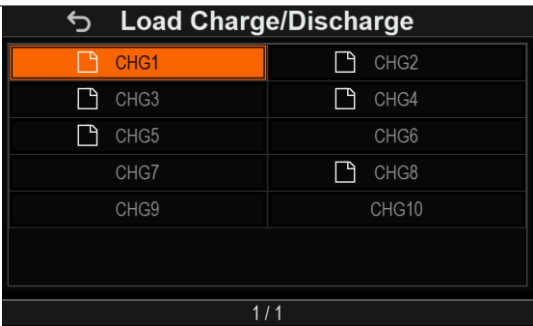
Edit CHG1	
Vset (V)	I limit (A)
4.00	2.000
Cut off time (Sec)	Cut off current (A)
10	0.000
Cut off voltage (V)	Stop at Capacity (AH)
5.00	10.003
OVP (V)	OCP (A)
50.00	30.000
2 / 2	

For the parameter setting ranges, please refer to the Menu Configuration Table.

10. After completing all parameter settings, press ESC to return to the Step 4 page and select Load.

Charge/Discharge		
 Load	 Delete	 Import from USB
 Export to USB	 Edit	
1/1		

11. Select the file you just edited.



12. The execution screen appears as shown below.
Wait for the output.



13. Press the **Output** to start execution.



Meter

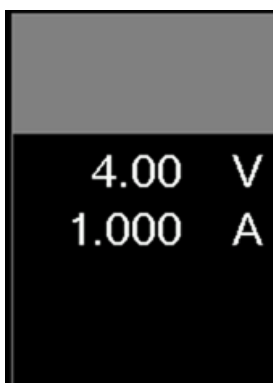
The values displayed on the right side of this page, from top to bottom, are:

- The voltage value measured at that moment.
- The current value measured at that moment.
- The AH value measured at that moment.



The values displayed at the bottom left of this page, from top to bottom, are:

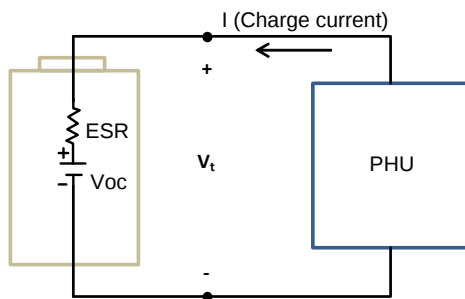
- The target voltage value.
- I Limit



Generate Model

Overview

The diagram below shows a simplified circuit when the PHU is charging the battery.



- I: Charge current.
- V_{oc} : Open circuit voltage.
- V_t : V_{oc} plus the voltage change during charging.

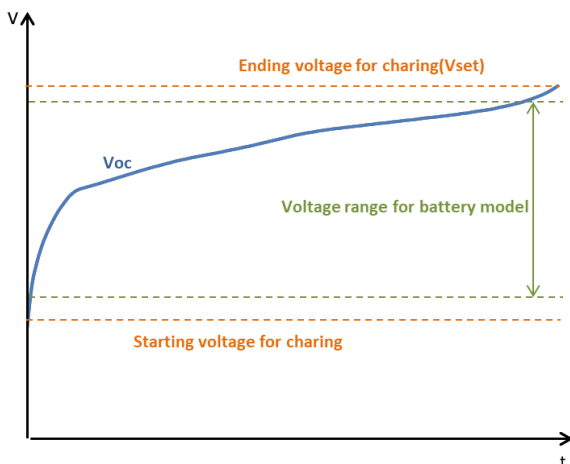
$$V_t = V_{oc} + I \cdot ESR$$

- ESR: battery resistance

$$ESR = \frac{V_t - V_{oc}}{I}$$

According to the battery charging process, measure the battery's open circuit voltage, battery capacity (amp-hour) and current, and calculate the equivalent resistance to generate a battery model.

When charging is finished, you can choose to generate a battery model after setting the voltage range for the battery model. As you can see from the following figure, the range should be within the starting voltage and V_{set} values.



 **Note** Only the data from charging is suitable for generating a battery model, because the discharging current cannot be set.

 **Note** Before charging to generate a battery model, ensure that the battery has reached a fully discharged state.

 **Note** An incomplete charging may not be able to provide the basis covering battery performance in all situations for generating a battery model.

Termination Conditions The PHU provides four termination conditions:

1. Cut off time (sec)
2. Cut off current (A)
3. Cut off voltage (V)
4. Stop at Capacity (AH)

The output turns off upon reaching any termination condition.

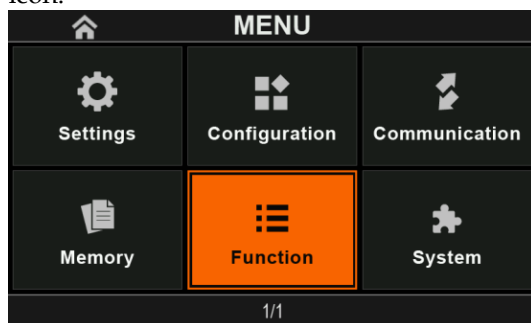
File The Generate Model provides ten editable configuration files, as listed below:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Note	Settings for Creating a Lithium Battery Model.											
2	Voc (V)	I limit (A)	Cut off time	Cut off	Cut off	Cut off	Stop at Cut	Voc_max (V)	ESR sample	Delay time	Save battery	OVF (V)	OCF (A)
3	4.2	1	0	0	4.3	10	4	3	0	0.123	10	5.56	3.333
4													
5													
6													

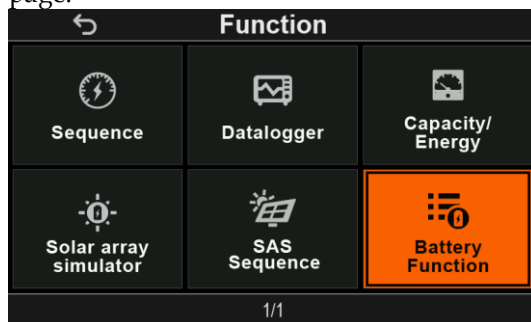
This file supports deletion, import, export, and editing. It can also be directly loaded and executed.

Panel operation

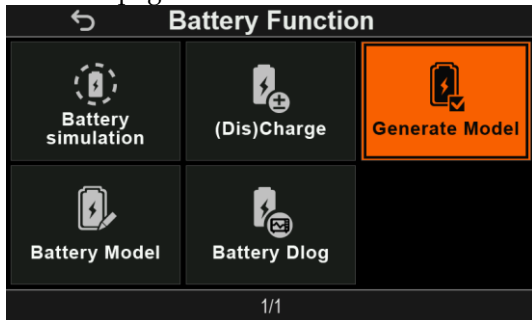
1. Press the menu button and enter the “Function” icon.



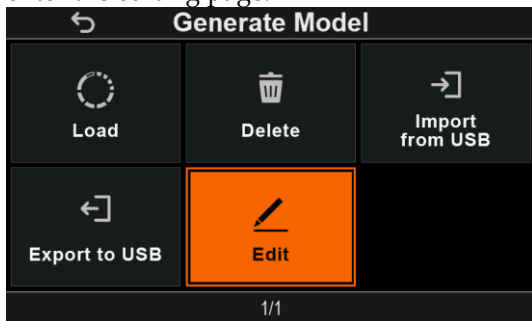
2. Choose the “Battery Function” in the Function page.



3. Choose the “Generate Model” in the Battery Function page.



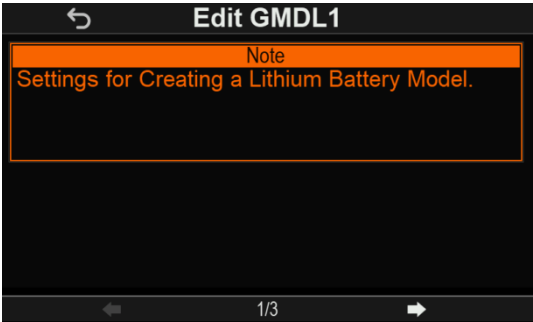
4. You will see options for deletion, import, export, and editing of the file. The file can also be directly loaded and executed. Here, we first enter the editing page.



5. Next, select the file you want to edit.



6. After entering the file, the first page will appear as follows:



Here, the “Note” can be used to annotate the purpose of this file.

7. Press the voltage knob to edit.



Rotate the Current knob to select the position you want to modify.

Rotate the Voltage knob to choose the letter to set.



Note

The blank space indicates the currently selected position for changes.

8. After editing, press ESC to save and return to the Step 6 page.
9. Rotate the Voltage knob to access the second page. This page displays the parameters to be set, and the third page is similar.

↶

Edit GMDL1

Vset (V)	I limit (A)
4.20	1.000
Cut off times (Sec)	Cut off current (A)
0	0.000
Cut off voltage (V)	Stop at Capacity (AH)
4.30	10.000
VOC_max (V)	VOC_min (V)
4.00	3.00

←

2 / 3

→

↶

Edit GMDL1

←

3 / 3

→

For the parameter setting ranges, please refer to the Menu Configuration Table.

10. After completing all parameter settings, press ESC to return to the Step 4 page and select Load.

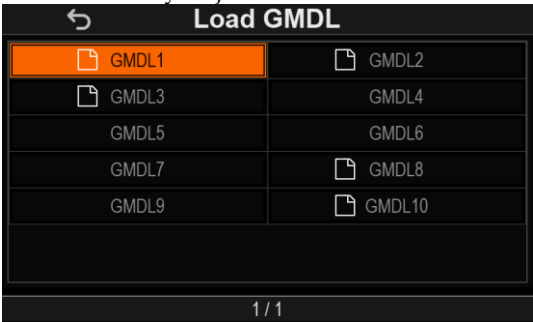
↶

Generate Model

⌛ Load	🗑 Delete	➡ Import from USB
↶ Export to USB	✎ Edit	

1/1

11. Select the file you just edited.



12. The execution screen appears as shown below.
Wait for the output.



13. Press the **Output** to start execution.



14. When a termination condition reached or the output turned off, the battery model generated based on the specified VOC range.

Meter

The values displayed on the right side of this page, from top to bottom, are:

- The voltage value measured at that moment.
- The current value measured at that moment.
- The AH value measured at that moment.



The values displayed at the bottom left of this page, from top to bottom, are:

- The target voltage value.
- I Limit
- Battery V_{oc_max}
- Battery V_{oc_min}



Battery Model

Overview

In “Battery Model”, you can manually enter 101 data points of SOC corresponding to VOC and ESR.

This model is also applicable for discharge simulation in “Battery Simulation”.

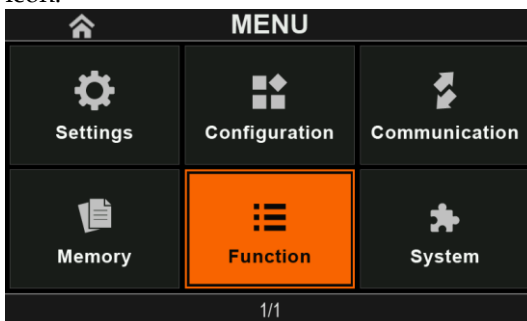
	A	B	C
1	Note	Voc=12~15.4V	
2	Capacity=2.000AH		
3	SOC(%)	Open Voltage	ESR(ohm)
4	0	12	0.785
5	1	12.4	0.75
6	2	12.8	0.715
7	3	13.2	0.679
8	4	13.61	0.644
9	5	13.83	0.627
10	6	13.9	0.625
11	7	13.98	0.623
12	8	14.05	0.621
13	9	14.12	0.619
14	10	14.18	0.618
15	11	14.23	0.618
16	12	14.28	0.618
17	13	14.33	0.618
18	14	14.38	0.618
19	15	14.43	0.617
20	16	14.47	0.615
21	17	14.51	0.612
22	18	14.55	0.61
23	19	14.59	0.608
24	20	14.62	0.607
25	21	14.65	0.608
26	22	14.68	0.609
27	23	14.72	0.609
28	24	14.75	0.61
29	25	14.78	0.61

The battery model contains the following parameters:

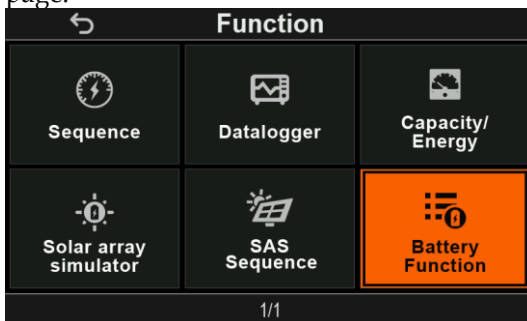
- Capacity
- SOC: State of charge
- VOC: Open circuit voltage
- ESR: Battery resistance

This file supports deletion, import, export, and editing.

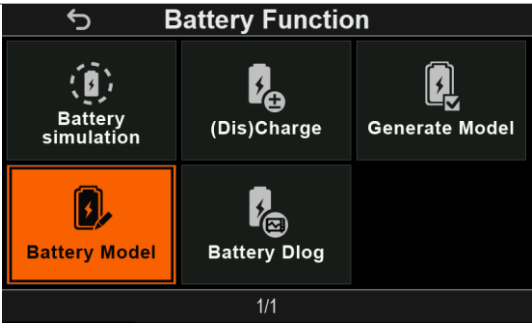
- Panel operation
1. Press the menu button and enter the “Function” icon.



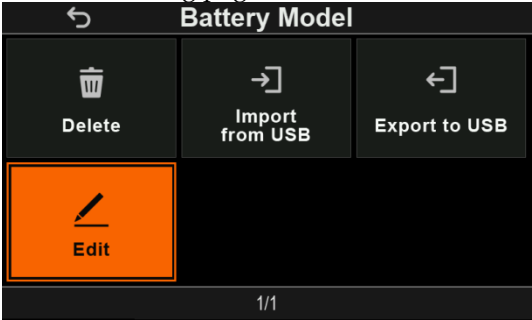
2. Choose the “Battery Function” in the Function page.



3. Choose the “Battery Model” in the Battery Function page.



4. You will see options for deletion, import, export, and editing of the file. Here, we first enter the editing page.



5. Next, select the file you want to edit.

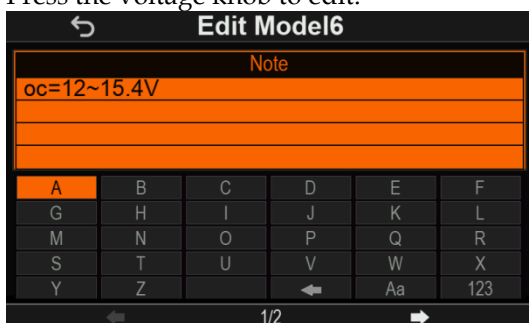


6. After entering the file, the first page will appear as follows:



Here, the "Note" can be used to annotate the purpose of this file.

7. Press the voltage knob to edit.



Rotate the Current knob to select the position you want to modify.

Rotate the Voltage knob to choose the letter to set.



Note

The blank space indicates the currently selected position for changes.

8. After editing, press ESC to save and return to the Step 6 page.
9. Rotate the Voltage knob to access the second page. This page displays the battery model data.



10. Selecting “List All” displays 101 data points in the model. Without this selection, a simplified mode shows 11 data points at intervals of 10.



11. In “List All” mode, press the Current knob to jump to a specified SOC.



12. Select “Edit” and press the Voltage knob to enter the editing page.

← **Edit Model 6**

Battery Capacity (AH)	2.000	☒ List All
SOC(%)	VOC(V)	ESR(ohm)
45	15.04	0.601
46	15.05	0.600
47	15.06	0.600
48	15.08	0.599
49	15.09	0.599
50	15.10	0.598

Save Edit

← 2 / 2 →

← **Edit Model 6 / SOC 50 %**

VOC (V)	ESR (ohm)
15.10	0.598

Prev SOC Next SOC

← 1 / 1 →

13. After editing, press **ESC** to return to the Step 12 page. Select **Save** to store the file.

← **Edit Model 6**

Battery Capacity (AH)	2.000	☒ List All
SOC(%)	VOC(V)	ESR(ohm)
45	15.04	0.601
46	15.05	0.600
47	15.06	0.600
48	15.08	0.599
49	15.09	0.599
50	15.10	0.598

Save Edit

← 2 / 2 →



Note

If you do not press **Save** after editing, the changes will not be stored.



Note

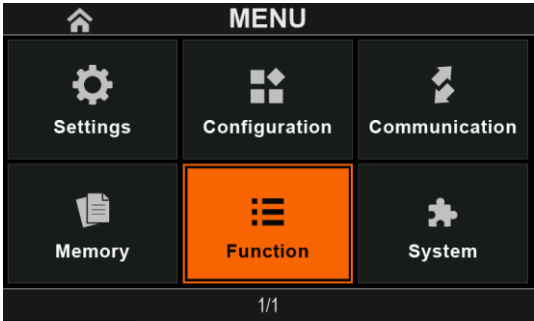
If “List All” is unchecked, editing in simplified mode and pressing Save will automatically generate 101 data points.

Battery Dlog

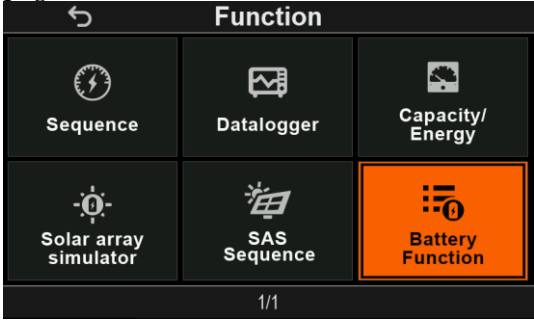
Overview The Data Logger in the battery function provides data recording.

When enabled, it automatically starts recording when Battery Simulation, Charge/ Discharge, or Generate Model begins.

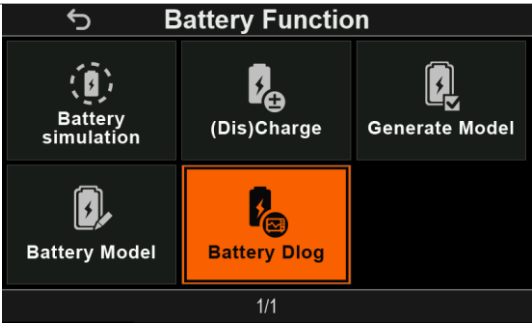
Panel operation 1. Press the menu button and enter the “Function” icon.



2. Choose the “Battery Function” in the Function page.



3. Choose the “Battery Dlog” in the Battery Function page.



4. Once you enter “Battery Dlog”, you can set the relevant parameters.



For the parameter setting ranges, please refer to the Menu Configuration Table.



Note

After the battery file loads and waits for execution, the data logger starts automatically.

USB Storage

Battery Simulation

The Data Logger for Battery Simulation is as follows:

	A	B	C	D	E	F	G
1	Sample Period : 1.0 sec						
2	Number	Voltage(V)	Current(A)	ESR(Ohm)	SOC(%)	State(Hex)	
3	0	4.2	-0.00246	0.066	100	0x00000000	
4	1	4.2	-0.00196	0.066	100	0x00000000	
5	2	4.2	-0.00196	0.066	100	0x00000000	
6	3	4.2	-0.00196	0.066	99.99999	0x00000408	
7	4	4.2	-0.00096	0.066	99.99999	0x00000108	
8	5	4.2	0.988437	0.065267	99.63365	0x00000108	
9	6	4.2	0.988938	0.064169	99.08427	0x00000108	
10	7	4.195349	0.988938	0.064	98.53487	0x00000108	
11	8	4.19	0.988437	0.063985	97.9855	0x00000108	
12	9	4.19	0.988938	0.063436	97.43612	0x00000108	
13	10	4.188868	0.988938	0.063	96.88674	0x00000108	
14	11	4.183373	0.988938	0.063	96.33736	0x00000108	
15	12	4.18	0.988938	0.063	95.78798	0x00000108	
16	13	4.18	0.989439	0.063	95.23858	0x00000108	
17	14	4.18	0.988938	0.063	94.68917	0x00000108	
18	15	4.18	0.988938	0.063	94.13981	0x00000108	
19	16	4.175904	0.988938	0.06259	93.59043	0x00000108	
20	17	4.170411	0.988938	0.062041	93.04104	0x00000108	
21	18	4.164917	0.988938	0.062	92.49164	0x00000108	
22	19	4.159423	0.988938	0.062	91.94227	0x00000108	
23	20	4.153929	0.988938	0.062	91.39288	0x00000108	
24	21	4.148435	0.988938	0.062	90.84351	0x00000108	
25	22	4.142941	0.988437	0.062	90.29414	0x00000108	
26	23	4.14	0.988938	0.062	89.74477	0x00000108	
27	24	4.14	0.988437	0.062	89.19539	0x00000108	
28	25	4.13646	0.988938	0.062	88.64602	0x00000108	
29	26	4.130967	0.989439	0.062	88.09664	0x00000108	
30	27	4.125473	0.988938	0.062	87.54727	0x00000108	
31	28	4.12	0.988938	0.062	86.9979	0x00000108	
32	29	4.12	0.988938	0.062	86.44852	0x00000108	
33	30	4.118991	0.989439	0.062	85.89915	0x00000108	

The recorded fields include the following:

- Voltage: The VOC corresponding to the selected model at that moment.
- Current: The current value measured at that moment.
- ESR: The ESR corresponding to the selected model at that moment.

- SOC: The SOC at that moment.
- State: Operation Status Register Group

Charge or
Discharge

The Data Logger for Discharge is as follows:

	A	B	C	D	E	F	G
1	Sample Period : 1.0 sec						
2	Number	Voltage(V)	Current(A)	ESR(Ohm)	AH	State(Hex)	
3	0	3.215678	-0.00196	0	0	0x00000000	
4	1	3.22401	-0.00146	0	0	0x00000408	
5	2	3.523947	0.996452	0	0.00024	0x00000408	
6	3	3.548942	0.996452	0	0.000517	0x00000408	
7	4	3.573937	0.998456	0	0.000794	0x00000408	
8	5	3.573937	1.00046	0	0.001071	0x00000408	
9	6	3.5906	1.002463	0	0.001349	0x00000408	
10	7	3.607263	1.001963	0	0.001626	0x00000408	
11	8	3.607263	0.996953	0	0.001903	0x00000408	
12	9	3.607263	0.998456	0	0.002181	0x00000408	
13	10	3.615595	0.998957	0	0.002458	0x00000408	
14	11	3.632258	0.998456	0	0.002735	0x00000408	
15	12	3.632258	1.002964	0	0.003013	0x00000408	
16	13	3.64059	0.996452	0	0.00329	0x00000408	
17	14	3.64059	0.997454	0	0.003567	0x00000408	
18	15	3.648921	0.997955	0	0.003845	0x00000408	
19	16	3.657253	0.994949	0	0.004122	0x00000408	
20	17	3.657253	0.997955	0	0.0044	0x00000408	
21	18	3.673916	0.999959	0	0.004677	0x00000408	
22	19	3.673916	0.998957	0	0.004954	0x00000408	
23	20	3.690579	0.996452	0	0.005232	0x00000408	
24	21	3.690579	0.998957	0	0.005509	0x00000408	
25	22	3.698911	1.001963	0	0.005787	0x00000408	
26	23	3.415637	-0.00246	0	0.005914	0x00000000	

The recorded fields include the following:

- Voltage: The voltage value measured at that moment.
- Current: The current value measured at that moment.
- ESR: This field remains 0 during charge and discharge.
- AH: The AH value measured at that moment.
- State: Operation Status Register Group

Generate model The Data Logger for Generate model is as follows:

A1							Sample Period : 1.0 sec
	A	B	C	D	E	F	G
1	Sample Period : 1.0 sec						
2	Number	Voltage(V)	Current(A)	ESR(Ohm)	AH	State(Hex)	
3	0	3.757232	-0.00196	0	0	0x00000000	
4	1	3.757232	-0.00196	0	0	0x00000000	
5	2	4.00718	1.979832	0	0.000123	0x00000408	
6	3	4.023843	1.991855	0	0.000676	0x00000408	
7	4	4.023843	1.997867	0	0.00123	0x00000408	
8	5	4.040506	1.994861	0	0.001784	0x00000408	
9	6	4.048838	1.995863	0	0.002338	0x00000408	
10	7	4.057169	1.991855	0	0.002892	0x00000408	
11	8	4.048838	1.991354	0	0.003447	0x00000408	
12	9	4.057169	1.995362	0	0.004001	0x00000408	
13	10	4.057169	1.996364	0	0.004555	0x00000408	
14	11	4.065501	1.991855	0	0.005109	0x00000408	
15	12	4.073833	1.993859	0.12061	0.005609	0x00000408	
16	13	4.082164	1.997867	0.12061	0.006163	0x00000408	
17	14	4.065501	1.996364	0.12061	0.006717	0x00000408	
18	15	4.082164	1.992356	0.12061	0.007271	0x00000408	
19	16	4.082164	1.992857	0.12061	0.007825	0x00000408	
20	17	4.090496	1.988348	0.12061	0.008379	0x00000408	
21	18	4.090496	1.994861	0.12061	0.008933	0x00000408	
22	19	4.098827	1.996364	0.12061	0.009487	0x00000408	
23	20	4.107159	1.990352	0.12061	0.010041	0x00000408	
24	21	4.098827	1.997366	0.12061	0.010595	0x00000408	
25	22	4.107159	1.995863	0.120861	0.011095	0x00000408	
26	23	4.11549	1.996364	0.120861	0.011649	0x00000408	
27	24	4.11549	1.990352	0.120861	0.012203	0x00000408	
28	25	4.11549	1.98935	0.120861	0.012757	0x00000408	

The recorded fields include the following:

- Voltage: The voltage value measured at that moment.
- Current: The current value measured at that moment.
- ESR: The ESR calculated from the sampled data at that moment.
- AH: The AH value measured at that moment.
- State: Operation Status Register Group



Note

Make sure to insert a USB drive into the front panel before starting the operation.



Note

For information on the Operation Status Register Group, please refer to the **PHU Programming Manual.pdf**.

Remote

Format

The Battery Dlog returns data in a block format as defined below:

```
#8<byte count(8B)>
<reserved(2B)>
<checksum(4B)>
<start number(4B)>
<sample period(4B)>
<cell total(4B)>
{Cell-1}
{Cell-2}
...
{Cell-N}
<end code(8B)>
<NL>
```

Data Block Structure

Field	Size	Description
Byte Count	8 bytes	Total length of the data block
Reserved	2 bytes	Reserved for future use
Checksum	4 bytes	Data integrity check
Start Number	4 bytes	Starting index of data
Sample Period	4 bytes	Sampling interval
Cell Total	4 bytes	Number of cells (N)
Cell Data	Variable	Repeated cell data (see below)
End Code	8 bytes	End of data block

**Cell Data
Structure**
Simulation:

Field	Size	Type	Description
Voltage	4 bytes	Float	The VOC corresponding to the selected model at that moment.
Current	4 bytes	Float	The current value measured at that moment.
ESR	4 bytes	Float	The ESR corresponding to the selected model at that moment.
SOC	4 bytes	Float	The SOC at that moment.
State	4 bytes	Integer	Operation Status Register Group

Charge:

Field	Size	Type	Description
Voltage	4 bytes	Float	The voltage value measured at that moment.
Current	4 bytes	Float	The current value measured at that moment.
ESR	4 bytes	Float	This field remains 0 during charge and discharge.
AH	4 bytes	Float	The AH value measured at that moment.
State	4 bytes	Integer	Operation Status Register Group

Generate Model:

Field	Size	Type	Description
Voltage	4 bytes	Float	The voltage value measured at that moment.
Current	4 bytes	Float	The current value measured at that moment.
ESR	4 bytes	Float	The ESR calculated from the sampled data at that moment.
AH	4 bytes	Float	The AH value measured at that moment
State	4 bytes	Integer	Operation Status Register Group



Note

For information on the Operation Status Register Group, please refer to the **PHU Programming Manual.pdf**.



Note

Data packets shall be queried via the :FETCh:BATTery:DLOG command through the remote interface.
